LEADERSHIP IN WORK ENVIRONMENT COMPLEXITY

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by

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Abstract

This PhD thesis is devoted to studying the topic of Leadership in Work Environment Complexity (WEC). In recent years, organisations have been rapidly evolving into ever more-complex workplaces that single actors are hardly able to oversee or control (Osborn & Hunt, 2007). This thesis therefore introduces and works with the construct of *Work Environment Complexity* (WEC), which outlines the *(individually perceived) complexity within organisational work contexts*. As WEC presents organisations and leaders with a new and often challenging quality of work, further research is needed to understand complexity as well as the consequences for working and leading in high-complexity work environments (e.g., Burnes, 2005; Uhl-Bien & Marion, 2009).

Leaders are especially expected to successfully navigate this new kind of business environment, which is more and more unstable, fluid, and challenging (e.g., Hannah, Avolio, Luthans, & Harms, 2008; Intezari & Pauleen, 2014). In organisational psychology, Complexity Leadership has thus emerged as one of the top leadership theories of the modern age (e.g., Dinh et al., 2014). However, the characterisation of WEC and the approach to its measurement have remained contested areas. In particular, with many and competing views in complexity science, there has not yet been a common agreement about what characterises a "complex" work environment for an individual, and how these insights can be substantially and empirically related to research in leadership and organisational psychology (Black, 2000; Burnes, 2005; Schneider & Somers, 2006). Consequently, this thesis aimed to expand knowledge and research, both on the construct of WEC itself and on leadership within complex working environments.

Chapter 2 sets out the theoretical foundations for studying the construct of WEC and its measurement. Reviewing the state of research, this section evaluates the diverse paradigms

on complexity thinking and through this develops this thesis' epistemological and methodological position. The perspective of this thesis proposes that studying WEC through a quantitative, empirical, and application-oriented measurement approach can advance complexity research by integrating existing standpoints, developing a measurement instrument for WEC, establishing linkages to leadership research, and accelerating application in organisational psychology. A central contribution lies in providing a scale that enables the measurement of the amount of complexity that an individual faces in their work environment. This aims to overcome current research gaps between WEC and leadership research, and to provide an empirical baseline from which to facilitate empirical study of work and leadership in WEC. Building on previous conceptualisations and measurement approaches, a preliminary operationalisation for WEC is established: Work Environment Complexity is characterised as *(the perception of) a frequently changing, unpredictable, and demanding work environment.*

Building on this operationalisation, the subsequent chapters present the research studies. Study 1 developed and validated a scale for measuring the construct of WEC in a set of empirical studies. It addressed the questions of how WEC can be measured, which core content and underlying structure can be assumed, and whether the construct can be applied to both employees and leaders. In a thorough process of construct validation, through a pre-test, a set of Exploratory Factor Analyses (EFA), and three subsequent Confirmatory Factor Analyses (CFA), the 7-item WEC Scales' factor structure and psychometric properties were explored and validated. Results suggest that leaders in modern organisations face a specific state of WEC characterised by frequent transformation, the occurrence of unpredictable events, and demanding yet uncertain work requirements. Two WEC factors can be identified, WEC-1 Frequent Change and Events, and WEC-2, Uncertain Work Demands. The WEC Scale for leaders has withstood both cross-sectional and longitudinal testing, demonstrating promising psychometric properties, including metric invariance.

To investigate which leadership approaches are suited to match these novel challenges of WEC, Chapter 2 develops a conceptual framework for Leadership in WEC. It evaluates the current state of research, finding strong support for a paradigm shift towards more *participative* or *empowering* leadership styles (e.g., Ashmos, Duchon, McDaniel, & Huonker, 2002; Burnes, 2005; Correia de Sousa & van Dierendonck, 2014; Lee, Willis, & Tian, 2018) and *adaptive leadership* (Uhl-Bien & Arena, 2017; Yukl & Mahsud, 2010), as well as the need to investigate *individual leader disposition and wellbeing* for contexts of WEC (e.g., Ashmos, Duchon, & McDaniel, 2000; Roche, Haar, & Luthans, 2014). This evaluation reveals that without an empirical approach to measure WEC (Maguire & McKelvey, 1999), today's research and models on leadership in complex work environments are inherently limited (Schneider & Somers, 2006).

With the validation of WEC in Study 1, the propositions of "optimal" leadership in WEC could be empirically addressed. Thus, studies 2-4 set out to examine the relationships between a complex working environment and leadership style, leader's adaptability and leader functional wellbeing, with the aim of identifying optimal ways for leaders to cope with and manage WEC.

Study 2 was the first to examine leader behaviour in this specific context. It empirically investigated, in a longitudinal study, whether leaders in the face of WEC will apply more empowering and less directive leadership style. This study contributes to the discussion on the seemingly opposing leadership styles (empowering vs. directive), and provides rationales for applying both leadership styles within high-complexity environments along with practical implications, e.g. for leadership training. Core finding is that the level of WEC appears to influence the adoption of Empowering Leadership (EL) and seems to less strongly affect a leader's choice of Directive Leadership (DL). Also, results indicated that on an absolute level, more empowering than directive leadership was shown. This study revealed that the two WEC factors play different roles in the prediction of leadership style. Finding that both leadership styles were independent constructs, this study broadens the debate on the application of DL as a beneficial supplement to EL in WEC and advocates for the coexistence of the two styles for effective leadership in WEC.

Study 3 empirically examined how and when EL and DL are adapted as a consequence of changing WEC across time. With the use of a longitudinal design and a sample of 117 leaders, findings indicated that there was significant adaptation of leadership behaviour as a result of changes in WEC. While EL was shown on a high level more or less independent of the changes in complexity, DL in particular was found to be significantly adjusted to strong changes in WEC. These findings add to the understanding of flexible leadership and the characteristics of WEC that may evoke adaptive behaviour. In summary, Studies 2 and 3 found that leaders adopt a combination of high levels of EL and are likely to adjust their level of DL when facing (changes in) WEC.

Study 4 addresses the specific challenges that a high-complexity work environment is likely to place on the individual leader's psychological wellbeing and resources. Several predictors of leader functional wellbeing were investigated. Applying Regression Analyses both for main and interaction effects, this study finds that a leader *can* thrive in the face of WEC. However, building on the model of challenge-skill balance (see e.g., Ceja, 2011; Chung-Yan & Butler, 2011; Moneta & Csikszentmihalyi, 1996), a leader's functional wellbeing appears significantly dependent on the nature of WEC itself, the leader's personal disposition, and the leadership style applied. Results indicated that WEC Factor 2 Uncertain Work Demands, by itself, had strongly detrimental effects on a leader's Self-Efficacy for Adaptive Behaviour and Eudaimonic Wellbeing. Proactive and embracing personality dispositions (high Uncertainty Tolerance, high Approach Motivation, and low Avoidance Motivation) and likewise, actively applying leadership behaviour (both EL and DL) were found to act as buffering mechanisms to secure high functional wellbeing even under high WEC. With this, the last empirical chapter complements the investigation of Leadership in WEC and the behavioural view of Studies 2-3 by taking into consideration the leader on an individual level.

Chapter 7 summarises the main findings of the thesis by enriching the theoretical frameworks of Chapter 2 with the empirical findings in Chapters 3-6. This final chapter reflects on the overall strengths and limitations of this thesis, and discusses overarching theoretical implications, opportunities for future research on Leadership in Work Environment Complexity, and practical implications of the work described.

This thesis contributes to knowledge and research on Leadership in Work Environment Complexity in several ways. In response to the growing interest in WEC in organisational research, Study 1 develops and validates a self-report measure of WEC for leaders. For the first time, researchers and practitioners are provided with a measurement scale for WEC that is consistent with a comprehensive definition of WEC, has good psychometric properties, and is so short that it can be applied in practical organisational research. The research conducted in Studies 2 and 3 adds knowledge and empirical insights into how complex circumstances affect the choice of leadership styles and the adaptation of leadership behaviour. For the first time, the integrative WEC Scale provides an empirical baseline for studying which form of leadership (empowering, directive, or adaptive) leaders choose in high-complexity contexts. Core finding of Study 2 is that the level of WEC appears to influence the amount of Empowering Leadership a leader shows, but seems to less strongly affect a leader's choice of Directive Leadership. Also, this thesis broadens the debate on DL as an independent leadership style in WEC that should be acknowledged as a relevant supplementary behaviour to EL. Study 3 suggests for the first time that specific environmental cues of high-complexity contexts (i.e. WEC-2 Uncertain Work Demands) trigger the adaptation of leadership behaviour. This advances the research on adaptive leadership to contexts of high complexity. Study 4 adds unique insights into leader wellbeing in contexts of WEC. For the first time, two variables in combination (Eudaimonic Wellbeing and Self-Efficacy for Adaptive Behaviour) are established for capturing leader functional wellbeing in WEC. Building on the concept of challenge-skill balance, this study's findings reveal that a leader's personal disposition (i.e. high Approach Motivation, high Uncertainty Tolerance, low Avoidance Motivation) and the active application of Empowering and Directive Leadership will secure high functionality and wellbeing under conditions of high WEC. Practically, these findings offer relevant input for leadership training, leader selection, change management, and the design of organisational structures to equip organisations for the challenges of high-complexity environments.

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Related Publications and Conference Presentations

Bezler, T. (2017), *Construct Validation Of A Work Environment Complexity Scale: Yes, It Is Complex – But What Is Complex?* 18th European Congress or Work and Organizational Psychology (EAWOP), Dublin, May 2017. (**Study 1**)

Bezler, T., Moneta, G. B., & Pheiffer, G. (in press). *Development and Validation of the Work Environment Complexity Scale for Leaders.* Submitted September 2017 to Journal of Organizational Change Management; reviewed November 2018; accepted April 2019. (JOCM-09-2017-0341; **Study 1**)

Contents

List of Tables

List of Figures

List of Abbreviations

AIC	Akaike Information Criterion
APP	Approach Motivation
AVO	Avoidance Motivation
CAS	Complex Adaptive Systems
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CRP	Complex Responsive Processes
DL	Directive Leadership
EL	Empowering Leadership
EUWELL	Eudaimonic Wellbeing
HMR	Hierarchical Multiple Regression
KMO	Kaiser-Meyer-Olkin Measure of Sampling Adequacy
NDS	Nonlinear Dynamic Systems
NNFI	Non-Normed Fit Index
RMSEA	Root Mean Square Error of Approximation
SEAB	Self-Efficacy for Adaptive Behaviour
SRMR	Standardised Root Mean Square Residual
UT	Uncertainty Tolerance
WEC	Work Environment Complexity
WEC-1	WEC Factor 1 “Frequent Change and Events”
WEC-2	WEC Factor 2 “Uncertain Work Demands”
WECS	Work Environment Complexity Scale
WDQ	Work Design Questionnaire

“It’s not easy
with this complexity”

Eagles of Death Metal, “Complexity”

Chapter 1 - Introduction

1.1 Rationale for the Research

Complexity is viewed as the new reality of organisations. Twenty-first-century work organisations are challenged more than ever before, by "rapidly changing technologies, globalisation, volatility, uncertainty, and foregone periods of cohesion and predictability" (Brodbeck, 2002, p. 2). To succeed in such radically transforming economic environments, organisations are undergoing profound changes that require fresh means of organising, structuring, and leading. In short, organisations are evolving into complex workplaces (e.g., Ashmos et al., 2000; Burnes, 2005; Uhl-Bien, Marion, & McKelvey, 2007; Wee & Taylor, 2018). Leaders and employees are faced with rapidly growing levels of complexity in their work – challenged by volatility, rapid change, unpredictability, uncertainty, ambiguity, interconnectivity and many other factors (Baard, Rench, & Kozlowski, 2014; Berman & Korsten, 2010; Pulakos et al., 2002; Uhl-Bien & Arena, 2017; Yukl & Mahsud, 2010). This work environment complexity (WEC) confronts organisations, leaders, teams, and employees with a new quality of work. The purpose of this thesis is to better understand WEC and investigate what it means to work, succeed, and lead in increasingly complex work environments (Burnes, 2005; Roche et al., 2014; Schneider & Somers, 2006).

Leadership in complex working environments deserves particular attention; not only do employees rely on leaders for guidance in such challenging times, leaders are also expected to drive success in this novel business environment that is more and more unstable, fluid and challenging (e.g., Ashmos et al., 2002; Intezari & Pauleen, 2014).

Where working environments are changing significantly, assumptions about "how to lead" that have been valid in the past are called into question. Traditional leadership models appear outdated and unable to match growing complexity (Ashmos et al., 2002; Brodbeck, 2002; Uhl-Bien & Arena, 2017). Thus, "complexity leadership" has become one of the most significant management themes of the modern age (Burnes, 2005; Dinh et al., 2014; Lavine, 2014; Uhl-Bien & Marion, 2009; Uhl-Bien et al., 2007). This thesis aims to add to this body of work, studying the characteristics of WEC and exploring appropriate leadership models.

Various articles and special issues have been published in well-established psychological journals, such as the *Journal of Applied Psychology* (Wee & Taylor, 2018), *Journal of Organisational Change Management* (Black, 2000; Karp & Helgø, 2008), *The Leadership Quarterly* (Boal & Schultz, 2007; Marion & Uhl-Bien, 2001; Mumford, Zaccaro, Harding, Jacobs, & Fleishman, 2000; Osborn & Hunt, 2007; Schneider & Somers, 2006; Uhl-Bien & Marion, 2009; Uhl-Bien et al., 2007), *International Journal for Management Reviews* (Burnes, 2005), *Organisational Dynamics* (Tetenbaum, 1998; Uhl-Bien & Arena, 2017), and *Emergence* (Maguire & McKelvey, 1999). Special issues have been titled "What is Complexity Science?" (*Emergence*, 3:1, 2001) or "Leadership and Complexity" (*The Leadership Quarterly* Special Issue 18:4, 2007). This range of publications demonstrates the growing need to discuss both the concept of complexity itself and its application to leadership in practice. We need to understand WEC in order to understand the consequences for organisations, management, and leadership (Ashmos et al., 2002; Karp & Helgø, 2008; Uhl-Bien et al., 2007). Thus, a growing number of contributions have covered epistemological, conceptual, and systemic debates on how – and whether – complexity can be defined (e.g., Black, 2000; Lissack, 1999), how – and whether – complexity theories can be applied to organisational reality (e.g., Burnes, 2005; Osborn & Hunt, 2007; Stacey, 2011), and how – and whether – they are useful for leadership theory and research (e.g., Lichtenstein et al., 2006; Marion & Uhl-Bien, 2001; Uhl-Bien & Arena, 2017).

Many questions around WEC and leadership remain unanswered. Organisational research draws partly from the early roots of complexity theories (Karp & Helgø, 2008; Stacey, 2011; Uhl-Bien et al., 2007). Traditional understandings of organisations as mechanistic, linear systems have developed "to a perspective of the organizations modern leaders act within as nonlinear and organic, characterized by uncertainty, dynamic, and unpredictability" (Marion & Uhl-Bien, 2001, p. 389-390). This understanding of organisations, which is gaining more and more recognition by leadership and organisation scholars (e.g., Boal & Schultz, 2007), offers novel and relevant insights for the practice of organisational psychology. However, even though complexity is a frequently used term, it still remains a contested area, and further research is required. In particular, there has so far been no common agreement on what characterises a "complex" work environment, and how, on this basis, these insights can be substantially related to research in leadership and organisational psychology (Black, 2000; Burnes, 2005; Maguire & McKelvey, 1999; Schneider & Somers, 2006). This is not least because a multitude of schools compete in their paradigms of how to grasp, define, and describe complexity (e.g., Burnes, 2005; Stacey, 2011). Although there has been some progress, especially in empirical studies, such as the ability to measure a complex work environment, organisational psychology is still in its infancy (Dinh et al., 2014; Karanika-Murray & Cox, 2010). This lack of clarity forms the rationale for this thesis, and the research conducted is aimed to advance these fields of knowledge.

1.2 Overarching Research Questions

Overarching Research Question 1: What is Work Environment Complexity (WEC) and how can it be measured?

In order to derive valid conclusions on which leadership approaches will suit the changed nature of modern organisations, it is important to understand what constitutes WEC. In an attempt to develop an integrative construct of WEC, Chapter 2 reviews the current state of research into how to characterise a complex organisational work context. The diverse perspectives and paradigms in complexity thinking are evaluated in order to develop the epistemological and methodological position of this thesis. The question of whether, and how, complexity can be measured is one of the fiercest debates in the current literature (Stacey, 2011). Weighing up different views, I argue in this thesis that in order to conduct substantial empirical research, WEC needs to be measurable. Without such a foundation, a clear link from "complexity" research to leadership research cannot be drawn at this current time (Schneider & Somers, 2006). Thus, this thesis aims to contribute to the above question by, firstly, developing an integrative construct of WEC (Chapter 2) and secondly, developing and validating a measurement instrument for WEC (Study 1, Chapter 3).

Understanding complexity and leadership is, however, not driven by academia alone; a strong movement can also be witnessed within management discourse. Almost 20 years ago, Maguire and McKelvey (1999) reported a rapid growth in the amount of practitioners' literature on complexity and its consequences for management. This reflected a high demand for leaders to understand and adapt to the challenges of WEC. "Managers now find themselves in a qualitatively different world", they state – a world described as "more uncertain, turbulent, complex, nonlinear, unpredictable, fast-paced, dynamic, and even postmodern" (p. 21). In 2010, IBM devoted its CEO Study entirely to the topic of managing organisational complexity as one of the most significant challenges to organisations. Even then, nearly 80% of CEOs anticipated even greater complexity ahead and around half doubted whether the management was equipped to meet this challenge (Berman & Korsten, 2010). As a result, pragmatic conclusions are presented as to how to “lead”, “handle”, or “manage” complex organisational systems (e.g., Lewis, 1994; Maguire & McKelvey, 1999); yet while the scientific world seems in agreement that new leadership approaches are needed to match WEC, academically these models are not yet well established nor empirically substantiated (e.g., Ashmos et al., 2002; Uhl-Bien et al., 2007; van der Voet, Kuipers, & Groeneveld, 2015; Zhang, Waldman, Han, & Li, 2015). Thus, one could argue that practitioners are jumping to conclusions without basing them on valid empirical evidence.

Overarching Research Question 2: Which leadership approaches are suited to match the novel challenges of Work Environment Complexity?

Where traditional models of leadership are seen as outdated or deficient in the face of complexity, new leadership models have to be established (Intezari & Pauleen, 2014; Uhl-Bien & Marion, 2009; Zaccaro & DeChurch, 2012). Consequently, the second section of Chapter 2 evaluates the current state of research on leadership in WEC. Several themes around “how to lead” in WEC have emerged from the academic discussion. Most prominent is the call for a more participative/empowering leadership style (e.g., Burnes, 2005; Correia de Sousa & van Dierendonck, 2014; Osborn & Hunt, 2007; Uhl-Bien et al., 2007), adaptive leadership (e.g., Uhl-Bien & Arena, 2017; Yukl & Mahsud, 2010), and the need to investigate individual leader disposition and wellbeing for contexts of WEC (e.g., Ashmos et al., 2000; Judge, Thoresen, Pucik, & Welbourne, 1999; Roche et al., 2014). However, in organisational psychology, many of these approaches have to date remained either purely conceptual (Burnes, 2005), fragmented, or inadequately linked to complexity research (Black, 2000).

This thesis aims to advance empirical research in complexity leadership. This will require the following: more substantial conceptual models of the relationship between WEC and leadership (Uhl-Bien et al., 2007); a means to measure WEC (Schneider & Somers, 2006); empirical testing and validation of the proposed approaches. Consequently, Chapter 2 aims to establish conceptual frameworks for Leadership in WEC, which will be empirically tested in Study 2 (empowering vs. directive leadership in WEC), Study 3 (adaptive leadership in WEC), and Study 4 (leadership wellbeing in WEC) in Chapters 4, 5 and 6. In summary, this thesis aims to address relevant questions of WEC and leadership style, adaptive leadership, and functional leader wellbeing to contribute both empirical and practical insights on leadership in complex work environments. Having outlined the core aims of the thesis in this introductory chapter, the thesis moves on to develop specific conceptual models, research questions, and hypotheses in the subsequent chapters.

Chapter 2 – Theoretical Framework: Leadership and Work Environment Complexity

2.1 Work Environment Complexity

2.1.1 Competing Paradigms and Complexity Theories

When studying complexity, where should one start? Complexity by itself is a fairly new science; indeed, it is not yet fully established, not fully agreed upon, and not fully accepted by the scientific community (e.g., Burnes, 2005). Also, in the narrower application of complexity to organisational psychology, a mutually agreed definition does not exist (Ashmos et al., 2000; Black, 2000; Burnes, 2005; Maguire & McKelvey, 1999; Marks, Mathieu, & Zaccaro, 2001). The landscape of complexity theories and their application to organisations is loaded with controversies, many of which appear irresolvable (Burnes, 2005; Thomas, 2005). Having acknowledged this disparity, the starting point of this thesis is therefore that complexity "is less an organized, rigorous theory than a collection of ideas" (Lissack, 1999, p. 112). Hence, when trying to make sense of these manifold views and when aiming to position one's research in this field, it is essential to take a closer look at the following: how the complexity sciences are being interpreted when applied to organisational and leadership reality; how scientists have approached the measurement of complex contexts; and how complex work has been characterised across different schools.

A multitude of perspectives have reflected on how to define or describe complexity in organisations, and this still remains one of complexity science's major debates. Approaches range from mathematical models, laws of natural sciences and deterministic concepts to theories guided by constructivist or interpretative approaches, systemic, emergent and agent-based views, responsive processes conceptualisations, and computer-based simulations (e.g., Burnes, 2005; Stacey, 2011). Complexity schools promote different terminologies and concepts when applying complexity thinking to organisational systems (Burnes, 2005; Manson, 2001). Thus, divergence of views far outweighs a communal agreement (e.g., Lissack, 1999).

While the number of views is steadily growing, several *Complexity Theories* are especially prominent when describing work organisations as complex systems (see for extensive reviews, Burnes, 2005; Lissack, 1999; Stacey, 2011; Stacey, Griffin, & Shaw, 2002). These include concepts and theories originating from natural sciences such as mathematics, physics, biology, chemistry, and meteorology. In the last decades, these theories have been used to describe complex working environments, because “many practical organisational issues and management problems – handling fast-changing environments and competition, creating and maintaining flexible and resilient organizations, etc. – seem to fit with the concerns of the frameworks” (Boal & Schultz, 2007, p. 412).

In particular, Chaos Theory (e.g., Gleick, 1988; Lorenz, 1993; Stewart, 1989), Catastrophe Theory (e.g., Ceja & Navarro, 2009; Thom, 1975), Nonlinear Dynamic Systems Theory (NDS) (e.g., Guastello, Koopmans, & Pincus, 2009; Munné, 2005), and the Theory of Complex Adaptive Systems (CAS) (e.g., Marion & Uhl-Bien, 2001; Schneider & Somers, 2006; Uhl-Bien et al., 2007) provide guiding principles to understand modern organisations as complex work environments. These are supplemented by Stacey’s (Stacey, 2011; Stacey et al., 2002) Complex Responsive Processes (CRP) view that constitutes a counterweight to these so-called “mainstream” theories (for an overview see Table 1). These theories are grounded in different schools of thought on how to characterise complex environments or systems (Manson, 2001). Also, they have distinctive views on the question of influence or causality: that is, can people (e.g. leaders) *influence,* through their own behaviour, the processes, structures or interactions in complex organisations (Stacey, 2011)? This question is important for the study of organisational behaviour and leadership, as it would only be reasonable to attempt measurement or empirical study if there were some forms of influence or causality in existence (Dinh et al., 2014; Gray, 2014).

The first group, Chaos Theory, Catastrophe Theory, and Nonlinear Dynamic Systems Theory, as so-called “deterministic complexity” theories, borrow from mathematical science and describe dynamic discontinuities in previously stable systems (Manson, 2001). Chaos Theory originally stems from Lorenz’s research on weather systems and the “butterfly effect” (Gleick, 1988; Lorenz, 1993; Stewart, 1989). Translated to business environments, organisations are seen as chaotic and constantly self-transforming systems in which complex patterns of behaviour cannot be explained by linear cause and effect mechanisms (Burnes, 2005; Haigh, 2002). This chaos – as a “new form of order” – leads organisational systems to a tipping point when they may suddenly self-organise into unprecedented patterns, so-called “dissipative structures” (Burnes, 2005; Haigh, 2002; Styhre, 2002). Catastrophe Theory (Thom, 1975), is concerned with the study and description of discontinuous, abrupt changes and has been applied to work contexts (Ceja, 2011; Ceja & Navarro, 2012). Similar to Chaos Theory, it claims that such a discontinuity or catastrophe can emerge from initially small internal or external changes (Manson, 2001). Nonlinear Dynamic Systems (NDS) Theory claims the existence of nonlinearity or deterministic chaos, fractals, catastrophic changes and fuzziness (Guastello et al., 2009; Munné, 2005). NDS methods explore these seemingly random interactions to identify underlying nonlinear or chaotic patterns in organisational behaviour (Ceja, 2011; Karanika-Murray & Cox, 2010).

These deterministic complexity theories have distinct attributes; they vary in the choice of their respective terminology and which rationales are used explain chaotic or complex states (Manson, 2001). They do, however, have in common the assumption that complexity is governed by fundamental deterministic rules; Chaos Theory and NDS claim that chaos is seemingly random but exhibits some underlying order (Ceja, 2011), Catastrophe Theory explains chaotic disruption as being caused by a small set of key variables (Manson, 2001). With this deterministic view comes the assumption that desired organisational outcomes can be somewhat *influenced* and that "one may *describe* [emphasis added], and potentially understand, chaotic or catastrophic systems in simple mathematical terms" (Manson, 2001). This makes these theories interesting for their application into organisational and leadership reality and empirical study. In recent years, and as discussed more in detail below, complex organisational behaviour is more and more being examined through nonlinear mathematics and NDS methods (Arrieta, Navarro, & Vicente, 2008; Ceja, 2011; Ceja & Navarro, 2009, 2012). Furthermore, deterministic complexity researchers have provided leadership recommendations on how to manage complex work situations, such as chaotic change processes (Bechtold, 1997; Burnes, 2005; Haigh, 2002; Karp & Helgø, 2008; Visscher & Rip, 2003).

Secondly, theories of "aggregate complexity" are guided by constructivist, systemic, or interpretative approaches that describe organisations as Complex Adaptive Systems (CAS) (Manson, 2001). The focus here lies in the dynamics of *relationships or interactions* between the members (groups). Organisations are described as operating on the "edge of chaos" and dynamically adaptable to changes (Marion & Uhl-Bien, 2001; Schneider & Somers, 2006; Uhl-Bien & Arena, 2017). An analogy for CAS is a neural network, where behaviour is self-organised and one can (only) understand the whole by understanding the interrelationships of the parts (Manson, 2001; Uhl-Bien et al., 2007). Underlying the CAS perspective is the assumption that people, for example leaders, can at the least *indirectly* influence behaviour in organisations through their interaction (e.g., Anderson, 1999; Boal & Schultz, 2007; Stacey, 2011). Since the mid-1900s, this systemic view has been prominent in explaining how managers as "system designers" (Stacey, 2011, p. 9) apply tools such as planning, forecasting, objective-setting, budgeting, and controlling. In this sense, CAS thinking is somewhat deterministic as well (Stacey et al., 2002) and opens the field for psychological research; an emerging strand of literature discusses recommendations for leadership in CAS (e.g., Boal & Schultz, 2007; Uhl-Bien & Arena, 2017).

A third paradigm is significantly influenced by Stacey's (Stacey, 2011; Stacey et al., 2002) Complex Responsive Processes (CRP) view. Similar to CAS, organisations are conceptualised as continually transforming patterns of interaction. These micro-level "responsive processes" occur in a self-organised way and form a collective organisational identity (Stacey, 2011). The major distinguishing feature of this view is that CRP does not think of the organisation as a system. Rather, complexity is used as a metaphor; there is no element of influence, as there is no mature or final state of the organisation that one could work towards (Stacey, 2011; Stacey et al., 2002). The CRP perspective thus challenges the other theories' assumptions that agents in organisations have influence (Stacey, 2011) and is perhaps the most critical towards applying complexity thinking to explain causalities in organisational behaviour. It does, however acknowledge that while the question of control or interference is problematic, "this does not mean that there is no control, however. It simply means that control has to be understood in a different way" (Stacey, 2011, p. 482). Ralph D. Stacey has publicised some influential books on Complexity Thinking and Strategic Management (Stacey, 2011); these works guide the reader through a rigorous and comprehensive theoretical framework, but they do not intend to offer easily applicable management tips on how to manage, handle, or lead complex organisations.

In summary, organisational complexity is viewed from a range of different perspectives, and the most prominent complexity theories disagree in their characterisation of complex environments. Stacey is probably the most reluctant to offer guidelines for the “management” or study of complex work environments. However, most (mainstream) approaches agree that complexity thinking is useful to apply to modern organisational contexts (Black, 2000; Boal & Schultz, 2007; Lissack, 1999) and further acknowledge that individuals (e.g. leaders) can exert influence on the dynamics of complex environments (Boal & Schultz, 2007; Burnes, 2005). This indicates that the study of causal mechanisms in complex working contexts should be possible (Manson, 2001).

Table 1: Complexity Theories for Understanding Organisations as Complex Systems

Reference	*Theory*	*School / Paradigm*	*Application in Organisational Behaviour and Leadership research*
e.g. Gleick, 1988; Stewart, 1989; Lorenz, 1993; see also Stacey, 2011; Haigh 2002; Styhre, 2002; Burnes, 2005	Chaos Theory	Deterministic Complexity Theory: Complexity is governed by fundamental deterministic rules, which can be described or studied.	Conceptual recommendations for leaders on how to manage or influence complex work situations, such as chaotic change processes (e.g., Bechtold, 1997; Burnes, 2005; Haigh, 2002; Karp & Helgø, 2008; Visscher & Rip, 2003)
e.g. Thom, 1975; see also Ceja, 2011	Catastrophe Theory	Deterministic Complexity Theory: Complexity is governed by fundamental deterministic rules, which can be described or studied.	Informs current complexity leadership thinking on how to lead in turbulent environments (e.g., Dinh et al., 2014).
e.g. Munné, 2005, Guastello et al., 2009; see also Ceja, 2011	Nonlinear Dynamic Systems (NDS) Theory	Deterministic Complexity Theory: Complexity is governed by fundamental deterministic rules, which can be described or studied.	Nonlinear mathematics and NDS methods study organisational behaviour (e.g., Arrieta et al., 2008; Ceja, 2011; Ceja & Navarro, 2009, 2012). Managerial recommendations for leading in NDS (Beeson & Davis, 2000; Lichtenstein & Ashmos, 2009).
e.g. Marion & Uhl-Bien, 2001; Uhl-Bien et al., 2007; Schneider & Somers, 2006; see also Stacey, 2011	Theory of Complex Adaptive Systems (CAS)	Aggregate Complexity Theory: One can understand the system by understanding the interrelations of the parts. Individuals can, at the least, indirectly influence behaviour in complex contexts.	Conceptual recommendations for leading in CAS (Lichtenstein et al., 2006; Marion & Uhl-Bien, 2001; Schneider & Somers, 2006; Uhl-Bien & Arena, 2017). Case studies, e.g. for leadership in turbulence (Lane & Down, 2010).
Stacey et al. 2002; Stacey 2011	Complex Responsive Processes (CRP) View	Organisations are not systems, complexity is a metaphor or analogy for constantly evolving patterns of interaction. This view generally opposes to assuming causal principles or influence in complex systems.	CRP perspective informs Strategic Management with Complexity Thinking (Stacey, 2011; Stacey et al., 2002).

2.1.2 Vocabulary and Characterisations of Organisational Complexity Theory

With these complexity theories comes a set of particular and idiosyncratic vocabulary. This terminology is often abstract, differs across schools of thought (Burnes, 2005; Lissack, 1999, see also Table 2; Schneider & Somers, 2006), and may partially explain why finding an integrative definition of complexity has been described as "utopic" (Fenwick, 2010), "messy" (Thomas, 2005), and, at best, "controversial" (Burnes, 2005). Furthermore, it may explain why the application of complexity sciences to organisations or management practice has not yet truly happened (Black, 2000). For instance, one finds descriptions of "phase changes, fitness landscapes, self-organisation, emergence, attractors, symmetry and symmetry breaking, chaos, quanta, the edge of chaos, self-organised criticality, generative relationships, and increasing returns to scale" (Lissack, 1999, p. 112). This highly specific vocabulary may be well intentioned, but it is likely to cause more confusion than clarity (Schneider & Somers, 2006). In fact, although often similar elements are described, it appears that each of the complexity schools seeks distinctiveness by applying unique terminology (Burnes, 2005; Schneider & Somers, 2006). Table 2 reflects how related concepts are often labelled with competing terminology.

Economic and business organisations are more and more becoming recognised as complex systems (Black, 2000; Karanika-Murray & Cox, 2010). An emerging sentiment is that "many concepts and constructs from complexity and organisation science are analogous" and "there would appear to be opportunities for seeking integration and synthesis between complexity constructs and those in existing organisational literatures" (Maguire & McKelvey, 1999, p. 25). Thus, when aiming to apply complexity thinking in organisational psychology, one may be better advised to use the idiosyncratic vocabulary only to the degree that is necessary to support understanding (see for a similar approach, Schneider & Somers, 2006) and detailed terminology discussions can be found elsewhere (Lichtenstein et al., 2006; Lissack, 1999; Manson, 2001; Stacey, 2011). In fact, when leaving specialised terminology aside, common characterisations of complexity can be found across the different paradigms (Burnes, 2005; Lichtenstein & Ashmos, 2009; Lissack, 1999; Stacey, 2011). Burnes (2005) summarises these basic elements as follows:

> *"Complexity theories are concerned with the emergence of order in dynamic non-linear systems operating at the edge of chaos: in other words, systems which are constantly changing and where the laws of cause and effect appear not to apply (Beeson and Davis 2000; Haigh 2002). Order in such systems is seen as manifesting itself in a largely unpredictable fashion, in which patterns of behaviour emerge in irregular but similar forms through a process of self-organisation, which is governed by a small number of simple order-generating rules (Black 2000; MacIntosh and MacLean 2001; Tetenbaum 1998)"* (Burnes, 2005, p. 77).

This summary deserves closer inspection to understand the basic characteristics of complex systems. To begin with, a complex and a complicated system are not the same (Lichtenstein & Ashmos, 2009). Uhl-Bien and Arena (2017) find the following analogy:

> *"Complicated systems may have many parts but when the parts interact they do not change each other. For example, a jumbo jet is complicated but mayonnaise is complex. When you add parts to a jumbo jet they make a bigger entity but the original components do not change—a wheel is still a wheel, a window is a window, and steel always remains steel. When you mix the ingredients in mayonnaise (eggs, oil, lemon), however, the ingredients are fundamentally changed, and you can never get the original elements back. In complexity terms, the system is not decomposable back to its original parts"* (p. 9).

Perhaps the most essential proposition of complexity theories is the element of *nonlinearity* (Burnes, 2005; Uhl-Bien & Marion, 2009). In linear models of causality; it is feasible to predict that A leads to B. In contrast, nonlinearity means that an effect in one part of the system (A) does not necessarily provoke a proportional change in another part of the system (B). Instead, effect A could produce unexpected other outcomes, no outcome at all, or interactions with other factors that were not foreseeable *a priori* (e.g., Styhre, 2002; Uhl-Bien & Marion, 2009). This means that in complex systems/organisations, order-generating mechanisms of cause and effect are no longer in place. Predictions become difficult, if not impossible, making *instability* or *unpredictability* two related characteristic elements of complex systems (Stacey, 2011). Authors who support with NDS Theory (e.g., Guastello et al., 2009) describe this as "deterministic chaos", where variables are antecedents and consequences simultaneously. This implies, as Catastrophe Theory outlines (see e.g., Ceja, 2011), that even initially small alterations in a complex system can result in abrupt or drastic change. *Change*, *disruption*, or *chaos* are thus additional key elements, as a complex system is continuously in a state of change (Black, 2000). So-called dissipative structures move dynamically from one state to the other, making them "potentially chaotic" (e.g., Schneider & Somers, 2006; Stacey, 2011). Such chaos – as described by Chaos Theory (e.g., Lorenz, 1993) – may lead organisational systems to tipping (or bifurcation) points where they suddenly self-organise into new, unprecedented patterns (Lichtenstein & Ashmos, 2009). This characteristic of *self-organisation* or *emergence* implies that formal or deliberate mechanisms of control may be overruled (Stacey, 2011). While outcomes are unpredictable, these systems – similar to commotion in liquids and gas – are ruled by order-generating principles (e.g., Burnes, 2005; Lorenz, 1993; Styhre, 2002). Stacey concludes, that "complex systems operating at the edge of chaos display the dynamics of order and disorder, stability and instability, regularity and irregularity, all at the same time" (2011, p. 185). Finally, with the system's ability to spontaneously self-organise, members (or agents) act under conditions of *high dynamic*, *constant interaction*, and *interconnectedness*. The interaction occurs in collective networks, which allow new structures, creativity, and innovation to emerge (e.g., Burnes, 2005; Tetenbaum, 1998; Uhl-Bien et al., 2007). However, it does mean that there is no plan or blueprint for the overall system, and exerting control or influence over the interactions becomes problematic (Stacey, 2011).

Following the propositions of complexity sciences, modern organisations can no longer be viewed as linear, mechanistic forms of operating, but are better understood as dynamic, complex, non-linear systems, in which outcomes are unpredictable and interactions of stakeholders are dynamic to an extent where they are no longer directly controllable or manageable (Burnes, 2005; Marion & Uhl-Bien, 2001; Stacey, 2011; Styhre, 2002). Several theories of complexity have been particularly prominent to describe complex systems (Table 1). Setting aside the respective idiosyncratic terminologies, the prominent views on complexity sciences largely share some common elements when characterising complex systems (see Table 2).

Table 2: Common Elements of "Complexity" Referred to when characterising organisations as complex systems

Element	*Description*	*Alternative Terminology*
Nonlinearity, Instability, Unpredictability	A nonlinear system is a system in which the change of the output is not proportional to the change of the input. Linear models of causality are not in place. As such, processes within complex systems are highly unpredictable and unstable.	Discontinuity (DC) Fragmentation (DC) (Dis-)Equilibrium/Multiple Equilibria (AC) Homeostasis (AC) Non-Predictability (AC) Asymmetry/Symmetry Breaking (AC) Stable Instability (CRP)
Change, Disruption, Chaos	Complex systems are continuously in a state of change. As dynamic entities, they remain constantly on the "edge of chaos" between order and disorder. Unpredictable disruptions are likely to occur.	Bifurcation (DC) Entropy/Negentropy (DC) Critical Values (DC) Phase Change (DC) Quantum Change (DC) Butterfly Effect (DC) Dissipative Structures (AC) Flux (AC) Edge of Chaos (AC) Adaptive Tension (AC)
Self-Organisation, Emergence	Organisational systems are guided by an emergent set of rules that surfaces through self-organisation. As these laws emerge from dynamic, complex patterns of behaviour, they are highly uncontrollable.	Attractors (DC) Strange Attractors (DC) Deterministic Chaos (DC) Fractals (DC) Generative Relationships (DC) Spatial Hierarchy (DC) Self-organised Criticality (AC) Internal Models (AC) Schemata (AC) Continual Iteration (CRP) Novelty (CRP) Perpetuation (CRP) Reinforcement (CRP)
Dynamic, Constant Interaction, Interconnectedness	Members in complex systems work in constant interaction, networks, or bonds. Stakeholders are highly interdependent and interconnected through (group) dynamics.	Oscillation (DC) Synergism (AC) Adaptive Agents (AC) Emergent Social Networks (AC) Neural-like Networks (AC) Fitness Landscapes (AC) Patches (AC) Co-Evolution (AC) Communicative Interaction (CRP) Perpetual Construction (CRP) Responsiveness (CRP)

Note. DC = Terminology related to Deterministic Complexity Theories (e.g. Chaos Theory, Catastrophe Theory, Nonlinear Dynamic Systems Theory); AC = Terminology related to Deterministic Complexity Theories (e.g. Theory of Complex Adaptive Systems); CRP = Terminology related to Complex Responsive Process view

2.1.3 Perspectives on Measuring Organisational Complexity

On an abstract level, one can find common characteristics of organisations as complex systems (e.g., Burnes, 2005; Lissack, 1999; Stacey, 2011). However, surprisingly little *empirical* research has examined the question of how to characterise or measure complex work contexts (Beeson & Davis, 2000; Black, 2000; Schneider & Somers, 2006). More and more voices are criticising this largely theoretical approach to complexity thinking in organisational and management sciences (e.g., Beeson & Davis, 2000; Maguire & McKelvey, 1999). However, there seems to be little progress. Why is this?

An explanation might lie in the fact that basic concepts in complexity thinking, such as “nonlinearity”, “dynamism”, or “chaos” are abstract and often hard to grasp (Lissack, 1999; Schneider & Somers, 2006). When discussing which research methods are best suited for complexity research, a prominent thought is that “it takes complexity to beat complexity” (Uhl-Bien & Arena, 2017, p. 10). In other words, if one wants to measure something particularly complex, one needs particularly complex tools to do so (Anderson, 1999; Lichtenstein et al., 2006; Stacey, 2011). Thus, recommendations for “complex” measurement methodologies are manifold, and many of them are costly, intricate, or not yet established in psychological research. For instance, proposals include: simulating complexity using computer-based or mathematical simulations (Dinh et al., 2014; Marion & Uhl-Bien, 2001; Schneider & Somers, 2006; Uhl-Bien & Marion, 2009); event-level methodologies, network analysis, and dynamic systems simulation (Dinh et al., 2014; Lichtenstein et al., 2006; Schneider & Somers, 2006); visualisation techniques such as neuroimaging technology (Dinh et al., 2014); experimental settings (Beeson & Davis, 2000; Marion & Uhl-Bien, 2001); extensive field and observational studies such as “event-bracketing” techniques (Beeson & Davis, 2000; Lichtenstein et al., 2006; Schneider & Somers, 2006); and qualitative approaches such as verbal enquiries (Beeson & Davis, 2000; Marion & Uhl-Bien, 2001; Schneider & Somers, 2006; Uhl-Bien & Marion, 2009). In contrast, “traditional” quantitative statistics are often criticised as being linear, static, and oversimplified causal assumptions, which do not adequately represent the nonlinearity and dynamics in complex organisational environments (Anderson, 1999; Dinh et al., 2014; Marion & Uhl-Bien, 2001). However, despite the plentiful suggestions for how to study complex systems with complex methods, not many of these methods have been attempted (Beeson & Davis, 2000; Burnes, 2005; Maguire & McKelvey, 1999; Schneider & Somers, 2006). The large majority of current research remains purely theoretical, without empirical foundation (Beeson & Davis, 2000; Burnes, 2005). In fact, it appears as though the most prominent promoters of complex methodology (e.g., Lichtenstein et al., 2006; Marion & Uhl-Bien, 2001; Uhl-Bien et al., 2007) remain those who still contribute theoretically only. This phenomenon may be explained by closer examination of the views on causality and measurement across complexity schools. As touched on in section 2.1.2, there is variation not only in complexity terminology, but also in the views on causality or influence. This is significant as it leads complexity paradigms to compete in their views on how, and to what extent, organisational complexity can be measured (Lichtenstein et al., 2006; Stacey, 2011).

Thinking in terms of a “measurement spectrum” for organisational complexity (see for a similar approach Stacey, 2011), on one end of the spectrum, one could locate Stacey’s (Stacey, 2011; Stacey et al., 2002) Complex Responsive Processes view (CRP) and the postmodernist understanding of complex systems (Cilliers, 1998). These two perspectives are critical in assuming causal or influential mechanisms in complex organisations. In simple terms, they largely object to the thought that (organisational) complexity should be measured. Cilliers (1998, preface) explains: “If something is really complex, it cannot be adequately described by means of a simple theory”. More specifically, this view proposes that any mathematical model of complexity is predestined to simplify complexity and is therefore nonsensical. Cilliers (1998), finds that:

> *“Despite this we can, at a very basic level, make general remarks concerning the conditions for complex behaviour and the dynamics of complex systems. Furthermore, I suggest that complex systems can be modelled. (...) The models themselves, however, will have to be at least as complex as the systems they model, and may therefore not result in any simplification of our understanding of the system itself”* (Cilliers, 1998).

This means that advanced technologies such as algorithms or computers *can,* to some extent, measure or simulate complex systems, but it would be unreasonable to do so. Stacey et al. (2002) speak of models that would need “infinite precision” (p. 98).

Ralph D. Stacey is a prominent and well-respected pioneer in the complexity sciences; he has laid the groundwork in many areas of complexity thinking (Burnes, 2005). His works on complexity thinking are perhaps not only the most comprehensive, but theoretically the most thorough and rigorous. The consequence of arguing with such rigour, however, is that at present, no method will be precise and comprehensive enough to measure a complex environment. Eventually, all discourse remains conceptual. This non-measurement approach thus exposes itself to the critique that “New Science is well on its way toward short-lived faddism unless serious research shows there is more than a metaphor to chaos theory and complexity science applications (...)” (Maguire & McKelvey, 1999, p. 57). With this, the postmodernist and CRP views largely fall short of guiding complexity ideas to true application in organisational research and practice.

Closer to the middle of the “complexity measurement” spectrum, one could place the conceptual or qualitative research by constructivist and systemic complexity researchers (Manson, 2001; Stacey, 2011). Based on the assumption that people can at the least *indirectly* influence behaviour in complex organisations (e.g., Anderson, 1999; Karp & Helgø, 2008; Stacey et al., 2002), CAS researchers have, for instance, provided conceptual models of micro-dynamics in organisations (Marion & Uhl-Bien, 2001) and a model of intertwined leadership styles: administrative, enabling, and adaptive (see Figure 1, Uhl-Bien et al., 2007). Other contributions include guidelines for strategic leadership in CAS (Boal & Schultz, 2007), leadership in chaotic change (Karp & Helgø, 2008), and implications of chaos theory for the application in nursing contexts (Haigh, 2002). These contributions bridge complexity theories and application in organisational study. They do, however, remain purely theoretical and the criticism is that it is difficult to test these models (Schneider & Somers, 2006). This being so, CAS research has not significantly influenced the ability to measure organisational complexity.

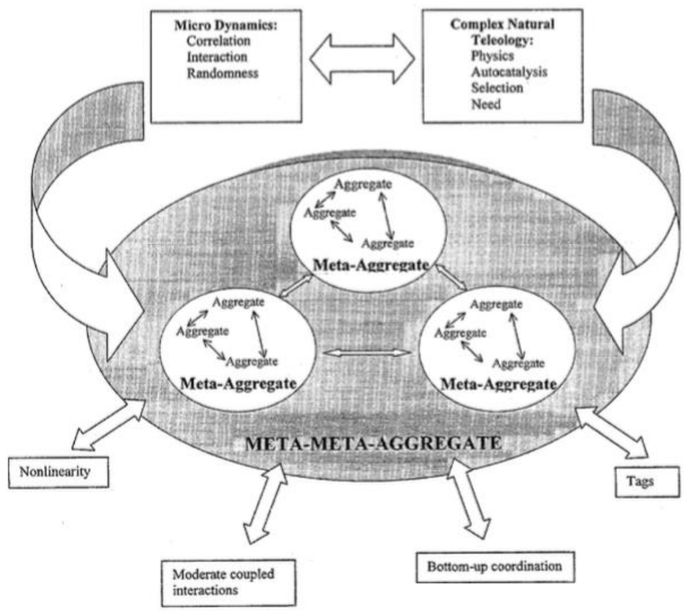

Fig. 1. Microdynamics and complex natural teleology drive aggregation, or emergence. The process is influenced by coupling, bottom-up coordination, nonlinearity, and tags (which are also emergent dynamics). In emergence, aggregates evolve into meta-aggregates, which, in turn, evolve into meta-meta-aggregates.

Figure 1. Conceptual Model of Micro Dynamics in Organisations
Based on Complexity Theory. Picture from Marion and Uhl-Bien (2001, p. 392).

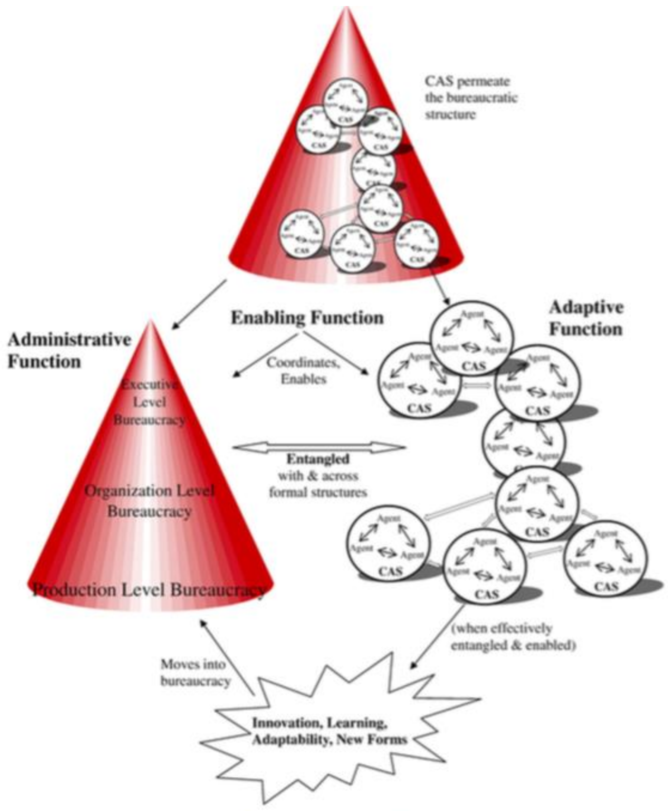

Fig. 1. Meso model of Complexity Leadership Theory.

Figure 2. Conceptual Meso Model of Complexity Leadership Theory
as proposed by Uhl-Bien and Marion (2009). Picture from Uhl-Bien and Marion, 2009, p. 634.

Authors across several complexity schools have published qualitative case studies. Here, concepts of complexity thinking are transferred to singular, real-life organisations, contributing with recommendations, for example for leadership of chaotic change (Lane & Down, 2010; Styhre, 2002; van der Voet et al., 2015) and leadership in NDS (Beeson & Davis, 2000; Lichtenstein et al., 2006). Some of the case studies are accompanied by interview studies (van der Voet et al., 2015). These qualitative contributions highlight the value of empirical research and add field insights. However, whilst they do suggest more rigorous dynamic research and the application of “complex” methodology (Anderson, 1999; Uhl-Bien & Arena, 2017), actual approaches in this direction are lacking within these schools (Maguire & McKelvey, 1999). In sum, many attempts to describe complex work environments still remain purely conceptual or based on single observations (Burnes, 2005).

In contrast, at the other end of the spectrum, the Nonlinear Dynamic Systems (NDS) approach has answered the call for mathematical simulations of chaos and complexity. Building on the causality assumption that complexity follows basic underlying rules of order, NDS psychologists have begun to simulate complex, nonlinear patterns of work. Examples of quantitative NDS methods are the modelling of neural networks (e.g., Karanika-Murray & Cox, 2010), nonlinear analysis of time series patterns (Ramos-Villagrasa, Navarro, & García-Izquierdo, 2012), and the experience sampling method (ESM, e.g., Ceja, 2011). ESM enables the collection of quantitative data through sequential observations several times per day. This facilitates the study of behavioural patterns such as engagement, wellbeing, and flow, in complex work environments (Arrieta et al., 2008; Ceja, 2011; Ceja & Navarro, 2009, 2012; Karanika-Murray & Cox, 2010; Navarro, Arrieta, & Ballén, 2007). Thus, the NDS approach is compatible with both complexity theories and classic (post-) positivistic research in organisational psychology (Ceja, 2011). Although this approach follows the mantra of complexity science in examining complex, nonlinear patterns with complex, nonlinear methods, as a methodology it will always have certain limitations. For instance, the simulation of organisational network models is still in its infancy (Karanika-Murray & Cox, 2010) and ESM data collection is reduced to singular points of observations (Ceja, 2011). Also, the process of data collection is costly, and thus small sample sizes of around 20 participants are not uncommon; this makes the generalisability of results questionable (Ceja, 2011; Ramos-Villagrasa et al., 2012). With such examples and more in-depth discussions on adequate research methodology, awareness is growing that basically *every* approach is somewhat limited in its ability to measure or simulate a complex system. In fact, most – if not all – the research methods proposed above, e.g.

experimental designs, case studies, network simulation, or neuroimaging techniques, are inherently likely to simplify the topic of complexity to some extent (Gray, 2014; Karanika-Murray & Cox, 2010). A similar point has been made for computer studies: a computer model is just that, a model, and will never be the same as the direct study of human behaviour (Burnes, 2005; Lissack & Richardson, 2001).

In psychological research, this is not a novelty: indeed, flaws, limitations, and errors and the handling of them are commonly accepted as part of empirical reasoning (Gray, 2014). As such, it seems as if the progress of measuring and empirically studying organisational complexity is partly hindered by the *ideological* mantra of “it takes complexity to beat complexity” (Uhl-Bien & Arena, 2017, p. 10). The commonly recognised fact that basically *all* research methods are likely to be somewhat flawed is not acknowledged. Whilst recognising their limitations, the upcoming NDS studies have contributed to the application of complexity theories for organisational psychology and have clearly advanced our understanding of individual behaviour in complex environments. While NDS techniques are used infrequently and their application is still intricate, they display promising potential for the future (Ramos-Villagrasa et al., 2012). Figure 3 shows an example from NDS research, where ESM data is transformed into structured, chaotic, and random patterns of motivational flow.

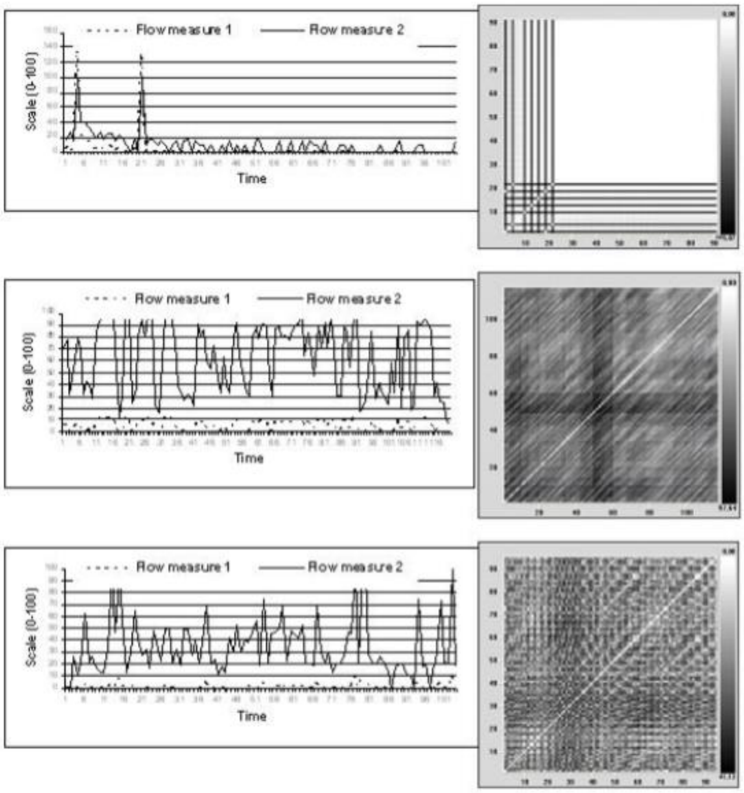

Figure 3. Example from NDS Studies: Chaotic Patterns of Flow in Workers Picture from Ceja, 2011, p. 103.

Note. Line graphs (left) represent ESM data on motivational flow measures, recurrence plots (right) represent a structural (top), chaotic (middle), and a random (bottom) pattern of flow that emerges during a workday.

Lastly, by turning to the opposite end of the measurement spectrum, one can locate quantitative studies by post-positivistic researchers in the field of complexity research. An emerging approach here is to apply (linear) quantitative measurement scales, often in cross-sectional designs, and seek empirical insights into organisational/leadership behaviour in complex work environments. Discussed in more detail below, examples of this approach include: the study of proactive personality in complex jobs by Chung-Yan and Butler (2011), where the authors have applied the “Job Complexity” Scale from the Work Design Questionnaire (WDQ, Morgeson & Humphrey, 2006) or studies looking at how employees cope with the uncertainty that emerges in complex work environments, applying self-report scales for unpredictability or uncertainty in organisations (Griffin, Neal, & Parker, 2007; Hochwarter, Ferris, Zinko, Arnell, & James, 2007; Rafferty & Griffin, 2006). This approach radically opposes the non-measurement position of postmodernist and CRP views (Cilliers, 1998; Stacey, 2011) by directly applying ideas from complexity thinking to empirical organisational research, seeking causal mechanisms, explanations and recommendations. A central thought in post-positivism research is that "all observation is inherently fallible – we can only approximate the truth, never explaining it perfectly or completely" (Gray, 2014, p. 23). Taking into account this inherent limitation, a vital aim for this school is to derive application-oriented insights for employees and leaders in complex working contexts. In recent discourse, quantitative, even cross-sectional methods for complexity research are gradually becoming accepted. Dinh et al., (2014) for example, in their review of emerging complexity leadership research argue that:

> *"despite our recommendations for dynamic research designs that capture events occurring across time, we do not intend to argue that well-designed cross-sectional research should be abandoned. Such designs, especially at initial stages of inquiry on specific research topics, may be very beneficial"* (p. 47).

Moreover, the post-positivistic view on complex work environments offers a clear perspective on exactly what one is measuring through work environment questionnaires. This is that quantitative self-reports reflect respondents' *perception* of work environments (Babalola, Stouten, & Euwema, 2016). That is, "the psychological meaning that respondents attach to events in their organisations, their organisational units, and their work groups" (Amabile, Conti, Coon, Lazenby, & Herron, 1996). Thus, such research is not an attempt to quantify actual objectifiable aspects of a work environment, but rather to capture a psychological evaluation of them (Amabile et al., 1996). Similar reasoning can be found in research on work design (Morgeson &

Humphrey, 2006), comparable scales for creative working environments (Amabile et al., 1996) in organisational change processes (Babalola et al., 2016), and the "total-work-environment level of analysis" approach (Pierce, Gardner, Cummings, & Dunham, 1989). Transferring the measurement of complexity to an individual-level-perception is unlikely to satisfy the most sophisticated and rigorous advocates of complexity theory; however, organisations have long been acknowledged as an individual construction of reality (Lissack, 1999). Furthermore, there is agreement in organisational research that one's perception of a work environment in turn influences individual behaviour in that context, and thus creates value for the study of higher-level behaviour (Amabile, 1988; Amabile et al., 1996; van Woerkom, Bakker, & Nishii, 2016; Woodman, Sawyer, & Griffin, 1993). Thus, approaching the measurement of a complex work environment as an individual's perception of it might offer a valuable perspective for empirical study. In summary, the post-positivistic measurement approach is less guided by the ideology that complexity research has to be particularly complex itself or work with "infinite precision", rather it aims at the pragmatic, application-oriented value that individual-based, quantitative insights can produce.

Whilst the post-positivistic approach has clearly advanced the study of complex work environments into empirical research, it is vulnerable to several criticisms. Firstly, the measurement instruments applied today to measure "complex" working contexts are not underpinned by research on a comprehensive construct of complex work environments. To date, there is no agreed-upon definition in organisational psychology of what factors make a work environment "complex" (Black, 2000; Burnes, 2005; Maguire & McKelvey, 1999; Marks et al., 2001). This means that most (post-)positivistic studies claim to study a "complex" work environment, without applying any form of foundational definition or measurement for this claim (Hannah, Balthazard, Waldman, Jennings, & Thatcher, 2013; Correia de Sousa & van Dierendonck, 2014; Wang, Tsai, & Tsai, 2014). Rather, as detailed below, these studies appear to tap singular self-proclaimed aspects of organisational complexity in a fragmented and unsystematic way (Black, 2000) or have simply *assumed* that the studied context is complex (e.g., White & Shullman, 2010). There is, as yet, no scale that measures how "complex" a work environment is. This means that the term "organisational complexity" is used here more as an analogy than an empirically substantiated concept (Burnes, 2005). Secondly, with the use of cross-sectional designs, the element of time is ignored. It does, however, seem crucial to incorporate temporal aspects into complexity research to account for dynamics of complex systems and interrelations (Dinh et al., 2014; Uhl-Bien & Marion, 2009). While this could be partly overcome by *longitudinal* quantitative designs, (post-) positivistic complexity research still fails to employ such approaches (Dinh et al., 2014).

2.1.4 Positioning of the Research Approach

In conclusion, organisational complexity has been reflected upon using a variety of paradigms and input from complexity theories has progressed our understanding of complex organisations. While several aspects remain controversial, most mainstream approaches agree that complexity thinking should be advanced towards the study of organisations and leadership within them. Furthermore, leaving idiosyncratic terminology aside, the major complexity theories share common characteristics in describing complex organisations: Nonlinearity/Unpredictability, Change, Self-Organisation, and Dynamic are typical characteristics referred to across different Complexity Theories. The mainstream approaches share the assumption that some form of causality exists and that individuals (e.g. leaders) may – to some extent – exert influence within complex organisational contexts. This implies that the context of organisational complexity can be studied or empirically measured.

However, it seems that "as yet, organisation theorists do not appear to have moved beyond the stage of using the complexity approach as metaphor rather than as a mathematical, [i.e. empirically substantiated] way of analysing and managing organisations" (Burnes, 2005, p. 73). At one end of the spectrum, theoretical models of organisational complexity ideologically oppose or sidestep the question of measurement (e.g., Maguire & McKelvey, 1999; Stacey, 2011), leaving many claims of complexity theory as purely conceptual and often abstract (Burnes, 2005; Schneider & Somers, 2006). Here, it appears that substantial empirical progress is often hindered by the dogma that complex methods are required to study complex phenomena (e.g., Uhl-Bien & Arena, 2017). At the other end of the spectrum, post-positivistic approaches have conducted quantitative research on singular, fragmented aspects of complex environments, without a communal conceptual rationale (Black, 2000). Many modern studies of "complex" organisations do not, in fact, attempt to measure the complexity of the work environment. Furthermore, the incorporation of time has not yet been achieved in most approaches, with the exception of studies that have applied methods of NDS. Quantitative approaches, if applied, would thus have to be conducted in a longitudinal manner to adequately address complex dynamics over time (Dinh et al., 2014; Uhl-Bien & Marion, 2009).

In summary, although it is frequently used, the term "complex" as a description of working contexts lacks both a communal conceptual foundation and an applied empirical foundation in organisational psychology (Black, 2000; Burnes, 2005; Maguire & McKelvey, 1999; Marks et al., 2001). Without this, complexity research faces the risk of ending up as a fad or triviality (Maguire & McKelvey, 1999).

Research in organisational psychology is led by the aim to study principles of individual and organisational behaviour and to contribute with applicable knowledge to the solution of problems at work (American Psychological Association (APA), 2017). Based on the above considerations, the complexity sciences have not yet arrived at a state where this is possible (Black, 2000; Burnes, 2005; Maguire & McKelvey, 1999; Schneider & Somers, 2006). One explanation for this might be the common theme for complexity research methodology: “It takes complexity to beat complexity” (Uhl-Bien & Arena, 2017, p. 10). Thus, post-positivistic, quantitative studies have been criticised for their apparent oversimplification. However, it is evident that every method will somewhat reduce or simplify complexity, as the methods of organisational psychology cannot claim “infinite precision” (Stacey et al., 2002). Despite some obvious limitations of the approach, post-positivistic complexity research shows clear potential to overcome ideological barriers and provide application-oriented insights for organisational psychology and leadership research.

A second major limitation to empirical research is that across the complexity schools there is no agreed-upon definition of what makes a working context “complex”. Given that there seems to be a general agreement on common elements or factors of complex working environments (Lissack, 1999; Stacey, 2011), it should, however, be possible to integrate these into a measurable and empirically substantiated construct. Leaving idiosyncrasy aside, this could be informed by the foundations provided across the schools of complexity thinking. In favour of a (post-) positivistic approach. Lissack (1999, p. 112) argues that complexity sciences for organisations share common characteristics that can “be discovered through (…) analytic, logical, and conceptual developments (…)”. Further, post-positivistic research here offers the perspective of understanding the definition of a work environment as an individual *perception* of it.

It therefore appears that the current state of complexity thinking in organisational psychology can be advanced by choosing a post-positivistic, application-oriented, and empirical approach towards it. At this point it is necessary to provide an integrative conceptualisation of a "complex working environment" that can be quantitatively measured. This thesis will introduce and work with the more specific construct of *Work Environment Complexity* (WEC), which outlines the *(individually perceived) complexity within organisational work contexts*. The process of conceptualising and clarifying this construct of WEC will be informed by a post-positivistic perspective (Burrell & Morgan, 2017; Gray, 2014).

"For every study supporting complexity, a host of criticisms seem to be raised" (Burnes, 2005, p. 80). Post-positivism seeks to identify constituent elements and search for consistencies (Burrell & Morgan, 2017; Gray, 2014). By choosing a post-positivistic lens on WEC, this project sees the potential to integrate existing standpoints and to create some common ground across the differing paradigms in complexity thinking. If WEC is not yet measurable, it will be challenging – if not impossible – to study organisational behaviour, leadership, and other research fields within complex contexts (Schneider & Somers, 2006). Without such research, there is a risk that the study of complexity will become "short-lived faddism" (Maguire & McKelvey, 1999, p. 57). A central goal of this work is thus to provide a measurement instrument for researchers and practitioners that enables an evaluation of the degree of complexity that individuals face in their work environment. The fact that this research is able to shed light on an integrative, measurable construct of WEC suggests that complexity thinking can be empirically linked to the study of complexity leadership and many other questions of organisational behaviour (Schneider & Somers, 2006). More substantial and application-oriented findings for research and practice can subsequently be obtained (Schneider & Somers, 2006).

This will require both inductive and deductive phases of reasoning. The first part of this thesis, establishing a framework for (Leadership in) Work Environment Complexity, is guided by an inductive approach: building on the above reflections and contributions from various schools of thoughts, it aims to collect and integrate diverse perspectives in order to find common patterns and binding principles, and thus to derive propositions (Gray, 2014). This will require creating clarity on existing conceptualisations of WEC *within* the post-positivistic and application-oriented landscape, as this has not yet been achieved (Ashmos et al., 2000; Black, 2000; Maguire & McKelvey, 1999; Marks et al., 2001). The second part of the thesis, the empirical chapters, will adopt more of a deductive approach, developing and testing hypotheses through quantitative analysis (Gray, 2014). Following the call by Dinh et al. (2014) as well as Marion and Uhl-Bien (2001), a central aim will be to include temporal aspects of measurement. Thus, the empirical studies of this thesis will use longitudinal survey designs. It is commonly accepted in organisational psychology that quantitative surveys and self-reports are vulnerable to common method bias and subjective interpretation of respondents (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003; Podsakoff & Organ, 1986). These biases may be partially mitigated through the careful research design of this project. Nevertheless, this limitation will have to be taken into account when discussing and generalising findings.

Lastly, to some extent this project will have to begin with an “act of faith”, as observed by Wheatley (2011), that complexity theories share valid propositions and that they can be transferred from the natural to the social sciences. With this in mind, it is believed by the author that this thesis paves the way to new, substantive, and applicable insights for studying Work Environment Complexity and leadership within it.

2.2 Current Conceptualisations of WEC in Organisational Psychology and Management Sciences

The (post-) positivistic interest in complexity research is advancing (Ceja, 2011). A growing body of contributions in organisational psychology and management sciences has empirically measured (facets of) "complex" work environments and/or have applied complexity thinking closely to organisational and leadership matters (Dinh et al., 2014). Yet, even *within* this strongly application-oriented literature, there is as yet no basic agreement on what makes a work environment "complex" and one finds a lack of clarity on existing conceptualisations of WEC (Black, 2000; Burnes, 2005; Maguire & McKelvey, 1999; Marks et al., 2001). This research project aims to provide an integrative conceptualisation of WEC that can be quantitatively measured. In line with Maguire and McKelvey's observation (1999) "we do not need to start from a clean slate: we need integration and synthesis of the complexity-inspired constructs with solid existing organisational research" (p. 57), Table 3 provides an overview of the literature evaluated in this section. It includes strongly application-oriented and empirical articles from organisational psychology and management sciences literature that work with complexity-inspired constructs and/or attempt to evaluate "complex" working contexts. This overview of current approaches to measure a "complex" work environment will inform the construct definition and measurement of WEC.

Table 3: Factors of WEC Explored in Previous Studies of Organisational Psychology and Management Sciences

Reference	*Research Topic /Objectives*	*Description of Complexity in Organisations*	*Factor(s) of Work Environment Complexity highlighted*	*Measure/Operationalisation*
Alison, Power, van den Heuvel & Waring, 2015	A taxonomy of uncertainty in high-risk, high-impact contexts	Complex work environments are characterised by high uncertainty, where individuals are frequently forced to make crucial job decisions with limited information at hand under high time pressure. Simulating a hostage negotiation situation with police officers, the authors draw parallels to organisational uncertainty and propose a post-hoc taxonomy to distinguish between endogenous uncertainty (= uncertainty about the situation itself) and exogenous uncertainty (= uncertainty about the operating system).	Uncertainty	*Fragmented approach* Uncertainty operationalised as communication of uncertainty on how to decide
Chung-Yan & Butler, 2011	Study of proactive personality in complex jobs	Complex jobs refer to jobs that are mentally challenging, requiring workers to use several, high-developed skills. Further, complex work is demanding because it has more unanticipated challenges, requiring more flexibility, judgment, and personal initiative on the part of the workers.	Challenging Work Demands / Job Complexity Unpredictability	*Fragmented approach* Challenging Work Demands assessed by Subscale “Job Complexity” of the Work Design Questionnaire (WDQ; Morgeson & Humphrey, 2006) No distinct measure of Unpredictability

Reference	*Research Topic /Objectives*	*Description of Complexity in Organisations*	*Factor(s) of Work Environment Complexity highlighted*	*Measure/Operationalisation*
Denison, Hooijberg & Quinn, 1995	Explore leaders' capacity to react to paradox and contradiction in work environments	Modern work environments are increasingly more challenging and complex, as paradox, ambiguous, and opposing demands have to be managed by leaders.	Ambiguity	*Assumed approach* Ambiguity operationalised as handling competing leadership demands, assessed by Competing Values Framework questionnaire
Frese, Kring, Soose & Zempel, 1996	Study on personal initiative and complex jobs	Job Complexity is characterised by complicated decisions. Extraordinary tasks that are particularly difficult require individuals to use diverse skills and knowledge, as well as to learn new skills.	Challenging Work Demands / Job Complexity	*Fragmented approach* Job Complexity assessed by self-developed Job Complexity measure
Gebauer, 2013	Mindful organising to equip managers for complexity and uncertainty	In today's organisations, uncertainty is a given. While complicated systems are considered as difficult but potentially controllable, organisations are complex systems which are unpredictable and thus not controllable for managers. Organisations are considered complex, social entities, which managers need to navigate.	Uncertainty Unpredictability	*Conceptual/theoretical approach*

Reference	*Research Topic /Objectives*	*Description of Complexity in Organisations*	*Factor(s) of Work Environment Complexity highlighted*	*Measure/Operationalisation*
Griffin, Neal & Parker, 2007	Explore positive behaviour in contexts of uncertainty and interdependency	One of the major changes for organisations is the increasing uncertainty and interdependence of work systems. Uncertainty occurs when work-related inputs, processes, or outputs cannot be predicted or are unclear. Organisations are seen as systems of interdependent behaviours where networks, e.g. a team, need to cooperate to accomplish a common goal.	Uncertainty Unpredictability Interdependence/ Interaction of many	*Fragmented approach* Uncertainty/Role clarity assessed by School Organisational Health Questionnaire (Hart, Wearing, Conn, Carter & Dingle, 2000) No distinct measure of Unpredictability No distinct measure of Interdependence
Hannah, Balthazard, Waldman, Jennings & Thatcher, 2013	Explore leaders' adaptability and decision-making in complex contexts	Complex work situations are described as contexts in which leaders need to cope with changing, volatile conditions, and face ambiguous decision-making scenarios. Managers need to adapt to unpredictability and challenging demands to function effectively. Modern, complex organisations need leaders to react to ill-defined, transforming, and ever-new decision-making situations to reduce ambiguity.	Frequent Change Interdependence/ Interaction of many Ambiguity Challenging Work Demands / Job Complexity Unpredictability	*Assumed approach* Frequent Change simulated in adaptive military leadership situations No distinct measures for the single factors

Reference	*Research Topic /Objectives*	*Description of Complexity in Organisations*	*Factor(s) of Work Environment Complexity highlighted*	*Measure/Operationalisation*
Hochwarter, Ferris, Zinko, Arnell & James, 2007	Study political behaviour in ambiguous organisations	Organisational environments are becoming increasingly vague, with states of ambiguity and uncertainty likely to arise. The study explores political behaviour as a sense-making function in such environments.	Uncertainty Ambiguity	*Fragmented approach* Uncertainty assessed by self-developed Uncertainty Scale. No distinct measure for Ambiguity
Intezari & Pauleen, 2014	Management wisdom in business environments of extreme unpredictability	Volatility and instability are core characteristics of today's business environment. These cause high levels of uncertainty. Where the future is no longer seen as predictable, even simple actions may lead to inadequate or unplanned results for managers as decision-makers.	Unpredictability Frequent Change Uncertainty	*Conceptual/theoretical approach*
Karp & Helg∅, 2008	Leadership principles to lead chaotic change by shaping patterns of human interaction	Chaotic change in organisations means changes where the external and internal complexity and uncertainty is too high to predict or control future developments. Management of such organisations will thus have to be re-thought.	Frequent Change Unpredictability	*Conceptual/theoretical approach*

Reference	*Research Topic /Objectives*	*Description of Complexity in Organisations*	*Factor(s) of Work Environment Complexity highlighted*	*Measure/Operationalisation*
Kaiser, Lindberg & Craig, 2007	Explore managerial flexibility when facing "a new kind of complexity"	Complexity in managerial contexts is created by strongly changing or ambiguous circumstances. These create the challenge of balancing competing demands or mastering opposites.	Frequent Change Ambiguity	*Assumed approach* Ability to handle Ambiguity and Frequent Change measured through Leadership Versatility Index (Kaplan and Kaiser, 2002) No distinct measures for Ambiguity and Frequent Change
Lavine, 2014	Proposition of a paradoxical perspective on leadership	Leaders are challenged by the growing intricacy and variety in organisations. Complex work is characterised by factors such as paradox and ambiguity. This creates the necessity for management to be answerable to and cope with complexity, interconnectedness, and diversity. Paradoxes call for increased leader "self-complexity" and greater flexibility.	Ambiguity Interdependence/ Interaction of many	*Conceptual/theoretical approach*

Reference	*Research Topic /Objectives*	*Description of Complexity in Organisations*	*Factor(s) of Work Environment Complexity highlighted*	*Measure/Operationalisation*
Maguire & McKelvey, 1999	Foundations of complexity and management	Reviewing practitioners' books, the authors call for exchange between research and practice when applying complexity models to today's organisations. From the discussion, organisations are described as fluctuating, chaotic, nonlinear contexts, and as adaptive systems that transform and self-organise. Traditional, linear cause-and-effect-predictions are called into question.	Frequent Change Unpredictability Ambiguity Interdependence/ Interaction of many	*Conceptual/theoretical approach*
Mumford, Zaccaro, Harding, Jacobs & Fleishman, 2000	Leadership skills in a complex world	Organisations are defined by complexity, divergence, and frequent change. In such contexts, the process of setting and attaining goals is, at best, uncertain. The complexity, conflict, and change in these environments present modern leaders with unclear, novel problems and information ambiguity. Leaders will need to solve (complex) social problems in interaction with others.	Frequent Change Uncertainty Ambiguity Challenging Work Demands / Job Complexity Interdependence / Interaction of many	*Conceptual/theoretical approach*

Reference	*Research Topic /Objectives*	*Description of Complexity in Organisations*	*Factor(s) of Work Environment Complexity highlighted*	*Measure/Operationalisation*
Oldham & Cummings, 1996	Contextual factors of creativity: complex work	Complex jobs are defined as challenging tasks that are multifaceted, provide autonomy for own decision-making, provide feedback, significance, and are multifaceted.	Challenging Work Demands / Job Complexity	*Fragmented approach* Complex Work/ Challenging Work Demands assessed by the Job Diagnostic Survey (Hackman & Oldham, 1975, 1980).
Osborn & Hunt, 2007	Guidelines for leading near the "edge of chaos"	Modern organisations tackle omnipresent dynamic and non-predictability. Balancing these uncertainties and turbulent environments creates a critical task complexity for leaders. Many members have to interact in order to achieve the organisational mission. Therefore, they are Complex Adaptive Systems that operate in chaos-like uncertainty and high interdependence.	Frequent Change Uncertainty Challenging Work Demands / Job Complexity Interdependence/ Interaction of many Unpredictability	*Conceptual/theoretical approach*

Reference	*Research Topic /Objectives*	*Description of Complexity in Organisations*	*Factor(s) of Work Environment Complexity highlighted*	*Measure/Operationalisation*
Ashmos, Duchon & McDaniel, 2000	Complexity absorption vs. reduction strategies in hospitals	Organisations are complex adaptive systems. The complexity is especially high for those with ambiguous work environments, where goals and strategies are diverse, structures are less clear or formalised and interaction of agents is common.	Ambiguity Interdependence/ Interaction of many	*Fragmented approach* Complexity assessed by self-developed Hospital Complexity measure (Ashmos et al, 1996)
Rafferty & Griffin, 2006	Perceptions and coping of individuals with frequent organisational change	In organisations, uncertainty, and complexity arises when changes are frequent. When organisational members perceive change as a constant rather than a discrete event, it is likely that such change creates situations of high uncertainty.	Frequent Change Uncertainty	*Fragmented approach* Frequent Change assessed by the self-developed Frequent Change Scale Uncertainty measured by the self-developed Uncertainty Scale

Reference	*Research Topic /Objectives*	*Description of Complexity in Organisations*	*Factor(s) of Work Environment Complexity highlighted*	*Measure/Operationalisation*
Tummers, Landeweerd, Janssen & van Merode, 2006	Relationships between organisational characteristics, work characteristics, and psychological work reactions in nursing	Organisational environments are described as complex and uncertain. Such organisational and work characteristics are likely to influence individual's psychological reactions; these relationships are investigated in the nursing context.	Uncertainty Unpredictability Challenging Work Demands / Job Complexity Interdependence	*Fragmented approach* Environmental Uncertainty assessed by the Environmental Uncertainty scale developed by Wibbelink (1995) and Tummers (1998) Complexity measured by (Nursing) Complexity Scale developed by Mandemakers (1993), adapted by Wibbelink (1995), and Tummers (1998)
Wang, Tsai & Tsai, 2014	Relating transformational leadership to the creativity of employees in complex jobs	Complex and challenging tasks are characterised by high autonomy, identity, feedback, skill variety, and significance.	Challenging Work Demands / Job Complexity	*Assumed approach* Job Complexity operationalised by differentiating front office and back office jobs

Reference	*Research Topic /Objectives*	*Description of Complexity in Organisations*	*Factor(s) of Work Environment Complexity highlighted*	*Measure/Operationalisation*
Wee & Taylor, 2018	Conceptualising Emergent Continuous Organisational Change	Organisational complexity is created as changes are no longer discrete, self-contained events. Instead, this study proposes that small, frequent bottom-up changes can accumulate into continuous change. The authors define Emergent Continuous Organisational Change as ongoing, cumulative, and substantive change.	Frequent Change	*Conceptual/theoretical approach*
White & Shullman, 2010	Acceptance of uncertainty as prerequisite for leaders in ambiguous environments	Ambiguity is a by-product of constantly changing and complex environments. With this comes an increase in the emotional reaction ambiguity evokes: uncertainty.	Ambiguity Uncertainty Frequent Change	*Assumed approach* Ability to accept Uncertainty measured by the self-developed assessment instrument “Ambiguity Architect™” (White, Hodgson, Lombardo, and Eichinger, 1999) No distinct measures for Ambiguity, Uncertainty, or Frequent Change.
Yukl & Mahsud, 2010	Flexible and adaptive leadership as a means of managing increasingly complex demands	Challenge and complexity in modern work contexts are created by sudden, unusual events that interrupt work processes. Leaders are required to show prompt but appropriate responses to these spontaneous crises.	Challenging Work Demands / Job Complexity Frequent Change Unpredictability	*Conceptual/theoretical approach*

Reference	*Research Topic /Objectives*	*Description of Complexity in Organisations*	*Factor(s) of Work Environment Complexity highlighted*	*Measure/Operationalisation*
Zaccaro, Banks, Kiechel-Koles, Kemp & Bader, 2009,	Predictors of leader and team adaptation	Complex/challenging work assignments are jobs with "informationally complex" components (unfamiliar responsibilities, high stakes, scope and scale) or "socially complex" components (conflict with employees, external pressures, influence without authority, diversity).		*Fragmented Approach* Complex/challenging work assignments measured with the Job Challenge Profile (McCauley, 1989)

In an attempt to summarise, these contributions describe common factors of Work Environment Complexity (Burnes, 2005; Dinh et al., 2014). Amongst the most prominent ones are *Frequent Change* (Hannah et al., 2013; Kaiser, Lindberg, & Craig, 2007; Karp & Helgø, 2008; Wee & Taylor, 2018), *Unpredictability* (Chung-Yan & Butler, 2011; Intezari & Pauleen, 2014; Karp & Helgø, 2008; Rafferty & Griffin, 2006; Tetrick & LaRocco, 1987; Yukl & Mahsud, 2010), *Ambiguity* (Ashmos et al., 2000; Denison, Hooijberg, & Quinn, 1995; Hannah et al., 2013; Kaiser et al., 2007; Mumford et al., 2000; White & Shullman, 2010), *Uncertainty* (Alison, Power, van den Heuvel, & Waring, 2015; Gebauer, 2013; Hochwarter et al., 2007; Karp & Helgø, 2008; Mumford et al., 2000; Tummers, Landeweerd, Janssen, & van Merode, 2006) *Interdependence/Interaction of Many* (Griffin et al., 2007; Hannah et al., 2013; Mumford et al., 2000; Osborn & Hunt, 2007), and *Challenging Work Demands/Job Complexity* (Chung-Yan & Butler, 2011; Frese, Kring, Soose, & Zempel, 1996; Morgeson & Humphrey, 2006; Tummers et al., 2006; Wang et al., 2014).

Similarities arise to the elements of early Complexity Theories identified in section 2.1.2: *Unpredictability, Ambiguity*, and *Uncertainty* reminds one of the elements of Nonlinearity, Instability, and Unpredictability. *Frequent Change* refers to Change, Disruption, and Chaos. *Interdependence/Interaction of Many* aligns with the elements of Constant Interaction and Interconnectedness. *Challenging Work Demands*, however, finds no adequate partner; neither does Self-Organisation/Emergence in the previous classification. This may be because, in the present overview, researchers' focus has shifted from describing the mere structure of complex systems to studying specific leadership or employee behaviour, which includes individuals' perceptions of work environments in a post-positivistic approach (Amabile et al., 1996; Morgeson & Humphrey, 2006). In summary, the literature evaluation above displays a broad agreement on some mutual characteristics of WEC and parallels can be found with the elements of classic complexity theories. Given this agreement, it should be possible to empirically measure an integrated construct of Work Environment Complexity.

Three important points have become evident. Firstly, despite a strongly application-oriented approach, many of the studies remain theoretical (Burnes, 2005). In fact, around one third of the studies outlined above are solely *conceptual or theoretical* (see respective labelling, e.g., Intezari & Pauleen, 2014; Osborn & Hunt, 2007; Yukl & Mahsud, 2010). Thus, assumptions as to what constitutes a complex work environment have not been empirically validated. Secondly some work, for example Hannah et al.'s (2013) study on adaptive decision-making, does not apply a measure of WEC. Rather, "organisational complexity" is basically *assumed*, and empirical research is conducted within this context (Wang et al., 2014; White & Shullman, 2010). The authors state that the context is complex, yet do not measure or evaluate this statement. Hence, these authors are not working with, or empirically testing, a common definition. Thirdly, although some empirical research has evaluated or described a "complex" working context, closer inspection reveals that the actual measures cover narrower constructs. This means that, while labelling the contexts as "complex", the measurement instruments actually examine singular, and thus more *fragmented* elements such as Uncertainty (Rafferty & Griffin, 2006) or Challenging Job Demands (Chung-Yan, 2010; Rafferty & Griffin, 2006; Tummers et al., 2006; Zaccaro, Banks, Kiechel-Koles, Kemp, & Bader, 2009).

Whilst this literature evaluation cannot claim to be complete, it shows that approaches to studying WEC to date are largely without empirical foundation or fragmented. Studying an integrative concept for WEC has not yet been attempted. Currently, the construct of WEC cannot be empirically grasped: no study known to the author has to date suggested a comprehensive measure for WEC. Instead, authors in application-oriented research are turning to the measurement of existing, yet unsystematic fragments of a "complex" work environment. Where research has been fragmented, overlaps are likely. In the attempt to desegregate these approaches and identify the core content of an integrated WEC construct, such overlaps or limitations of the different factors need to be addressed. This requires more detailed examination of the operationalisations and measurement approaches to WEC applied so far. Table 4 summarises this evaluation.

2.2.1 Frequent Change

Summarising the literature above, a common theme emerges around Frequent Change being a defining characteristic of WEC: complex work environments are contexts in which individuals are confronted with the need to cope with frequent change. These changing and volatile conditions include unprecedented decision-making situations where transformation is a constant rather than a discrete event (Hannah et al., 2013; Karp & Helgø, 2008; Rafferty & Griffin, 2006; Wee & Taylor, 2018). As can be seen in Table 4, Frequent Change has appeared in current WEC-related studies as both an indirectly and a directly measured construct. Hannah, Balthazard, Waldman, Jennings & Thatcher (2013) propose that Frequent Change creates complexity in leadership situations and have followed an assumed approach: their study simulated military situations that confronted participants with frequently changing scenarios. There was, however, no quantitative evaluation of this "complex" design. Rather, the study measured participants' situational awareness, decisiveness, and action orientation.

A more concrete measurement approach related to the WEC-context comes from Rafferty & Griffin (2006), where Frequent Change was operationalised as a sub-dimension of perceived change in working environments. Psychometric properties are promising, and the scale has since been used in a recent study by Babalola et al. (Babalola et al., 2016). Beyond the context of WEC, Kunze and colleagues (Kunze, Raes, & Bruch, 2015) have applied their so-called “Environmental Dynamism” scale to measure how much a company’s products and services are subject to change. In summary, Frequent Change appears as a facet that is prominent in WEC literature and has also been integrated both indirectly and directly into empirical work. As such, it can be considered as a core element to the definition of a complex working environment. Conceptual overlaps with the construct of Uncertainty are addressed below.

2.2.2 Unpredictability

From the evaluation above, it is clear that Unpredictability is one of the most commonly cited factors of WEC: complex work is described as demanding because it is characterised by high Unpredictability, confronting workers with many unanticipated challenges, unexpected events, lack of clarity on roles or procedures, and the challenge of making decisions with unclear and unforeseeable consequences (Karp & Helgø, 2008; Uhl-Bien & Marion, 2009). The above evaluation of complexity theories yielded similar findings (cf. Section 2.1.2) where Unpredictability – or Nonlinearity – emerged as one of the most prominent complexity characteristics. In contrast to this finding, no current study known to the author has yet directly measured Unpredictability as a component of a complex working environment. One explanation – covered in more detail below – could be the overlap between Unpredictability and Uncertainty, which are often used as synonyms (e.g., Gebauer, 2013). Outside “complexity” research, Tetrick & LaRocco (1987) have proposed measuring the Unpredictability of a work setting with a three-item subscale, outlining unexpected demands, events, and decision-making situations that are hard to foresee. Despite not fully satisfying reliability scores, Unpredictability seems to be an inherent characteristic and one of the most agreed-upon of WEC. This means it can be considered as an element of an integrative WEC construct. Descriptions of Unpredictability often seem very similar to descriptions of Ambiguity and Uncertainty. Such conceptual overlaps are discussed in more detail below.

2.2.3 Ambiguity

Thirdly, work environments are described as complex because they are ambiguous and often require the management of contrasting or paradoxical demands. Ambiguous work situations are also seen as unclear, diverse, ill defined, or vague (e.g., Denison et al., 1995; Mumford et al., 2000). However, by examining descriptions and item content, such portrayals of Ambiguity show relevant overlaps with Unpredictability, Uncertainty, Interaction, and Challenging Work Demands: often the descriptions do not clearly discriminate between the concepts, or they are used as synonyms. These overlaps will have to be considered when forming an integrated construct of WEC. It is likely that choosing one construct may cover many qualities of the others.

When measuring Ambiguity, some complexity/paradox leadership researchers have taken a specialised approach of weighing opposing item pairs, creating so-called “versatilities” or competing demands. Denison, Hoojberg & Quinn (1995), for instance, measured a leader’s ability to handle ambiguous work environments through their Competing Values Framework questionnaire. Similarly, Kaiser, Lindberg & Craig (2007), applied a “master of opposites” approach with their self-developed Leadership Versatility Index. Here, pairs of items reflect complementary opposite challenges for leaders (“versatilities”). From a measurement perspective, this approach is appropriate in specific contexts where the competing demands are known, for example in distinct managerial roles (Kaiser et al., 2007). This approach seems less suitable for measuring a more general state of Ambiguity in complex working contexts.

Ashmos et al. (2000) used a self-developed “hospital complexity” measure, which asks respondents to evaluate the diversity/clarity of content specifically appropriate to hospital environments. Ashmos’ approach is interesting, as it is one of the only organisation-directed measures in WEC-literature; however, the limitation of such a scale is that the content of organisational goals, strategies, and typical challenges must be known. This high degree of specification makes generalisability questionable and content quickly out-dated. Integrating Ambiguity into the WEC construct in these narrow conceptualisations thus does not seem appropriate. Furthermore, conceptual overlaps with Unpredictability, Uncertainty, Interaction, and Challenging Work Demands need to be considered.

2.2.4 Uncertainty

Uncertainty is described as an unsettling state that emerges from ambiguity, change, or unpredictability (Bordia, Hobman, Jones, Gallois, & Callan, 2004; White & Shullman, 2010). It outlines work settings that are unclear, lack information, or confront the individual with competing, ambiguous demands, making it sometimes hard for the individual to cope (e.g., Gebauer, 2013; Hochwarter et al., 2007).

Several approaches have been made to measure Uncertainty: in a recent qualitative approach, Alison et al. (2015) classified two types of Uncertainty (endogenous and exogenous) from observation, performance logs, and recall interviews with police officers in a simulated hostage situation. Here, uncertainty occurred in situations where individuals were perceived to communicate that they were uncertain in decision-making. Given small sample sizes (n=11 simulations, n=5 interviews) and only a vague taxonomy that was constructed post-hoc, this study falls short of presenting a coherent and convincing Uncertainty construct that could be applied to develop an integrative WEC measure.

Several other studies have applied quantitative scales to measure Uncertainty. Hochwarter et al. (2007) used a self-developed scale that assessed Uncertainty as an outcome of political behaviour in organisations. Griffin, Neal, and Parker (2007) measured the (un)clarity of a situation at work by borrowing from a Role Clarity subscale (School Organisational Health Questionnaire; Hart, Wearing, Conn, Carter & Dingle, 2000). Rafferty and Griffin (2006) applied a measure of Psychological Uncertainty in change that reflects an individual's feelings of uncertainty about on-going changes in work. These quantitative scales display sufficient psychometric properties, but in the item content, the construct of Uncertainty largely overlaps with Unpredictability, Ambiguity, and Frequent Change.

Also, one finds that the terms Uncertainty and Unpredictability are often used synonymously in WEC-related literature (e.g., Griffin et al., 2007). Uncertainty has been substantiated elsewhere not as an aspect of a work context, but as a *psychological state* or *consequence* that results from encountering ambiguous or unpredictable work environments (e.g., Bordia et al., 2004; Rafferty & Griffin, 2006; White & Shullman, 2010). Unpredictability, in contrast, describes (the perception of) a work environment where events and demands are hard to foresee, which might result in an individual's feeling of Uncertainty. Given these limitations, the conceptual fit of Uncertainty for the WEC construct seems questionable and may be better addressed by the construct of Unpredictability.

2.2.5 Interdependence/Interaction

The interaction with or interdependence of other stakeholders is proposed as another factor of WEC, reflecting the connectedness or dependency of one's work with the work of others (Griffin et al., 2007; Marion & Uhl-Bien, 2001; Rafferty & Griffin, 2006). As interaction with others is a necessary precondition in most modern team or leadership roles, Interdependence, as such, is not directly measured in current WEC-literature (e.g., Griffin et al., 2007). Outside the topic of WEC, Morgeson and Humphrey (2006) have proposed a "Received Interdependence" measure in their Work Design Questionnaire (WDQ). It measures the extent to which one's job depends on the job of others. A second WDQ scale measures Initiated Interdependence, the extent to which others rely on your job. Both scales display sufficient psychometric properties. In summary, it appears that Interdependence can be measured. However, considering that Interdependence is a given precondition in effectively all team and managerial work settings, and it has been treated as such in previous WEC-literature, the integration into the WEC construct seems questionable.

2.2.6 Challenging Work Demands/ Job Complexity

Many researchers have agreed that the complexity of one's job can be defined through the inherent challenging work demands of the job itself. Thus, many authors to date have approached the measurement of work complexity by applying scales for "job complexity". A "complex" job, in this view, is mentally challenging and requires individuals to use highly developed skills or creativity in order to solve problems. This is in contrast to simple, repetitive, and uncomplicated tasks (e.g., Chung-Yan & Butler, 2011; Frese et al., 1996; Hackman & Oldham, 1975; Schmitz & Ganesan, 2014). Complex jobs include solving novel tasks or problems that require solutions that are not yet defined, as opposed to familiar problems that can be solved by known solutions (Heifetz, 1994; Morgeson & Humphrey, 2006).

To assess complex jobs, several researchers have used the Job Diagnostic

Survey (JDS; Hackman & Oldham, 1975, 1980). Here, five job characteristics (autonomy, task significance, task identity, task feedback, and skill variety) are summarised to form the Job Characteristics Model (JCM) or the Motivating Potential Score (MPS). This measure, however, appears to be an indirect measure of job complexity, as it is moderated by the influence of many other variables such as autonomy and feedback. More distinct measures for Job Complexity/ Challenging Work Demands come from work by Frese et al. (1996), which assesses difficult or complicated tasks. A limitation of this scale is perhaps the inconsistency of scale labelling, which may explain the lack of internal reliability.

A prominent approach towards assessing job complexity is to tailor scales to the requirements of specific job types. Examples are the Tummers et al. (2006) nursing complexity scale and the Schmitz and Ganesan (2014) scales for customer and organisational complexity in sales jobs. While such scales may be highly practical and applicable, their conceptual foundations are often vague. Also, the concept of (Nursing) Complexity shows strong overlap and inter-correlation with a second scale, Environmental Uncertainty (Tummers et al., 2006). Furthermore, the high degree of specialisation of content makes generalisability difficult.

In more recent work, a study by Wang et al. (2014) takes a different approach. Here, Job Complexity is operationalised as the difference between front office and back office jobs; comparison of employee samples was based on this assumption. This study is another example of studies that are *assuming* complexity without empirical foundation for this claim. Chung-Yan and Butler (2011) as well as Park, Zhou, and Choi (2018) have used the scale “Job Complexity” from the Work Design Questionnaire (WDQ, Morgeson & Humphrey, 2006) to measure Challenging Work Demands. Psychometric properties are mediocre to sufficient. However, with all four items reverse-scored, this scale appears less a measure of the complexity, but more a measure of the *simplicity* of a job. Additionally, the WDQ (Morgeson & Humphrey, 2006) proposes another scale which is named “Problem Solving”. While it has not yet been applied in WEC-related studies, based on its item content this scale addresses more clearly the challenge of solving complex problems. This may be a better option for measuring the inherent complexity of one’s work tasks, even if the scale labelling suggests differently.

In summary, applying measurements of Job Complexity has been a prominent way to evaluate challenging work demands or tasks in an individual’s job. However, on closer examination, current operationalisations reveal potential limitations in existing scales, such as unclear construct definitions and inconsistent scale labelling. In addition, the critique has been that “Job Complexity” describes complexity in a narrow sense, falling short of acknowledging the link between the job and the broader work environment (Morgeson & Campion, 2003; Morgeson & Humphrey, 2006; Parker & Wall, 1998). Challenging Work Demands appears as a relevant, yet insufficient standalone factor for capturing WEC.

Table 4: Factors of WEC, Measurement Approaches and Identified Limitations

Factor	*Description*	*Reference*	*Measurement Approach*	*Items*	*Psychometric Properties*	*Overlaps / Limitations*
Frequent Change	Changing and volatile conditions make work complex. In such contexts, transformation is a constant rather than a discrete event.	Hannah et al., 2013	Military simulation that confronted participants with frequently changing scenarios. No distinct measure for Frequent Change (= *Assumed* complex environment)	N/A	N/A	Conceptual overlaps with Uncertainty
		Rafferty & Griffin, 2006	Self-developed Frequent Change Scale, operationalised as a sub-dimension of perceived change in working environments	1. *Change frequently occurs in my unit* 2. *It is difficult to identify when changes start and end* 3. *It feels like change is always happening* Responses: 1 = strongly disagree to 7 = strongly agree	Factor loadings .53 - .84 Cronbach's alpha = .76 (Rafferty & Griffin, 2006) and .78 (Babalola et al., 2016)	
		Kunze, Raes & Bruch, 2015	Self-developed Environmental Dynamism Scale	1. *In our market, products and services to be delivered change very often* 2. *In our market, the methods to produce products and services change very often* Responses: 1 = totally disagree to 7 = totally agree	Cronbach's alpha = .74	
Unpredic-tability	Unpredictability makes work contexts complex as it confronts workers with unanticipated challenges, unexpected events, lack of clarity on roles or procedures, and the challenge of making decisions with unforeseeable consequences.	Tetrick & LaRocco, 1987	Self-developed Predictability of Events Scale (non-WEC related literature)	1. *To what extent can you predict what job demands will be placed on you each day?* (R) 1. *To what extent do unexpected events occur on your job?* 3. *To what extent are you faced with unexpected decisions concerning your work?* Responses: 1 = very little to 7 = a great extent	Cronbach's alpha = .66	While Unpredictability or Nonlinearity is commonly cited as one of the most prominent factors of WEC, no complexity study has applied a measure for Unpredictability Reliability of Predictability of Events Scale below alpha = .7 Conceptual overlaps with Ambiguity and Uncertainty. Unpredictability and Uncertainty are often used as synonyms

[1] (R) indicating reverse scored items.

Factor	*Description*	*Reference*	*Measurement Approach*	*Items*	*Psychometric Properties*	*Overlaps / Limitations*
Ambiguity	Ambiguity makes work contexts complex because they require the management of contrasting or even paradoxical demands. Ambiguous work situations are unclear, diverse, ill defined, or vague.	Denison, Hoojberg & Quinn, 1995	Weighing opposing item pairs: Self-developed Competing Values Framework questionnaire. 222 questions relate to 8 leadership roles that represent leadership paradoxes	E.g. Conflicting demand of leading in an Innovator Role as well as a Monitorer Role: *Comes up with inventive ideas* vs. *Maintains tight logistical control*	Not provided	Measurement approach of opposing item pairs requires specific contexts where the competing demands are known, e.g. in distinct managerial roles (Kaiser et al., 2007). Similarly, Ashmos et al. (2000) hospital complexity measure asks respondents to evaluate the diversity/clarity of content specifically curated to hospital environments Both approaches less suited for assessing a general state of Ambiguity in complex working contexts Conceptual overlaps with Unpredictability, Uncertainty, Interaction, and Challenging Work Demands
		Kaiser, Lindberg & Craig, 2007	"Master of opposites" approach: self-developed Leadership Versatility Index. Pairs of items reflect complementary opposite challenges for leaders ("versatilities")	E.g. Versatility pair of "Forceful and Enabling": *Pushes people hard* vs. *Is understanding when people do not deliver*	Versatility pairs reached Cronbach's alphas of .73-.79.	
		Ashmos, Duchon & McDaniel, 2000	Self-developed complexity measure for hospitals (Ashmos et al., 1996) measures CEO's strategic decision-making in hospitals	*Goal complexity*. Ten-point scale assesses importance of 13 hospital-related goal statements. Higher goal complexity when more goals are more important. *Strategic Complexity*. Relative importance of 20 strategic hospital activities, a higher score represents a hospital that pursued competitive advantage through a wider range of strategic activities. *Interaction complexity*. Likely involvement of six different internal stakeholder groups in resolving four different strategic issues. More involvement was viewed as more interaction complexity. *Structural complexity* considered greater for hospitals that were decentralised, and not highly formalised. Eleven items adapted from Hage and Aiken (1967).	Goal complexity, Cronbach's alpha = .89; Strategic complexity = .86; Interaction complexity = .84; Centralisation = .91; Formalisation = .66	

Factor	*Description*	*Reference*	*Measurement Approach*	*Items*	*Psychometric Properties*	*Overlaps / Limitations*
Uncertainty	Uncertainty is described as an unsettling state that emerges from ambiguity, change, or unpredictability in work environments. Uncertain work settings are described as unclear, lack information, or confront the individual with competing, ambiguous demands, making it hard for the individual to cope.	Griffin, Neal & Parker, 2007	(Un)clarity of a situation measured by Role Clarity subscale (School Organisational Health Questionnaire; Hart, Wearing, Conn, Carter & Dingle, 2000)	1. I am always clear about what others at my workplace expect of me 2. My work objectives are always well defined 3. I always know how much authority I have in this workplace 4. I am clear about my professional responsibilities Responses: 1 = strongly agree to 5 = strongly disagree	Cronbach's alpha = .76 and .77 for two separate organisational samples	Conceptual overlaps with Unpredictability, Ambiguity, and Frequent Change. Unpredictability and Uncertainty are often used as synonyms Uncertainty has been substantiated not as an work environment factor but psychological *state* or *outcome* that results from encountering ambiguous or unpredictable work demands (e.g., Bordia et al., 2004; Rafferty & Griffin, 2006; White & Shullman, 2010)
		Hochwarter et al., 2007	Self-developed Uncertainty Scale as an outcome of political behaviour at work	1. *I am unclear regarding what is expected of me at work* 2. *I get mixed messages from different people concerning what I am supposed to do at work* 3. *There is a great deal of ambiguity in my job* 4. *I do not fully understand the reporting channels at work* Responses: 1 = strongly disagree to 7 = strongly agree	Cronbach's alpha = .86.	
		Rafferty & Griffin, 2006	Self-developed Psychological Uncertainty in Change Scale based on work by Milliken (1987)	1. *My work environment is changing in an unpredictable manner* 2. *I am often uncertain about how to respond to change* 3. *I am often unsure about the effect of change on my work unit* 4. *I am often unsure how severely a change will affect my work unit* Responses: 1 = strongly disagree to 7 = strongly agree	Factor loadings = .70-.91 Cronbach's alpha = .88 and .91 in two different samples	
		Tummers et al., 2006	Environmental Uncertainty Scale developed by Wibbelink (1995) and Tummers (1998)	1. *The unit is daily confronted with emergencies* 2. *Patient care is diverse with regard to the nursing activities to be performed* 3. *The intensity of the patient care is unpredictable* 4. *Changes in the demand of care are unexpected* 5. *In addition to the ordinary nursing activities, nursing work often consists of unpredictable activities* Responses: 1 = totally disagree to 5 = totally agree	Cronbach's alpha = .77 and .82 in two different samples Intercorrelations with second scale "Complexity" $r = .40$ and .49	
		Alison et al. (2015)	Post-hoc taxonomy, classifying two types of Uncertainty (endogenous and exogenous) through observation, performance logs, and recall interviews with police officers in a simulated hostage situation (n=11 simulations, n=5 interviews). Uncertainty operationalised as communication of uncertainty on how to decide.		N/A	

Factor	*Description*	*Reference*	*Measurement Approach*	*Items*	*Psychometric Properties*	*Overlaps / Limitations*
Inter-dependence / Interaction	Work environments are described as complex because of the interaction with or interdependence of other stakeholders. This reflects the connectedness or dependency of one's work with the work of others.	Morgeson & Humphrey, 2006	Received Interdependence Scale (Work Design Questionnaire): Extent to which one's job depends on the job of others	1. *The job activities are greatly affected by the work of other people* 2. *The job depends on the work of many different people for its completion* 3. *My job cannot be done unless others do their work* Responses: 1 = strongly disagree to 5 = strongly agree	Cronbach's alpha = .84	Morgeson and Humphrey's WDQ is not directly related to complex working environments Given that interaction with others in team or leadership roles is a necessary precondition, Interdependence is not directly measured in current WEC-literature (e.g., Griffin et al., 2007)
		Morgeson & Humphrey, 2006	Initiated Interdependence Scale (Work Design Questionnaire): Extent to which others rely on one's job	1. *The job requires me to accomplish my job before others complete their job* 2. *Other jobs depend directly on my job* 3. *Unless my job gets done, other jobs cannot be completed* Responses: 1 = strongly disagree to 5 = strongly agree	Cronbach's alpha = .80	
Challen-ging Work Demands	A "complex" job is mentally challenging and requires individuals to use highly developed skills or creativity in order to solve it. This outlines the opposite of simple, repetitive, and uncomplicated tasks.	Hackman & Oldham, 1975	Job Diagnostic Survey (JDS; Hackman & Oldham, 1975, 1980): Five job characteristics (autonomy, task significance, task identity, task feedback, and skill variety) are summarised to form the Job Characteristics Model (JCM) or the Motivating Potential Score (MPS) More indirect measure of job complexity, as it is moderated by the influence of many other variables such as autonomy and feedback.	Sample item: *How much variety is there in your job? That is, to what extent does the job require you to do many different things at work, using a variety of your skills and talents?* Responses range on varying 7-point scales	Cronbach's alphas of the five subscales range from .59 to .71	Inconsistent scale labelling of the JDS and Frese et al. (1996) scale produce partly insufficient reliability scores. Conceptual overlaps with Ambiguity Job-specific scales such as the Nursing Complexity scale (Tummers et al., 2006) are highly curated towards specific jobs and combine, e.g. facets of Challenging Tasks, Interdependence, and Unpredictability. This scale overlaps and correlates strongly with the second scale of the study, "Environmental Uncertainty". Challenging Work Demands/ Job Complexity describes WEC in a narrow sense, falling short of acknowledging the link between the job and the broader work environment (Morgeson & Campion, 2003; Morgeson & Humphrey, 2006; Parker & Wall, 1998). Thus, appears as a relevant, yet insufficient standalone factor for capturing WEC
		Frese et al., 1996	Self-developed Job Complexity Scale	1. *Do you receive tasks at work that are extraordinary and particularly difficult?* 2. *A must make complicated decisions in his/her work, B only has to make very simple decisions* 3 *Can you use all your knowledge and skills in your work?* *4. Can you learn new things in your work?* Responses range on varying 5-point scales	Cronbach's alpha = .67	

	Reference		*Measurement Approach*	*Psychometric Properties*
Challen- ging Work Demands (Contd.)	Tummers et al., 2006	Nursing Complexity Scale based on Mandemakers (1993), adapted by Wibbelink (1995) and Tummers	1. *Patients on this unit show different clinical pictures that can be categorised by more than one specialism* 2. *If it is a priori known that there are some beds unoccupied, patients from other specialisms are admitted* 3. *On this unit, many patients are admitted from other hospitals or units, because adequate care is lacking there* 4. *Nursing work is stable, predictable and to be planned from admittance to discharge* 5. *There is a high chance of a high-risk situation for patients on this unit* 6. *In order to coordinate nursing care, nurses need information from different health care workers* 7. *Patients on this unit need intensive emotional and psychological help from nurses* 8. *Patients on this unit are self-supporting* 9. *Patients are physically not able to communicate with nurses* Responses: 1 = totally disagree to 5 = totally agree	Cronbach's alpha = .69 and .73 in two different samples Intercorrelations with second scale "Environmental Uncertainty" *r* = .40 and .49
Challen- ging Work Demands (continued)	Schmitz, 2014	Sales-specific, self-developed Customer Complexity and Organisational Complexity scales	Customer Complexity 1. *Customer needs are complex and diverse.* 2. *Many different customer personnel are involved in the purchase process* 3. *The customers' buying process involves executives from many different departments* 4. *Our customers require customised products and services* 5. *Each customer wants to be treated as a unique entity* Organisational Complexity 1. *Internally there are many different contact people* 2. *Often, I don't clearly know who is responsible for various decisions* 3. *In general, individual Business Areas operate very differently* 4. *Different ways of action of my headquarters make sales processes complicated* *Responses: 1 = strongly disagree to 7 = strongly agree*	Factor loadings = .63-.81 Cronbach's alpha = .82 Factor loadings = .59-.80 Cronbach's alpha = .79

	Reference	*Measurement Approach*		*Psychometric Properties*
	Wang et al., 2014	Job Complexity operationalised as the difference between front office and back office jobs (= *Assumed* complex environment)		N/A
	Zaccaro, Banks, Kiechel-Koles, Kemp & Bader, 2009	Job Challenge Profile (McCauley, 1989)	*50 items measuring 5 Challenging Work Assignments Dimensions:* *JT = Job Transitions* *CC = Creating Change* *HLR = Managing at High Levels of Responsibility* *MB = Managing Boundaries* *DD = Dealing with Diversity.* Scale N/A	Cronbach's alpha of the dimensions = .65 - .82
Challen-ging Work Demands (Contd.)	Chung-Yan & Butler, 2011 Park, Zhou & Choi, 2018	Job Complexity Scale from the Work Design Questionnaire (WDQ, Morgeson & Humphrey, 2006) With all items reverse-scored, this scale appears less as a measure of the complexity, but rather a measure of the simplicity of a job	1. *The job requires that I only do one task or activity at a time* (R) 2. *The tasks on the job are simple and uncomplicated* (R) 3. *The job comprises relatively uncomplicated tasks* (R) 4. *The job involves performing relatively simple tasks* (R) Responses: 1= strongly agree to 5 = strongly disagree	Cronbach's alpha = .88 (Chung-Yan & Butler, 2011), .63 (Park, Zhou & Choi, 2018), and .87 (Morgeson & Humphrey, 2006)
	Morgeson & Humphrey, 2006	Problem Solving Scale from the (WDQ, Morgeson & Humphrey, 2006). Item content addresses the challenge of solving complex problems more clearly than the above "Job Complexity Scale"	1. *The job involves solving problems that have no obvious correct answer* 2. *The job requires me to be creative* 3. *The job often involves dealing with problems that I have not met before* 4. *The job requires unique ideas or solutions to problems* Responses: 1= strongly agree to 5 = strongly disagree	Cronbach's alpha = .84

2.3 WEC: A Preliminary Conceptualisation and Future Directions

Based on the considerations above, WEC-related literature from organisational psychology and management sciences reveals characterisations of complexity that share several common facets or elements. However, current research has only studied these elements in isolation (Black, 2000), not as a comprehensive complexity construct. As result of this fragmentation, previous descriptions and conceptualisations reveal several overlaps between the constructs (e.g. Unpredictability overlapping with Ambiguity and Uncertainty), measurement shortcomings (e.g. Ambiguity), as well as conceptual limitations in their suitability for the WEC concept (e.g. Interdependence as a given precondition; Uncertainty as a psychological state/consequence). This research project aims to provide an integrative conceptualisation of WEC that can be quantitatively measured. In an attempt to clarify the construct of WEC, such conceptual overlaps and limitations have to be overcome (Morgeson & Humphrey, 2006). It is only recently that research has examined constructs of *accumulating* job demands (van Woerkom et al., 2016). This implies that WEC might be formed by the *interaction* of several work environment facets, which create a new quality of work (van Woerkom et al., 2016). Aligned with Morgeson and Humphrey's (2006) guidelines for the development of the Work Design Questionnaire, the only factors that should be integrated as WEC "core content" (1) are prominent in the characterisations of WEC literature, (2) appear conceptually sound, yet distinct and (3) show no apparent measurement or content limitations.

In light of the above, it appears plausible to assume that the three subjects of *Frequent Change, Unpredictability, and Challenging Work Demands* meet these requirements and thus characterise the integrated construct of WEC. Based on this assumption, the preliminary operationalisation of WEC for this project can be outlined as follows:

Work Environment Complexity is characterised as (the perception of) a frequently changing, unpredictable, and demanding work environment.

Figure 4 presents a conceptual diagram of the proposed Work Environment Complexity construct, visualising the relations and identified overlaps between the examined factors.

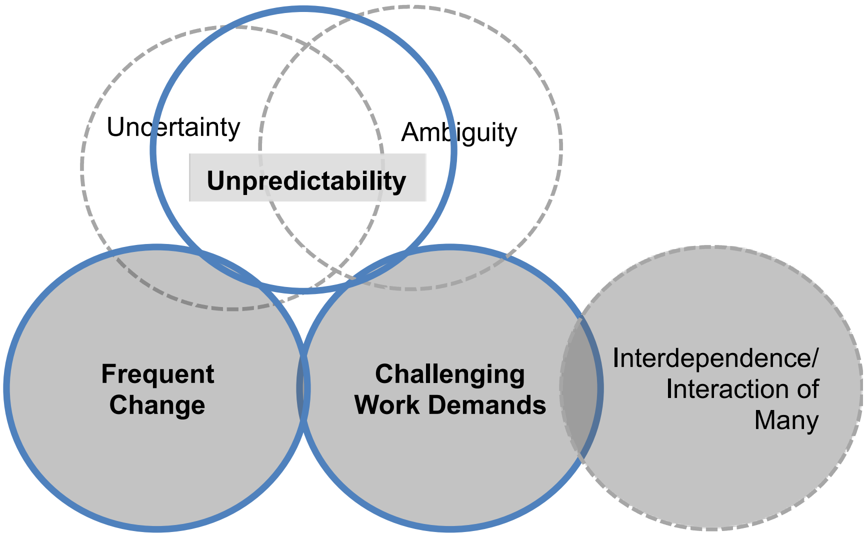

Figure 4. Conceptual Diagram of Proposed Work Environment Complexity Core Content.
Notes: Circle overlaps represent conceptual overlaps. Blue circles represent Work Environment Complexity core factors; grey circles depict factors to be excluded due to conceptual overlaps, measurement deficits, and/or conceptual limitations.

To substantiate this conceptualisation of WEC, it will have to be tested empirically through applying a quantitative measurement approach. Further, it will be important to understand the underlying factor structure of an integrated construct (Morgeson & Humphrey, 2006). Given no previous research on this topic, it is possible that the three core elements merge into either a one-dimensional or a multi-dimensional construct, forming new inherent factors of Work Environment Complexity.

A second question arises: Is the same WEC construct applicable to the target groups of both employees and leaders? Describing WEC from an organisational viewpoint often comes with a description of “members” or “agents” in these contexts (e.g., Black, 2000; Lichtenstein et al., 2006; Lissack, 1999). While the majority of studies above have focused on describing complex working environments for leaders (e.g. Burnes, 2005; Uhl-Bien et al., 2007), several others have applied their description of WEC to employees (Chung-Yan, 2010), or have studied mixed managerial and non-managerial samples (e.g., Griffin et al., 2007). Descriptions of WEC have intertwined employee and leadership perspectives. In fact, although it is claimed that the “management” of WEC is a primary leadership concern (Lichtenstein et al., 2006; Marion & Uhl-Bien, 2001; Nienaber & Svensson, 2013) – which, in turn, influences subordinates – it is not yet clear whether the concept of WEC is equally meaningful for leaders and employees. Given that leaders’ work contexts differ considerably from other positions within the organisation (Pulakos, Arad, Donovan, & Plamondon, 2000), it is likely that perceptions of WEC will differ in their nature for leaders and employees. Validating and clarifying a construct also includes examining whether it is able to detect differentiations between occupational groups (Morgeson & Humphrey, 2006). A clarification of the WEC construct will also have to consider its valence with regard to these two populations.

2.3.1 Conclusion

In conclusion, following the propositions of early complexity sciences, modern organisations can no longer be viewed as linear, mechanistic forms of operating, but have to be understood as dynamic, complex, non-linear systems, where outcomes are unpredictable and interactions of stakeholders are dynamic to the extent that they are no longer directly controllable or manageable (Burnes, 2005; Marion &

Uhl-Bien, 2001; Stacey, 2011; Styhre, 2002). While complexity frameworks are advancing into organisational and leadership research and “complexity” in work contexts is frequently referred to, contributions based on early complexity theories remain not only heavily disputed, but abstract (Lissack, 1999; Stacey, 2011). Furthermore, it appears that significant empirical advance in complexity research has been hindered by a certain idiosyncrasy and the belief that it requires particularly complex methods to study complex phenomena (e.g., Uhl-Bien & Arena, 2017). In contrast, post-positivistic, quantitative studies have been criticised for their apparent oversimplification. Indisputably, they still have inherent limitations. Nevertheless, this branch of complexity research shows potential to overcome current ideological barriers and provide application-oriented, empirical advancements to organisational psychology and leadership research. There is an opportunity for this research project to consolidate ideas across the different complexity schools to form an understanding of what makes a working context “complex”. Given that there seems to be a general agreement on common elements or factors of complex working environments (Lissack, 1999; Stacey, 2011), it should be possible to integrate these into a measurable and empirically substantiated construct. Post-positivistic research here offers the perspective of understanding the definition of a work environment as an individual *perception* of it. For these reasons, this thesis is aimed at establishing and clarifying the construct of *Work Environment Complexity* (WEC), which outlines the *(individually perceived) complexity within organisational work contexts*, informed by a post-positivistic perspective (Burrell & Morgan, 2017; Gray, 2014). This is an opportunity to advance complexity thinking into applied organisational psychology, as research currently lacks both conceptual and empirical foundation of WEC (Black, 2000; Burnes, 2005; Maguire & McKelvey, 1999; Marks et al., 2001). To date, an agreement on a common definition and hence the establishment of an empirically substantiated construct, has not been achieved (Black, 2000; Burnes, 2005; Maguire & McKelvey, 1999; Marks et al., 2001). Without this agreement, research on organisations or leadership in WEC is inherently limited (Schneider & Somers, 2006) and even faces the risk of becoming a fad or triviality (Maguire & McKelvey, 1999).

In the application-oriented literature around the topic of WEC, current studies have conducted quantitative research on singular, fragmented aspects of complex environments without a communal conceptual rationale (Black, 2000; Burnes, 2005). One objective of this section was to conceptually identify the core content of WEC, which should include facets that are conceptually sound, measurable, yet distinct enough from one another. By examining current measurement approaches, definitions and operationalisations of "complex" work environments, the preliminary conceptualisation of the WEC construct assumes that these are the subjects of Frequent Change, Unpredictability, and Challenging Work Demands, and that the construct of WEC reflects an individual's perception of the work environment. Study 1 of this thesis will be devoted to validating this conceptualisation of the WEC construct empirically. The quantitative validation of the construct should further identify its factor structure and the application to the target groups of employees and/or leaders. This research project will be the first to develop an integrated construct of WEC and a corresponding questionnaire to measure it. This will contribute to advancing both conceptual and empirical research in organisational complexity and complexity leadership. Practically, it will allow the degree of complexity that an individual faces at work to be quantified, monitoring the level of WEC, for example, in change processes, leadership development and HR processes. Based on the above considerations, the preliminary operationalisation of WEC as a frequently changing, unpredictable, and demanding work environment will serve as the basis for constructing a Framework of Leadership in WEC.

The research questions for Study 1 are:

Research question #1: *Which factors form the integrated construct of Work Environment Complexity?*

Research question #2: *Can the same construct of Work Environment Complexity be applied to both employees and leaders?*

2.4 Leadership in Work Environment Complexity

2.4.1 The Search for New Leadership Models in WEC

Although there is no agreed-upon definition of it, Work Environment Complexity is seemingly omnipresent in modern organisations (Burnes, 2005). The above discussion has outlined how, so far, the term "complex" in current research is frequently used but without a common and integrated conceptual foundation. However, based on the preliminary conceptualisation of WEC established above, one can find agreement that individuals in organisations are increasingly confronted with frequently changing, unpredictable, and demanding work environments. Why is this relevant for leadership? Leadership researchers find that this growing complexity of work is created by strongly transforming business environments, often described as a shift from industrial age to the so-called knowledge age (Osborn & Hunt, 2007; Uhl-Bien et al., 2007). "This new age is about an economy where knowledge is a core commodity and the rapid production of *knowledge and innovation* [emphasis added] is critical to organisational survival" (Uhl-Bien et al., 2007, p. 299). This means that in the face of increasing globalisation, dynamisation and rapid technological advances, organisations are adapting their business models from optimising the production of physical assets (Industrial Age) to catering to the increasing value of assets such as data, knowledge, services, and information (Knowledge Age) (e.g., Berman & Korsten, 2010; Uhl-Bien & Arena, 2017; White & Shullman, 2010).

Economic environments are drastically transforming; business cycles are faster, risks are higher, changes are more unpredictable, market players are more multifaceted and interconnected, entry barriers are lower and organisational structures become less stable (Berman & Korsten, 2010). This paradigm shift requires organisations to be increasingly agile and flexible towards radical fast-paced change and volatile markets with highly dynamic, interconnected agents (Baard et al., 2014; Berman & Korsten, 2010; Ployhart & Bliese, 2006; Pulakos et al., 2002; Silverthorne & Wang, 2001; Uhl-Bien et al., 2007; Yukl & Mahsud, 2010). As a result, organisations are undergoing profound changes in the way that they are organised, structured, and led. Leaders – as the decision-makers and drivers of organisational change – are thus made responsible for accomplishing these transformations in a business environment that is more and more unstable, fluid, and challenging (e.g., Ashmos et al., 2002; Intezari & Pauleen, 2014).

This Work Environment Complexity changes the work of individuals, especially leaders (e.g., Burnes, 2005; Gebauer, 2013; Uhl-Bien & Arena, 2017). Rather than leading for optimisation, efficiency, and control, which have been appropriate for manufacturing, organisations now require leaders to master the skills of adaptivity, innovation, learning, creativity and continuous development (Amabile et al., 1996; Berman & Korsten, 2010; Horner, 1997; Shalley, Zhou, & Oldham, 2004; Uhl-Bien & Arena, 2017). Classic leadership models commonly used today were created in different times and thus for more traditional, linear organisational structures where optimisation goals could be executed top-down through centralised control (Burnes, 2005; Marion & Uhl-Bien, 2001; Schneider & Somers, 2006; White & Shullman, 2010). Enabling greater agility and innovation, however, requires a *decentralisation of power* that facilitates greater self-organisation at lower levels of the organisation (Burnes, 2005; Karp & Helgø, 2008; Lichtenstein et al., 2006).

Today, many organisations are flattening their hierarchies and consequently expanding the responsibilities and scope of lower-level roles (Lee et al., 2018). To increase speed, leaders need to enable flexible subunits that self-directedly solve unprecedented problems in contexts where unpredictability is high and changes are constant (Berman & Korsten, 2010; Burnes, 2005; Karp & Helgø, 2008). Such non-linear, dynamic interaction "explicitly rejects cause-and-effect, top-down, command-and-control styles of management" (Burnes, 2005, p. 82). Thus, many traditional leadership models may be out-dated or deficient to match the novel complexity requirements (Ashmos et al., 2002; Burnes, 2005; Dinh et al., 2014; Lee et al., 2018; Uhl-Bien & Marion, 2009).

Managers and their teams are faced with the challenge of finding new and appropriate ways to lead and work in times of increasing WEC (e.g., Ashmos et al., 2002; Gebauer, 2013; Uhl-Bien & Arena, 2017). Thus, "Complexity Leadership" is regarded as one of the most significant leadership themes of the modern organisational age (Burnes, 2005; Lavine, 2014) and has been listed as one of the top emerging leadership theories of the millennium (Dinh et al., 2014). As Beeson and Davis (2000) put it: "Though it may indeed be fruitful to see organisations as non-linear systems, to do so will require a fundamental shift in our understanding of the (…) role and limits of management" (p. 181).

Consistent with these transformations, discussion is taking place to determine new leadership models that match these radically different, diverse and complex contexts (Lee et al., 2018; Uhl-Bien & Marion, 2009; Uhl-Bien et al., 2007; Zaccaro & DeChurch, 2012). While this field is clearly still evolving (Uhl-Bien et al., 2007), one can see some emerging themes. The current state of this research will be outlined and evaluated in the following sections. In particular, this thesis argues for a paradigm shift towards (1) more *participative* or *empowering* leadership styles as well as (2) *flexible* or *adaptive* leadership behaviour (e.g., Ashmos et al., 2002; Correia de Sousa & van Dierendonck, 2014; Lane & Down, 2010; Martin & Ernst, 2005; Schneider & Somers, 2006). These views address leaders on a *behavioural* level in their role as facilitators of performance in the face of changing and complex environments. Considerably less attention has been given to the question of how individual leaders may be affected by the novel challenges of WEC (Roche et al., 2014). This section will explore leadership in WEC from a *dispositional* and *individual point of view*, addressing what this paradigm shift may mean with regards to an individual leader's psychological wellbeing and functionality. A central topic addressed here is a managerial mindset or disposition of "*embracing" the complexity* (Ashmos et al., 2000; White & Shullman, 2010).

Although this discussion seems both urgent and vibrant, complexity leadership researchers are finding that these novel leadership models are yet not mature (Dinh et al., 2014; Schneider & Somers, 2006; Uhl-Bien et al., 2007). For instance, Uhl Bien et al. (2007) find that:

> *"while it has become clear that the old model of leadership was formed to deal with a very different set of circumstances and is therefore of questionable relevance to the contemporary work environment, no clear alternative has come along to take its place"* (p. 229).

Why is this the case and how can research towards these proposed leadership models for WEC be advanced? The previous section has addressed the inherent limitation of complexity leadership research: to date, there has been no substantial empirical approach to measure Work Environment Complexity (Maguire & McKelvey, 1999). This limitation is mirrored in the existing state of research; models of complexity leadership have so far evolved by *bypassing* the question of how to empirically grasp WEC. This may be an explanation for the current state of immaturity seen in these models. The term “complex” has been used without a common - and empirically substantiated - foundation. Schneider and Somers (2006) observe: “We find that the assumptions of Complexity Theory remain murky despite much description of the theory, which hinders the development of its implications for leadership” (p. 351). Authors have chosen different research approaches, as mentioned in the previous WEC-chapter 2.2: a large proportion of studies deal with the topic of leadership in WEC from a solely *conceptual* or *theoretical* perspective (e.g., Uhl-Bien & Arena, 2017), thus sidestepping the measurement or testing of propositions. The second group has empirically studied complexity leadership through *assuming* or *stating* that the studied contexts are “complex”, yet without conceptually or empirically substantiating this claim (e.g., Correia de Sousa & van Dierendonck, 2014; Silverthorne & Wang, 2001; Zhang et al., 2015). Other researchers have linked singular factors of WEC (cf. Chapter 2, section 2) empirically to leadership matters (e.g., Dóci & Hofmans, 2015). These studies are taking a *fragmented* view of WEC and falling short of applying an integrated construct.

In summary, these approaches towards new leadership models offer a valuable foundation for exploring the questions of leadership in WEC and have contributed both conceptual and singular empirical insights. However, without a measurement approach to WEC, organisational psychology’s models of leadership in complex working environments remain untested and without empirical foundation, as do the conclusions for managers in practice. Substantial findings are now needed to explore which form of leadership leaders choose, and which form optimally manages the complex circumstances (Brodbeck, 2002; Marion & Uhl-Bien, 2001; Marks et al., 2001). The previous section has advanced this discussion by providing a preliminary operationalisation of an integrated WEC construct. This section of the thesis has the following aims: firstly, to evaluate the current state of research for Leadership in

Work Environment Complexity, secondly, to discuss the most prominent propositions for the first time with a linkage to the proposed integrated WEC construct, thirdly, to apply this relation in order to provide a sound framework around 1) Empowering vs. directive leadership in WEC, 2) Adaptive leadership in WEC, and 3) Embracing the complexity/leadership wellbeing and functionality in WEC. Once WEC can be measured, these can be empirically tested. Table 5 provides an overview of studies outlining the proposed leadership approaches.

Table 5: Proposed Leadership Approaches for WEC

Reference	*Research Question/Topic*	*Major Assumptions/Findings on Leadership in Work Environment Complexity*	*Proposed Leadership Approach*	*Study Design*
		Participative/Empowering Leadership		
Ashmos, Duchon, McDaniel & Huonker, 2002	Call for participation in decision-making in Complex Adaptive Systems (CAS)	Conceptual paper that argues for leaders to let others participate in decision-making and to connect individuals as a simple managerial rule for leading in complex organisations. Control, in comparison is an out-dated management concept for leadership of organisations in today's business environments.	*Participative/ empowering leadership* *Leadership embracing complexity*	*Theoretical / Conceptual Approach*
Brodbeck, 2002	Linking complexity theory to the leadership of teams	Qualitative study that argues for a more contemporary leadership approach that is able to cope with modern challenges of complexity, e.g. frequent change processes. In this argumentation, traditional hierarchical "command and control structures" are out-dated. Instead of clinging to past mechanisms, leaders must embrace a more empowering leadership approach, which will enable self-organisation and independent decision-making for employees and teams.	*Participative/ empowering leadership*	Qualitative analysis of qualitative group discussion / focus group of 15 managers. No distinct measure for "organisational complexity" / WEC *Assumed Approach*
Burnes, 2005	Linking complexity theories, organisational change and leadership	Conceptual paper arguing that leaders in complex systems will need to manage flexible structures that are operating on the edge of chaos and are thus most fruitful for creativity, growth, and self-organisation. Therefore, much greater democracy and power equalisation as well as a non-controlling leadership mindset are needed for effective leadership in complex structures.	*Participative/ empowering leadership* *Leadership embracing complexity*	*Theoretical / Conceptual Approach*
Elkington & Booysen, 2015	Leadership in CAS as enabling function	Conceptual paper that sees leadership in complex systems as an enabling function, mediating processes such as innovation and security through social relations.	*Participative/ empowering leadership*	*Theoretical / Conceptual Approach*

Reference	*Research Question/Topic*	*Major Assumptions/Findings on Leadership in Work Environment Complexity*	*Proposed Leadership Approach*	*Study Design*
Correia de Sousa & van Dierendonck, 2014	Servant leadership under high uncertainty	Studying a dynamic merger process under conditions of high uncertainty and volatility, the authors argue for the value of servant leadership for such complex contexts. Servant leadership includes empowerment, the development of individuals, providing coaching and giving priority to the interest of others. In the study, servant leadership as perceived by employees strongly affected employee's work engagement, mediated by organisational identification and psychological empowerment.	*Participative/ empowering leadership*	Questionnaire study with 1,107 respondents, applying the 30-item Servant Leadership Survey (SLS) by van Dierendonck and Nuijten (2011). No distinct measure for "uncertainty/volatility" / WEC *Assumed Approach*
Karp & Helgø, 2008	Embracing Chaotic Change Leadership	Drawn from examples in complex public organisations, leaders are advised in this conceptual study to lead by "loosening control" in order to overcome out-dated administrative structures of power and authority. In this argumentation, change processes fail since managers do not apprehend the complexity they are confronted with. Instead of micro-management, leaders must face the reality of "chaotic change" where cause-effect loops are unpredictable and uncertainty is normal. Instead, a more people-oriented and empowering leadership approach is suggested as a means of enabling processes of self-organisation, surfacing of new ideas, diversity, and creative problem solving. Here, social processes such as role modelling and involvement play major roles for the effective leading of others.	*Participative/ empowering leadership* *Leadership embracing complexity*	*Theoretical / Conceptual Approach*
Lane & Down, 2010	Leadership of turbulence	Conceptual study arguing that in a world of unpredictability and turbulence, existing linear models of management are inadequate for contemporary leadership. Managing uncertainty can only be achieved by managing relationships and engaging in dialogue. The further a company turns from certainty to chaos, the less it will be a manager's role to monitor performance against pre-determined goals, but rather to create spaces for learning, dialogue and creativity. This includes integrating divergent perspectives. Whilst uncertainty can be a place of anxiety and frustration, leaders will be required to manage their own insecurity and try to create some other form of stability within their team.	*Participative/ empowering leadership* *Leadership embracing complexity*	*Theoretical / Conceptual Approach*

Reference	*Research Question/Topic*	*Major Assumptions/Findings on Leadership in Work Environment Complexity*	*Proposed Leadership Approach*	*Study Design*
Lee, Willis, Tian, 2018	Meta-Analysis Empowering Leadership	In an economically shifting world, organisations are flattening their hierarchies and with this expanding the responsibilities of lower-level roles. Thus, interest is growing in leadership approaches that allow coping with continuous, rapid transformations and the associated uncertainties. Empowering leadership addresses such situations particularly well through promoting shared decision-making and self-management. The meta-analysis finds that positive effects of empowering leadership on performance, OCB, and creativity are largely mediated by follower trust in leader and a feeling of empowerment. Environmental factors were not considered.	*Participative/ empowering leadership*	Meta-Analysis from 105 samples No distinct measure for WEC *Assumed Approach*
Marion & Uhl-Bien, 2001	Complexity Leadership	Conceptual framework stating that complex organisations are coordinated by bottom-up interaction and thus capable of greater adaptability and creativity than top-down, single-person-controlled systems. In this thinking, leaders cannot control such environments anymore single-handedly. Thus, "complexity leadership" is less a matter of "controlling" than one of "enabling". A successful manager in complex systems is one who turns from "providing answers" towards a non-predictive, empowering leadership style creating conditions in which employees can produce their own structure and innovation.	*Participative/ empowering leadership* *Leadership embracing complexity*	*Theoretical / Conceptual Approach*
Schneider & Somers, 2006	Organisations as Complex Adaptive Systems (CAS) and the implications on leadership	Conceptual proposition that leadership in CAS is often non-reliant on formal or authoritarian structures. Rather, a leader can influence the process of emergence or self-organisation within organisations through mediating social processes.	*Participative/ empowering leadership*	*Theoretical / Conceptual Approach*
Styhre, 2002	Management of non-linear change	Theoretical paper arguing that management in complex and change-driven organisations can not follow rational, top-down and linear approaches but must instead enable empowerment and the flourishing of social interaction.	*Participative/ empowering leadership*	*Theoretical / Conceptual Approach*

	Research Question/Topic	*Major Assumptions/Findings on Leadership in Work Environment Complexity*	*Proposed Leadership Approach*	*Study Design*
van Dam, Nikolova & van Ruysseveldt, 2013	Exploring supervisor relations on job crafting	Study exploring job crafting, an employee's act to proactively adapt the design of their workplaces. This is especially relevant under challenging and changing work environments. Results suggest that employees in a supportive high-quality (LMX) supervisor relationship reported more job crafting, allowing for them to flexibly alter the boundaries of their responsibilities.	*Participative/ empowering leadership*	Questionnaire study with 260 employees. "Challenging work situations" operationalised by situational goal orientation *Fragmented Approach*
van der Voet, Kuipers & Groeneveld, 2015	Leadership of change processes in complex public sector environments	In a qualitative analysis, change processes in the public sector are used as an example for a complex environment. With increasing degrees of complexity, a "typical" planned, top-down approach as well as transformational leadership activities are appropriate, but reach their limits. With increasing complexity, it is suggested that leaders must additionally engage in more externally oriented, networking activities to manage external cooperation with other stakeholders.	*Participative/ empowering leadership*	Qualitative analysis of 23 interviews with executives. No distinct measure for "organisational complexity" / WEC *Assumed Approach*
		Adaptive/Flexible Leadership		
Baard, Rench & Kozlowski, 2014	Review of adaptive performance	Review of adaptive performance. To be effective under conditions of novelty, instability, unpredictability, and complexity, teams, leaders, and individuals must be able to adapt to new environmental demands.	*Adaptive/flexible leadership*	*Theoretical / Conceptual Approach*
Bartone, Kelly & Matthews, 2003	Adaptivity in military leaders	Study finding that military leaders' resilience scores predict their adaptability. While the significance of adaptive leadership behaviour in complex working contexts is highlighted, this study does not measure the degree on complexity in the participants' work	*Adaptive/flexible leadership*	694 military leaders and 259 supervisors (commanders) studied during and after their military career. No distinct measure for "complexity" /WEC *Assumed Approach*

Reference	*Research Question/Topic*	*Major Assumptions/Findings on Leadership in Work Environment Complexity*	*Proposed Leadership Approach*	*Study Design*
DeChurch & Marks, 2006	Leadership in Multiteam-Systems	Study researching Multiteam-Systems in military setting. In complex contexts with many involved actors, the role of leadership is described as a two phased model: 1) a strategic direction-giver role in phases of planning and shifting to 2) a coordinating and overseeing role in phases of action. Thus, building networks and strengthening relations across internal and external borders becomes more important than managing details on a micro-level.	*Adaptive/flexible leadership* *Participative/ empowering leadership*	Laboratory study with 384 undergraduate students modelling a military battle scenario. No distinct measure for "complexity" /WEC *Assumed Approach*
Denison, Hooijberg & Quinn, 1995	Theory of Behavioural Complexity	Study finding that a leader's ability to handle even contradicting or ambiguous tasks and fulfilling various leadership roles adaptively, corresponds with leaders' effectiveness ratings.	*Adaptive/flexible leadership*	Multidimensional Scaling approach with Quinn's model of 8 leadership roles, sample of 176 middle managers and their 670 subordinates as well as 222 senior managers. No distinct measure for "organisational complexity" / WEC *Assumed Approach*
Hannah, Balthazard, Waldman, Jennings & Thatcher, 2013	Exploring Leader's Self Complexity as a predictor of adaptive behaviour	Study finding that more effective leaders possess a high level of Self Complexity. This allows them to assess complex dynamics and demonstrate higher levels of adaptive decision-making in novel, ill-defined, and changing leadership tasks.	*Adaptive/flexible leadership*	Psychometric and neurologically based measures, testing effects on the adaptive decision-making of 103 military leaders. No distinct measure for "complexity" / WEC *Assumed Approach*
Hannah, Woolfolk & Lord, 2009	Exploring leader's self-structures for influencing employees in complex situations	Conceptual article arguing that for leaders, a broader (more "complex") self-construct as well as approach-oriented attitudes are preconditions for a proactive pursuit of opportunities and the development of adaptive leadership behaviour. In opposition, a less "complex" leader will be able to rely on a more limited behavioural skill set to draw from and manage complex scenarios.	*Adaptive/flexible leadership* *Leadership embracing complexity*	*Theoretical / Conceptual Approach*

Reference	*Research Question/Topic*	*Major Assumptions/Findings on Leadership in Work Environment Complexity*	*Proposed Leadership Approach*	*Study Design*
Hooijberg, Hunt & Dodge, 1997	Development of the leaderplex model	Theoretical paper that proposes the self-developed Leaderplex Model to manage the challenges of complex organisations. This combines facets of cognitive, social, and behavioural complexity of leaders. The authors highlight the necessity to flexibly adapt leadership in the face of complex environments.	*Adaptive/flexible leadership*	*Theoretical / Conceptual Approach*
Hyllengren, 2017	Leader adaptability in unexpected military situations	In a two study-approach, military leaders' adaptive responses to unexpected situations in battle are investigated. The author develops and tests a model where leaders need to master the balancing acts between providing structure and deciding self-reliantly, versus allowing freedom to act and relying on group decisions. Quantitative results suggest that unexpected scenarios are perceived as being handled more effectively when leaders show strong relationship-oriented behaviours.	*Adaptive/flexible leadership* *Participative/ empowering leadership*	Model development through interview study with 16 military leaders, subsequent model testing through quantitative study with 102 (non-managerial) respondents. Self-report of an "unexpected and demanding situation" / no distinct measure for WEC *Fragmented Approach*
Judge, Thoresen, Pucik & Welbourne, 1999	Managerial coping with organisational change	Study finds a leaders' ability to effectively cope with organisational change (= adaptive reactance to change and leading change) to be predicted by a leaders' dispositional variables and a mindset embracing change as something positive, e.g. via openness and tolerance ambiguity.	*Adaptive/flexible leadership* *Leadership embracing complexity*	Questionnaire study with 540 managers, incl. 12-item "Coping With Organisational Change Scale" (developed in 1998 by Timothy A. Judge and Vladimir Pucik) No distinct measure for "organisational complexity" / WEC *Assumed Approach*
Lawrence, Lenk & Quinn, 2009	Exploring behavioural complexity in paradox: The Competing Values Framework (CVF)	The CVF outlines paradoxes leaders are faced with in complex work environments, e.g., managing the ambiguity of creating continuity versus transformation. The authors argue that leaders with higher behavioural complexity (as measured by CVF) are better equipped for complex environments.	*Adaptive/flexible leadership*	Competing Values Framework (CVF), 36-Item Managerial Behaviour Instrument (Lawrence et al., 2009) with 523 respondents. No distinct measure for "organisational complexity" / WEC *Assumed Approach*

Reference	*Research Question/Topic*	*Major Assumptions/Findings on Leadership in Work Environment Complexity*	*Proposed Leadership Approach*	*Study Design*
Pulakos, Arad, Donovan & Plamondon, 2000	Develop a Taxonomy of Adaptive Job Performance	In the taxonomy, adaptability is argued to be a vital skill in effectively managing uncertain and complex work environments. The authors propose a model of eight adaptability dimensions for performance in work: (1) Handling crisis; (2) handling work stress; (3) creative problem solving; (4) dealing with uncertain or unpredictable work situations; (5) learning work tasks, technologies, and procedures; (6) demonstrating interpersonal adaptability; (7) cultural adaptability; and (8) physically oriented adaptability.	*Adaptive/flexible leadership*	Critical Incident analysis, Development of Job Adaptive Inventory (JAI): 68 behavioural items (Pulakos et al., 2000) with a mixed, i.e. managerial- and non-managerial sample largely in military context. I-ADAPT self-report measure for individual adaptability (Pulakos et al., 2000) No distinct measure for “organisational complexity” / WEC *Assumed Approach*
Silverthorne & Wang, 2001	The productivity effect of adaptive leadership style in high-tech environments	Quantitative comparison of adaptive and non-adaptive leaders yields indications that adaptive leaders have positive influence on six measures of productivity such as employee absenteeism, turnover rate, quality of work, reject rates, profitability, and units produced. Furthermore, the results indicate that the greater the level of adaptability, the more productive the organisation is likely to be.	*Adaptive/flexible leadership*	Quantitative study with a sample of 79 managers and 234 subordinates. Styles of leadership determined by LEAD-Self and LEAD- Other instruments (Hersey & Blanchard, 1988). No distinct measure for “organisational complexity” / WEC *Assumed Approach*
Uhl-Bien & Arena, 2017	Complexity leadership: Enabling people and organisations for adaptability	Conceptual framework proposing that in complex systems, leaders must show adaptive, rather than ordered and reactive responses. Enabling leaders in this view are personally flexible to adjust their approach and style depending on their appraisement of the situations they are presented with. One major factor of success is finding the on-going balance between when to be visible and intervene, and when to step back to enable others.	*Adaptive/flexible leadership* *Participative/ empowering leadership*	*Theoretical / Conceptual Approach*

Reference	*Research Question/Topic*	*Major Assumptions/Findings on Leadership in Work Environment Complexity*	*Proposed Leadership Approach*	*Study Design*
Uhl-Bien & Marion, 2009	Complexity Leadership in bureaucratic systems	Conceptual paper studying bureaucratic systems. Complex organisations call for the consideration of more informal, emergent, and adaptive leadership processes, even though the lack of "control" may appeal uncomfortable in the desire for predictability and order. Leadership in Complex Adaptive Systems therefore has three functions: Administrative Function (managing the desire for structure), Adaptive Function (allowing the need for creative chaos), and Enabling Function (coordinating and enabling optimal conditions) in order to be successful.	*Adaptive/flexible leadership* *Participative/ empowering leadership*	*Theoretical / Conceptual Approach*
Uhl-Bien, Marion & McKelvey, 2007	Complexity Leadership Theory: Interplay of adaptive, administrative, and enabling leadership	Conceptual framework arguing leadership models of the last century are becoming out-dated as they reflect top-down and bureaucratic structures. These are not well suited for a more knowledge-oriented economy anymore. Following the argumentation of complexity sciences, leadership has to be understood as an interactive dynamic, which creates adaptivity, learning, and innovation. The framework for leading in CAS proposes three intertwined leadership responsibilities (i.e., adaptive, administrative, and enabling leadership) that reflect a dynamic interplay between the necessary roles of modern leaders.	*Adaptive/flexible leadership* *Participative/ empowering leadership*	*Theoretical / Conceptual Approach*
Yukl & Mahsud, 2010	Flexible and adaptive leadership	Review of flexible leadership arguing that in complex settings, a leader more than ever before will have to show both cognitive and behavioural flexibility to adapt to various and changing circumstances. The review discusses insights, strengths, and current limitations of adaptive leadership research.	*Adaptive/flexible leadership*	*Theoretical / Conceptual Approach*
Zaccaro, Banks, Kiechel-Koles, Kemp & Bader, 2009	Predictors of leader and team adaptation	Quantitative analysis of cognitive and process variables that are proposed to predict leader and team adaptation. For example, in military contexts, leaders need to handle rapidly transforming and novel battlefield conditions. Findings revealed that several cognitive abilities as well as challenging work assignments facilitated the leader's adaptive skills.	*Adaptive/flexible leadership*	Questionnaire studies with 222 military and 120 industrial leaders. Challenging work assignments measured with Job Challenge Profile (McCauley, 1989): transitions, creating change, responsibility, nonauthority relationships, obstacles *Fragmented Approach*

	Research Question/Topic	*Major Assumptions/Findings on Leadership in Work Environment Complexity*	*Proposed Leadership Approach*	*Study Design*
Zhang, Waldman, Han & Li, 2015	Paradoxical leader behaviour	Quantitative study that introduces the construct of paradoxical leader behaviour (PLB) as an appropriate leadership response to increasingly complex environments that inherit contradictory or paradoxical challenges for leaders. The authors argue that increasing complexity will require a mindset shift from an "either or" of leadership styles to a more holistic "both and" understanding of people management. PLB thus conceptualises competing, yet interrelated management behaviours, e.g. the maintaining of control as well as the granting of autonomy. In two studies, the authors develop a measure for PLB and find that the extent to which leaders show paradoxical behaviour is related to increased employee proficiency, adaptivity, and proactivity.	*Adaptive/flexible leadership*	Quantitative study with 76 supervisors and 516 subordinates. Self-developed measure for paradoxical leader behaviour in people management (PLB) with 22 items. No distinct measure for "organisational complexity" / WEC *Assumed Approach*
		Leadership Embracing Complexity		
Crooke, Csikszentmihalyi & Bikel, 2015	Managing complex values – the "tragedy of choice"	Conceptual article arguing that in modern complex organisations, leaders are constantly confronted with the "tragedy of choice": These are situations where two or more seemingly incompatible values stand in conflict. As a means of success, leaders must accept the complexity that lies within ambiguous and incompatible dilemmas, and let go of the feeling there is only one "clear" alternative at hand. In order to solve complex dilemmas, another main factor is allowing managers and employees a broad range of freedom to act.	*Leadership embracing complexity* *Participative/ empowering leadership*	*Theoretical / Conceptual Approach*
Dóci & Hofmans, 2015	Task complexity and transformational leadership	The authors argue there is a growing need for transformational leadership when working in complexity, albeit finding in the experimental study that when leaders encountered tasks that were overwhelmingly complex, they acted in less transformational ways as the cognitive challenge momentarily depleted the manager's psychological resources. A partial mediation of leader's state core self-evaluations (CSE) suggests that the decrease in transformational leadership behaviour may be partly caused because the leader may be feeling less in control and confident about embracing the complex situation's demands.	*Leadership embracing complexity* *Participative/ empowering leadership*	Experimental design with 111 university students (of which 37 acted as leaders). Task complexity operationalised by an increasing number of alternatives in decision- making *Fragmented Approach*

Reference	*Research Question/Topic*	*Major Assumptions/Findings on Leadership in Work Environment Complexity*	*Proposed Leadership Approach*	*Study Design*
Fredberg, 2014	CEO strategies for managing paradox	Interview study that reveals seven paradoxes that global CEOs are confronted with which add to the complexity within which they act. These are, e.g. the paradox of change, paradox of innovation, and paradox of direction. The authors highlight the necessity to manage conflicting, often opposing goals and interests for the organisation's benefit. Rather than choosing between conflicting outcomes, top executives argue that their responsibility is to embrace the complexity and such paradoxes to make both things happen simultaneously. Being able to do so will create competitive advantages and solve the paradoxical tension.	*Leadership embracing complexity*	Interview study with CEOs of 20 global organisations. No distinct measure for "organisational complexity" / WEC *Assumed Approach*
Gebauer, 2013	Mindful organising to manage complexity and uncertainty	Conceptual study that proposes that managers can benefit from mindful organising (MO) principles to manage complexity and uncertainty. Dealing with the unexpected has become a central challenge for leaders. Thus, MO principles enable managers to take into account and embrace the given complexity of today's organisations.	*Leadership embracing complexity*	*Theoretical / Conceptual Approach*
Intezari & Pauleen, 2014	Management wisdom for uncertain and complex business environments	In complex business environments characterised by constant uncertainty and volatility, this conceptual study proposes that leaders need to be aware of their inability to fully comprehend and control decision-making situations. As decisions in complex organisations are likely to be fallible and inconsistent, the authors propose to reclaim management wisdom and virtues.	*Leadership embracing complexity*	*Theoretical / Conceptual Approach*
Lichtenstein & Ashmos, 2009	The leadership of emergence in Complex Systems	Conceptual study arguing that leaders in complex environments need to embrace uncertainty, surface conflicts and controversy, and allow for experiments. Successful agents in complex systems are in constant interaction exchanging information, learning and adapting. Leadership is therefore seen as a mediator of social interactions, and a supporter of collective actions.	*Leadership embracing complexity* *Participative/ empowering leadership*	*Theoretical / Conceptual Approach*

Reference	*Research Question/Topic*	*Major Assumptions/Findings on Leadership in Work Environment Complexity*	*Proposed Leadership Approach*	*Study Design*
Ashmos, Duchon & McDaniel, 2000	Comparison of complexity absorption vs. complexity reduction approaches of hospital CEOs	Empirical study finding that organisations and their CEOs who pursued a "complexity absorption" response, i.e. a managerial view of embracing the ambiguity and uncertainty in complex work settings, outperformed those with "complexity reduction" responses, i.e. a managerial view of trying to control, predict and apply linear, mechanistic approaches to handle the complexity. Performance criteria were solid financial measures such as return on assets, margin, and utilisation indices.	*Leadership embracing complexity*	Comparison of eight hospital companies and correlation with financial performance measures. Self-developed Hospital Complexity measure curated to hospital-specific goals, strategies and challenges *Fragmented Approach*
Ramos-Villagrasa, Navarro & García-Izquierdo, 2012 Ramos-Villagrasa, García-Izquierdo & Navarro, 2013	Chaotic dynamics and team effectiveness: evidence from professional basketball	The study of longitudinal data on basketball teams suggests that there is an inherent instability and "normal" chaotic dynamics in teams, players, and their performance. Team leaders are advised to avoid attempting to control the team too much based on static assumptions on their performance or personality. By contrast, they are advised to embrace the instability and uncertainty and use it to their benefit, e.g. by accepting that there will be different phases of greater and phases of lower performance.	*Leadership embracing complexity*	Longitudinal data on basketball team and players' performance measures over 10 years No distinct measure for "complexity" / WEC *Assumed Approach*
Roche, Haar & Luthans, 2014	Leader mindfulness as a psychological resource for complex, challenging work	The authors examine a leader's wellbeing and psychological resources in the face of complex and challenging work contexts. While research has focused extensively on employee-wellbeing, a leader's individual wellbeing perspective has been left out of scope. In the study, the authors propose that leaders' mindfulness and psychological capital (PsyCap) are functional psychological buffers against the "potentially toxic" effects of complex work. Across all examinations, the psychological resources were found to significantly reduce detrimental effects on leaders' mental health.	*Leadership embracing complexity*	Four samples of leaders: CEOs/presidents/top (n = 205), middle (n = 183), and junior (n = 202) managers, and (n = 107) entrepreneurs. No distinct measure for "organisational complexity" / WEC *Assumed Approach*

Reference	*Research Question/Topic*	*Major Assumptions/Findings on Leadership in Work Environment Complexity*	*Proposed Leadership Approach*	*Study Design*
Visscher & Rip, 2003	Leadership in change processes: Coping with chaos	Qualitative analysis finding that in contemporary organisations, leaders are confronted with uncontrollable states, complexity, and indeterminacy of change processes. Effective leaders of change will therefore have to accept and embrace the evolving chaos instead of trying to control it on a micro-level.	*Leadership embracing complexity*	Series of in-depth interviews conducted with managers and change consultants. No distinct measure for "organisational complexity" / WEC *Assumed Approach*
White & Shullman, 2010	Acceptance of uncertainty as indicator of effective leadership	This paper introduces a preliminary consulting instrument to assess a leader's skill in accepting uncertainty. The authors argue that with a shift from command-and-control structures to learning organisations, leaders need to manage substantial amounts of ambiguity and with this, embrace the feeling of uncertainty. Preliminary data suggests that leaders who display high uncertainty acceptance are rated higher on their current performance as well as their ability to handle change.	*Leadership embracing complexity*	Preliminary data on assessment instrument for consulting psychology: Enabling skills to accept uncertainty (n=156, supervisor ratings n=25) No distinct measure for Ambiguity / WEC *Assumed Approach*

2.4.2 Participative and Empowering Leadership

One of the most prominent propositions for leading in nonlinear, ambiguous, changing, unpredictable, and fast-paced – complex – environments advocates empowering, participative, creative, non-authoritarian, non-prescriptive, and enabling leadership behaviour (Horner, 1997; Lichtenstein & Ashmos, 2009; Mumford et al., 2000; Uhl-Bien & Marion, 2009). It is suggested that effective leaders in WEC facilitate networks across internal and external borders, engage in dialogue, and link people to each other (DeChurch & Marks, 2006; Lane & Down, 2010; Martin & Ernst, 2005; van der Voet et al., 2015). Descriptions of this “optimal” leadership approach for WEC include various, yet similar terms. In order to advance models for leadership in WEC in this thesis, these descriptions will be subsumed under the construct of a *participative* or *empowering* leadership style (Ashmos et al., 2002; Burnes, 2005; Correia de Sousa & van Dierendonck, 2014; Marion & Uhl-Bien, 2001; Mumford et al., 2000; Osborn & Hunt, 2007; Uhl-Bien et al., 2007). Thus, detailed below, it is proposed that it is beneficial for leaders to apply a more participative/empowering leadership style in WEC.

The rationale for this proposition is guided by the assumption that empowering leadership can overcome the limitations of traditional, linear management approaches which are viewed as unable to meet today’s business requirements (e.g., Ashmos et al., 2002; Lee et al., 2018; Styhre, 2002). Burnes (2005) similarly observes that “managers need to abandon top-down, command-and-control styles, organisational structures need to be flatter and more flexible, and greater employee involvement is essential for success” (p. 84). However, there is still no solid conceptual model nor empirical proof that has substantiated a relation between complex work environments and participative leadership. The limitations span across several areas. First, there is yet no comprehensive definition of WEC (see section 2.2). Thus, studies have only investigated a participative leadership style and its relationship with singular factors of "complexity" (e.g., B. Griffin & Hesketh, 2003). This, however, does not meet the wide range of the concept of WEC, and a fundamental flaw of research so far is to equate a singular concept such as "change" or "unpredictability" with complexity. This is not least because the impact of one work factor on individuals is significantly different from the dynamic that several work factors exert in combination (van Woerkom et al., 2016). A second limitation is that, conceptually, there is no model that explains why an empowering leadership style would be more adequate to meet WEC-characteristics. There is need to provide a rationale behind the relation between the WEC factors (Frequent Change, Unpredictability, and Uncertain Work Demands) and the benefits of an empowering leadership style. Thirdly, there needs to be empirical testing to the subject. As discussed in detail below, there is as yet no study that demonstrates the link between WEC and the display of empowering leadership. In summary, the proposition of empowering leadership being beneficial to contexts of WEC still lacks a clear conceptual model, a link to an integrated concept of WEC, and eventually, empirical testing. This section aims to advance these links.

In leadership research, *participative or empowering leadership* has been substantiated as a non-directive leadership style by which the leader involves employees in the process of decision-making and problem-solving (e.g., Lee et al., 2018; Spreitzer, 1995, 1996; Yukl, 2013). This includes asking others to contribute through consultation, empowerment, power sharing, and by passing responsibility on to employees (Ogbonna & Harris, 2000; Yukl, 2013). A participative leader delegates decisions to team members on how to accomplish their objectives (Sauer, 2011), encourages employees' self-management abilities (Pearce et al., 2003), and in a supportive manner provides consultation rather than direction (Amabile, Schatzel, Moneta, & Kramer, 2004). Because an empowering leader instils in team members the sense that they can meaningfully influence their work and autonomously seek out new solutions (Dong, Liao, Chuang, Zhou, & Campbell, 2015; Spreitzer, 1995), such leadership has been widely suggested to be beneficial for several work-related aspects such as employee wellbeing and engagement (e.g., Bycio, Hackett, & Allen, 1995; for an extensive review of studies see Donaldson-Felder, Munir, & Lewis, 2013), employee feelings of empowerment and self-efficacy (e.g., Zhang & Bartol, 2010), (team) performance (Lee et al., 2018), creative achievement (Amabile et al., 2004; Lee et al., 2018; Oldham & Cummings, 1996), innovative behaviour (Spreitzer, 1995), as well as improving quality of judgements, the development of team members' skills, and for gaining acceptance for organisational decisions (Yukl, 2013). However, these positive findings have not been consistent. Instead, the relations have been found to vary depending on the *situation* in which participative leadership is applied. Thus, its effectiveness has been found to depend, amongst other factors, on a leader's status, time pressure, goal congruency, role ambiguity, the extent to which team members are willing to take responsibility, followers' expectations, the feeling of empowerment, and the level of trust in the leader (Lee et al., 2018; Sauer, 2011; Spreitzer, 1996; Wong & Giessner, 2016; Yukl, 2013).

2.4.3 Empowering Leadership in Work Environment Complexity

In this line of thought, WEC is also a specific situation that needs further exploration. The preliminary operationalisation has characterised WEC as a frequently changing, unpredictable, and demanding work environment. The question is thus: Why would empowering leadership be beneficial to manage these complex work characteristics more successfully? Until now, little research has examined this question (Baard et al., 2014).

A central rationale that guides the call for more empowering leadership is that due to the demanding, turbulent, and unpredictable nature of WEC, leaders cannot control single-handedly complex environments (anymore), and thus will be advised to share control by empowering and involving others (Karp & Helgø, 2008; Lee et al., 2018). Firstly, the identified WEC factors Frequent Change and Unpredictability become relevant here, as they can be linked to the need for more empowering behaviour. In environments where changes are constant and often hard to predict, the work premise, goals, strategies, and projects are steadily evolving, and work approaches have to respond flexibly to this transformation (Uhl-Bien & Arena, 2017). Traditional managerial approaches of controlling, planning and executing strategies "top down" are likely to reach their limits, as are the skills of single managers; in a work environment that is frequently adapting, the need to make decisions, choices, and adjustments becomes a constant (Black, 2000; Burnes, 2005). Or, as Karp and Helgø (2008) put it: "In the 'world' of chaos, complex interaction processes between people dominate the stage – these are self-governing, non-linear, dynamic and emergent – and leaders are not in control" (p. 90).

Leading through participation implies, in contrast, that managerial control or responsibility will be shared with others; team members and smaller work units are granted the autonomy to interact more speedily and adapt their working approach self-reliantly (Ashmos et al., 2002; Lee et al., 2018; Styhre, 2002). Indeed, findings from related fields have shown that servant leadership within a complex change process under high uncertainty positively predicted employee's work engagement (Correia de Sousa & van Dierendonck, 2014), and that leader supportive behaviour will foster an employee's job crafting efforts (van Dam, Nikolova, & van Ruysseveldt, 2013). This means, employees who are led in a supportive manner are more likely to take over the responsibility of proactively adapting their workplaces to necessary changes. Similarly, Griffin and Hesketh (2003) found that employees of a multinational IT company who were led supportively and rated their work environment as complex (i.e. challenging workers' skills), scored higher on external ratings of adaptive performance. Where team behaviours are shaped dynamically on a micro-level through the interaction of many interconnected individuals, a leader's influence is likely to become more indirect by nature. It may be vital for managers to use informal leadership skills that emerge from the team to address complex work demands (Osborn & Hunt, 2007). Recent findings have revealed that in contexts of frequent change, employees are more likely to leave their jobs due to strong feelings of uncertainty or anxiety (Babalola et al., 2016). However, studying ethical leadership, the authors found that leaders who create a trustworthy environment can considerably reduce the adverse impact of frequent change on turnover intentions, for example by strengthening an employee's self-esteem (Babalola et al., 2016). Similarly, a study by Bordia and colleagues (2004) substantiated that employees who were involved by their leaders in decision-making showed significantly less uncertainty and psychological strain to cope with the turbulences of transformation. This implies that empowering leadership in contexts of Frequent Change and Unpredictability is likely to have a positive effect on employee engagement, wellbeing, and adaptivity.

Further, WEC has been characterised by the factor Challenging Work Demands. This means that the problems to be solved and choices to be made are often radically new, ill-defined, and without pre-defined solutions. In search of answers to such challenging problems, team members will often have more knowledge or expertise than the single leader (Gebauer, 2013; Mumford et al., 2000). This emphasises the need to share control; a leader's decision-making in complex contexts will have to be backed up by the joint effort of many. In a study of fire-fighters, Tuckey, Bakker, and Dollard (2012) found that empowering leadership was positively related to employee engagement when faced with "complex" cognitively demanding tasks. Thus, the strengthening of exchange, engagement, and interaction seems more appropriate to create high-quality and novel solutions driven by a joint effort (Lichtenstein & Ashmos, 2009). In support of this, several studies have uncovered a positive connection between supportive, promotive, or transformational leadership and employee creativity in jobs that were more "complex", defined as being cognitively challenging (Li, Li, Shang, & Xi, 2015; Shalley, Gilson, & Blum, 2009; Tierney & Farmer, 2002; Wang et al., 2014). As there are often no predefined answers to complex problems, a team will need room for creatively testing new approaches (Elkington & Booysen, 2015), and effective problem-solving might require integration of different perspectives or even to actively surface controversy (Crooke, Csikszentmihalyi, & Bikel, 2015). A supportive leader can influence these creative processes both directly and indirectly, for example by role modelling, supporting knowledge exchange and interaction between subordinates, and by providing constructive feedback (Carmeli, Gelbard, & Reiter-Palmon, 2013). In addition, participative leadership is likely to develop employee's problem-solving skills (Yukl, 2013) and has been shown to facilitate team learning by actively encouraging a climate of psychological safety, where team members feel safe to take risks, discuss ideas freely, and openly admit to and learn from errors (Nembhard & Edmondson, 2006; Sarin & McDermott, 2003). Especially in high-complexity contexts, where problems are often new or ill-defined, a leader's ability to create a psychologically safe team environment might be vital to foster the creativity and problem-solving needed. Previous research has associated psychological safety in teams and organisations with higher team learning, performance, creative achievement, innovation behaviour and engagement, and has demonstrated that the influence of leadership behaviour in this relationship is high (Carmeli, Brueller, & Dutton, 2009; Nembhard & Edmondson, 2006; Ortega, Van den Bossche, Sánchez-Manzanares, Rico, & Gil, 2014; Roussin & Webber, 2012). If an empowering leader succeeds in facilitating skill-development and learning amongst the team, this should, in turn, help to equip teams for future complex challenges (Porteous, 2013). Recent research further finds that merely being listened to by their leader fosters employees to be more creative; and that supervisor listening might be an aspect of (empowering) leadership that has hitherto been underrated (Castro, Anseel, Kluger, Lloyd, & Turjeman-Levi, 2018).

In summary, the seemingly uncontrollable and evolving nature of WEC calls leaders to pass responsibility to others and encourage self-organisation as it is unlikely that a single manager will be capable of single-handedly fulfilling complex work demands (e.g., Burnes, 2005; Schneider & Somers, 2006; Uhl-Bien & Arena, 2017; Uhl-Bien & Marion, 2009). Consequently, one can find strong arguments that due to the characterisation of WEC as frequently changing, unpredictable and demanding context, leadership in WEC has to be about enabling, empowering, and involving others to achieve high quality, shared, and agile decisions (e.g., Ashmos et al., 2002; Brodbeck, 2002; Karp & Helgø, 2008; Lee et al., 2018; Marion & Uhl-Bien, 2001). Empowering leadership in high-complexity contexts could also be vital to establishing team climates of psychological safety: an atmosphere where team members are more likely to speak up, try out unconventional ideas, and to engage in innovative problem-solving (Kahn, 1990). Rationales behind this are that leadership behaviours such as consultation, empowerment, power sharing, and the passing of responsibility are likely to encourage employees' responsibility-taking, proactivity, engagement with creative and learning processes, and the development of employee skills (e.g., Carmeli et al., 2013). This section has added to these rationales by linking them to the preliminary operationalisation of WEC. Thus, if participative leadership were the "leadership style of choice" for WEC, it should be possible to empirically substantiate this relation.

However, as of today, it is not clear whether leaders will *actually engage* in more participative/empowering leadership behaviour. There are at least two possible explanations for this lack of empirical links: firstly, there is no conceptual model that directly links WEC and participative/empowering leadership, secondly, there is not WEC measure, which could test such a model. However, several insights from related fields make it plausible to assume that leaders who are being confronted with WEC will engage in more empowering leadership. Brodbeck (2002), for example, studied a focus group of 15 executives in an volatile IT-business environment. While these executives stated there was some need for managerial support based on traditional top-down control, they altogether agreed on the necessity to assign greater responsibility and decision-making authority to all hierarchical levels (Brodbeck, 2002). Similarly, in an interview study by van der Voet et al. (2015), managers affirmed that in situations of complex change, followers will have to be encouraged and empowered to enact the changes themselves. Another insight comes from Martin and Ernst's (2005) study on future leadership skills for managing complexity and paradox. In this exploratory semi-quantitative approach, 157 participants of a leadership development programme found relationship building, participative management, and the development of employees to be of prime importance in effectively handling complex work demands.

Other findings have challenged the relation of WEC and more participative leadership. Dóci and Hofmans (2015) observed an experimental setting where students enacted transformational leadership (which is related to empowering leadership as it considers employees' needs and resources in change processes). Findings revealed that when leaders encountered tasks that were increasingly "complex" (i.e., cognitively challenging), they engaged in significantly less transformational leadership behaviour. The authors explain, that the cognitive challenge of a complex task momentarily may deplete the manager's psychological resources to act transformatively. Thus, the application of participative leadership in WEC may also have its limits.

Previous research largely suggests that it is likely for leaders to show more empowering behaviour in the face of WEC. Also, it is likely that such a leadership style may be more beneficial for the quality of decisions and problem-solving as well as for employees' engagement, wellbeing, adaptive behaviour, skill development, and creativity in WEC. However, in contrast to the large number of conceptual studies suggesting a link between WEC and empowering leadership, no studies have tested these propositions. Thus, these assumptions are not based on sound conceptual nor empirical foundations. While the studies outlined above indicate a possible relation between empowering leadership and WEC, their transferability is limited by various factors described below.

Firstly, none of the above studies have explored whether executives *actually engaged* in more participative leadership behaviour in response to WEC, i.e. whether a complex work environment was *causal* for a leader's adoption of more empowering leadership. Secondly, the results of qualitative, explorative study designs with small sample sizes (Brodbeck, 2002; van der Voet et al., 2015), semi-quantitative approaches (Martin & Ernst, 2005), or experimental settings with students rather than leaders (Dóci & Hofmans, 2015) are limited in the generalisability of their results. Thirdly, in all the above studies, with the exception of Tuckey et al. (2012), only related leadership styles were examined rather than empowering/participative leadership. Whilst for example supportive leadership has been found to be related to participative leadership (correlation of $r = .55$), they are still distinct concepts (Ogbonna & Harris, 2000). Fourthly, though claiming to examine a "complex" work environment, either no measure for the nature of WEC was applied (e.g., Bordia et al., 2004; Correia de Sousa & van Dierendonck, 2014; van Dam et al., 2013), or the term "complexity" was limited in its definition to fulfilling tasks that are (cognitively) challenging (e.g., Dóci & Hofmans, 2015; B. Griffin & Hesketh, 2003; Tuckey et al., 2012; Wang et al., 2014). This conceptualisation has been criticised as too narrow for measuring WEC as a whole (Morgeson & Campion, 2003), and has been discussed in detail in section 2.2.6. None of the studies has empirically worked with an integrated WEC construct.

In conclusion, there seems to be a consensus that for modern leadership in WEC the "belief of order and control needs to be redressed" (Brodbeck, 2002), and the arguments for a paradigm shift towards applying more empowering leadership behaviour in WEC are manifold. This section has added to the call for empowering leadership and a conceptual model for this equation by relating it directly to the integrated operationalisation of WEC. Nevertheless, empirical studies that investigate this proposed relation are scarce or limited. The above discussion highlights the need to link an integrated understanding of WEC not only conceptually, but also empirically to a leader's participative leadership behaviour. It is not clear how leaders react to complex environments, and whether they will embrace more empowering leadership behaviour in WEC. As several insights are suggestive of a linkage, it should be possible to explore this relationship empirically. Consequently, after establishing the measurement instrument of WEC, Study 2 aims to empirically explore the proposition of whether WEC causes leaders to adopt a more participative leadership style. Substantiating this relationship would allow, eventually, to examine the outcomes of this managerial style in WEC, e.g. its effects on the wellbeing and productivity of employees; the consequences for organisational agility and productivity, and many other factors.

The first research question for Study 2 is:

Research question #3: *Is the level of Work Environment Complexity causal for leaders to adopt higher levels of empowering leadership?*

2.4.4 The Other Side of the Coin: Directive Leadership in WEC

When recommending empowerment and participation as the "optimal" leadership behaviour, this claim is often contrasted with describing "how not to lead" in WEC: These descriptions include planning, managing and controlling in a top-down and linear fashion (Styhre, 2002), relying on managerial authority (Schneider & Somers, 2006), applying a "top-down command-and-control style" to uphold rigid order and hierarchy (Burnes, 2005), clinging to control and micro-management (Karp

& Helgø, 2008), reacting to changes by increasing regulatory control (Uhl-Bien & Arena, 2017), applying hierarchical authority in order to command (Lichtenstein & Ashmos, 2009), and trying to predict and control activities on a micro-level (Marion & Uhl-Bien, 2001). Therefore, scholars suggest that the following leadership styles should not be applied: "controlling", "directive", instructing", "instrumental", or "authority-based". These leadership styles are in fact displayed as the opposite of empowering leadership (e.g., Yukl & Mahsud, 2010). This multitude of terms indicates that there has still been no conceptual model to establish the connections between such leadership behaviours and WEC. In this thesis, for the purpose of advancing research and clarity, these leadership behaviours will be subsumed under the construct of a *directive or instrumental leadership style*.

There is a prominent notion that directive leadership is less beneficial or suited for contexts of WEC. However, research is not yet mature in this aspect either. Firstly, whilst it is suggested that leaders should not lead instrumentally in WEC, there are no empirical studies into whether leaders will *actually* find it appropriate to engage in less directive/instrumental leadership in WEC and what effect this behaviour may have. Also, these propositions have not yet been conceptually or empirically linked to an integrated WEC construct. Conceptually, there is so far no model to explain why directive leadership would be less beneficial to meet the work characteristics of WEC. Thus, a direct linkage between Frequent Change, Unpredictability, Challenging Work, and directive leadership is required. Empirically, there have as yet been no studies that work with a comprehensive construct of WEC, rather than exploring only related fragments of it, such as "change". Further, the fact that the two leadership behaviours (empowering vs. directive) are so strongly contrasted in the discussions of leading in

WEC suggests that both should be studied simultaneously. This has yet not been attempted in the context of WEC. One question that requires particular attention here is the assumption that empowering and directive leadership are opposites that cannot coexist. This thesis aims to directly compare both styles in relation to the integrated WEC construct. This will allow for substantially more exploration of the choice of leadership behaviour that is made in contexts of WEC.

2.4.5 Contrasting Directive and Empowering Leadership for WEC

In leadership research outside of WEC, Pearce and colleagues (2003) have substantiated a directive leadership style to be clearly distinct from empowering leadership, defining it as behaviour that: "includes direction, command, assigned goals", and even "intimidation and reprimand as the primary mechanisms to influence subordinate behaviour" (p. 275). Similarly, even as early as 1958, Tannenbaum and Schmidt (Tannenbaum & Schmidt, 1958, 1973, 2009) differentiated in their leadership continuum a directive, boss-centred leadership behaviour from more subordinate-centred leadership behaviours. The former is thus referred to in the following as instrumental or directive leadership, outlining a leadership style which includes a close supervision or control of employees and decisions taken by the manager alone, rather than involving others (see also Ogbonna & Harris, 2000; Wendt, Euwema, & van Emmerik, 2009).

How do directive and empowering leadership relate to another? To date, there are no studies known to the author that contrast participative and directive leadership in the context of WEC. Yukl and Mahsud (2010) have addressed this limitation of leadership research criticising the "analysis of each type of leadership behaviour separately, rather than examining the pattern of leadership behaviours used by a leader" (p. 89). However, exceptions exist from fields outside the context of WEC: Zhou (2003), for example, examined the different effects on employee creativity by contrasting supervisor developmental feedback (empowering behaviour) to supervisor close monitoring (directive behaviour). Whilst developmental feedback was not significantly related to creativity ($\beta = .05$), the findings reported a significant negative correlation of supervisor close monitoring behaviour on employee creativity ($\beta = -.21$ and $\beta = -.45$). Wendt et al. (2009) found positive effects of supportive leadership ($r = .44$) and detrimental effects of directive leadership ($r = -.19$) when studying team cohesion. Finally, Donaldson-Felder et al. (2013) conclude in their review of leadership and employee wellbeing: "High levels of initiating-structure behaviours can have a detrimental effect on employee wellbeing, but this negative impact may be reduced if the manager displaying them also exhibits a range of more consideration-based behaviours" (p. 158). These findings appear to be in line with the proposed equation above, arguing for the benefits of more empowering, and consequently less directive leadership action.

Other findings disrupt this picture: Somech (2006), studying the innovative performance of heterogeneous teams, contrasted both styles and found positive effects of participative leadership on team innovation when teams were heterogeneous ($\beta = .80$), as well as positive influence of directive leadership on team in-role performance ($\beta = .67$) when teams were less diverse. Furthermore, Judge et al. (2004) in a meta-analysis compared the two contrasting leadership styles of Consideration (leader shows concern and support for followers) and Initiating Structure (leader defines and organises follower's role and is oriented toward goal attainment). They found that both Consideration ($r = .48$) and Initiating Structure ($r = .29$) have moderately strong relations with positive outcomes of leadership. Each style, however, fuelled different outcomes: Consideration was associated with follower satisfaction, motivation, and leader effectiveness, whereas Initiating Structure showed stronger correlations with leader job performance and group–organisation performance. Similarly, Sarin and McDermott (2003) studying R&D teams, have substantiated that *both* participative leader behaviours (passing responsibility in decision-making) as well as initiating leader behaviours (define expectations, rules, and roles) foster team learning, team innovation and speed. Research on creativity and creative problem-solving has shown that creative processes often require a combination of both directive and supportive leadership behaviours (Carmeli et al., 2013). Drawing from the Full Range of Leadership theory (Avolio, 1999), not only can different styles coexist, but just recently a combination (e.g. transformational and transactional) has even been labelled as most effective (Arnold, Connelly, Gellatly, Walsh, & Withey, 2017). These findings are limited in their transferability to the present subject, as they were not conducted in contexts of WEC and predominantly studied only related leadership styles. They do, however, question the abandonment of directive leadership for WEC.

In psychology literature there is a predominant belief that direction and participation contradict each other (Sagie, 1997), and many scholars have treated them this way (Blanchard, Zigarmi, & Nelson, 1993). Yet, findings on the relation of the two styles have not been consistent. Ogbonna and Harris (2000), for example, report a -.05 correlation between the seemingly contradictory leadership styles. Other authors have stated relations, varying from Wendt et al. (2009), where supportive and directive leadership were negatively and significantly correlated with each other at -.19; to a minor, non-significant but positive correlation of .16, as reported by Somech (2006); to a meta-analytic estimated positive and significant correlation of .19 comparing Consideration and Initiating Structure (Judge et al., 2004). In a slightly different approach, Lawrence and colleagues (Lawrence, Lenk, & Quinn, 2009) in their Competing Values Framework (CVF) find the behaviours of “Managing Processes” (e.g. controlling projects) and “Relating to People” (encouraging participation) to be distinct but related to each other strongly with a correlation of .46. In summary, applying Hemphill’s (2003) guidelines on interpreting the magnitude of correlation coefficients (lower third/weak correlation < r = .2, medium correlation r = .2 – .3, upper third/strong correlation > r = .3), most previous studies, with the exception of Lawrence et al. (2009), have found a weak correlation between the two styles. From this, the conclusion can be drawn that instrumental leadership not the *opposite* of participative leadership, but rather a contrasting, different approach. Bridging this discussion and WEC, might mean that both styles can be applied *simultaneously* and that leaders might find it appropriate to show directive leadership in certain WEC *situations*.

This returns us to the valence of the situation in which leadership behaviour is applied, and why directive leadership would be more or less beneficial in contexts of WEC. In the above section (2.4.3), applying the preliminary operationalisation of WEC has added to the necessity and value for leaders to share control in a seemingly uncontrollable environment. As outlined above, this sharing of control and the passing of responsibility are likely to encourage employees’ responsibility-taking, proactivity, engagement with creative and learning processes, and the development of employee skills (e.g., Carmeli et al., 2013). Instrumental leadership, in contrast, is highly related to the leader exerting control and not sharing it. This builds a strong rationale to propose empowering behaviour as the leadership of choice, in turn rejecting a directive leadership style. In other words, it is plausible to suggest that WEC may be causal to explain a leader's choice of more empowering, and less directive leadership. According to Lane and Down (2010), however, leaders in WEC face the dilemma of creating a "leadership of complexity, uncertainty and ambiguity *as well as* certainty" (p. 522). This means – incorporating the above findings on the two styles – that the two leadership styles do not necessarily have to exclude one another.

If this is the case, where *could* a directive leadership style in WEC be beneficial? The preliminary operationalisation of WEC describes contexts where decisions are made by dynamically interacting individuals that face demanding, turbulent, and largely unpredictable work environments. In such contexts, one could claim that at certain times there are valid reasons to lead through direction. For example, teams faced with a rapid pace of change and unpredictability may benefit from a managerial backbone (Brodbeck, 2002) and the creation of some stability based on rules, boundaries, or the monitoring of goal achievement (Lane & Down, 2010). Furthermore, some level of administrative leadership may be useful to structure actions and give the teams direction (Uhl-Bien et al., 2007). Where problems are highly complex, less mature employees are likely to require more direct guidance by a leader (Silverthorne & Wang, 2001). Also, creativity research has substantiated that successful creative problem solving not only benefits from empowering approaches, but also requires leaders who provide direction and structure in this process (Redmond, Mumford, & Teach, 1993). Carmeli et al. (2013) explain: "Because creativity takes place when issues are novel and complex, often ill-defined and poorly structured, leaders can set up expectations and direct the attention of followers to specific goals"

(p. 98). In fact, team innovation, speed, and learning have been shown not only to be positively influenced by participation, but by leaders who *also* instruct teams on expectations, roles and rules (Sarin & McDermott, 2003).

Feelings of uncertainty and anxiety have been substantiated as detrimental for individuals' wellbeing and engagement in changing environments (Bordia et al., 2004). In working situations that are likely to inhibit high levels of ambiguity and role conflict, clear, transactional supervisor expectations have been found to reduce these uncertainties for employees (Schmitz & Ganesan, 2014). Similarly, Karp and Helgø (2008) find that in times of chaotic change "leaders and employees in organisations simply want to believe that someone, somewhere, is in control" (p. 91), suggesting that leaders may engage in directive behaviour to reduce both their own and their employees' anxiety in the face of uncertainty. It is therefore not unreasonable to argue that leadership actions in WEC such as giving stability by controlling processes, directing behaviours, setting boundaries and goals, taking decisions, or defining "what and how things shall be done" are likely to be beneficial in specific situations. As Karp and Helgø (2008) said, in WEC: "there is still plenty of space and need for leadership" (p. 91).

This invites further expansion of the debate on directive leadership in WEC. The above discussion has shown that it is not yet clear whether leaders will actually engage in less instrumental leadership when facing WEC. While the case for empowering leadership appears strong, several arguments also propose that for specific causes, directive behaviours in WEC contexts can be beneficial for employee and team success. If it is found that the two leadership styles do not exclude one another, the choice of leadership behaviour in WEC might be a question of *as well as* rather than *either/or*. This view can be addressed by an empirical study that includes both leadership styles simultaneously. A necessary precondition for examining a causal relationship is the ability to measure WEC. Consequently, after substantiating a WEC-measure, this thesis will aim to broaden the discussion and empirically investigate the relationship between empowering and directive leadership in WEC. Study 2 will be devoted to this.

The second and third research questions for Study 2 are:

Research question #4: *Is the level of Work Environment Complexity causal for leaders to adopt lower levels of directive leadership?*

Research Question #5: *Are empowering leadership and directive leadership in WEC shown independently of one another?*

2.5 Flexible and Adaptive Leadership

The second stream of research that has made both theoretical and empirical progress for leadership in WEC highlights a leader's adaptability and flexibility to master complex demands (e.g., Kaiser, 2010; Pulakos et al., 2000; Uhl-Bien & Arena, 2017; Yukl & Mahsud, 2010). Effective leaders in this view have the cognitive and behavioural flexibility to respond appropriately to a wide range of situations in WEC, even if these may require contrary or opposing behaviours (Denison et al., 1995; Hannah et al., 2013; Hooijberg, Hunt, & Dodge, 1997; Mumford et al., 2000; Uhl-Bien et al., 2007; Yukl & Mahsud, 2010; Zhang et al., 2015). It must be emphasised that leaders are not encouraged to show sheer flexibility. Whilst there is no one and consistent "right" leadership style, the idea is that leaders will be required to assess the respective situation and change behaviours "in *appropriate* [emphasis added] ways as the situation changes" (Yukl & Mahsud, 2010, p .81). WEC as a turbulent, demanding, and often unforeseeable work environment is likely to present a leader with ever-new, dynamically changing, and unexpected situations. This presents a new quality of work environment to today's leaders, and is a stimulus to re-activate thoughts of contingency theories, i.e. leaders will need to diagnose the context and identify leadership behaviour likely to be effective (Yukl & Mahsud, 2010). Thus, the skill to flexibly adapt to these different situations becomes especially relevant in contexts of WEC where uncertainty is high, when work requirements are not stable or formalised, where paradoxes are common, and where many contingencies cannot be anticipated (Burke, Pierce, & Salas, 2006; Griffin, Parker, & Mason, 2010; Ilgen & Hollenbeck, 1991; Ilgen & Pulakos, 1999; Zhang et al., 2015). As Lane and Down (2010) put it:

> *"In the past many traditional narratives about leadership were based on the 'heroic visionary leader', whose role is to drive the organisation forward towards a predefined vision or goal in the relentless quest to drive shareholder value. This paradigm fits well with a future that is predictable, where the past can be used to project the future but less helpful in managing on the edge of chaos. In the future leadership will be much more about balancing the art of leading uncertainty with certainty and adapting the style of approach to address both" (p. 518).*

Several authors have proposed taxonomies such as the Job Adaptability Inventory (JAI, Pulakos et al., 2000), and have reviewed the research of adaptive performance (Baard et al., 2014) and flexible leadership (Kaiser, 2010; Yukl & Mahsud, 2010) in light of changing and increasingly complex work contexts. Yet, and as touched on below in more detail, the conceptual model as well as the empirical evidence behind adaptive leadership and WEC are limited for several reasons. First, considerably less is known about leaders' adaptivity than that of employees. Second, as long as characteristics of WEC have not been clearly outlined, the explanatory models behind *if* and *why* individuals would adapt to them are significantly limited; the "complexity" of a context was often simply assumed, not measured. Thirdly, the concept of adaptive leadership is not uniform, and different leadership styles may be examined at different times. Lastly, as long as there has been no longitudinal research around complexity and adaptivity, a reverse causality cannot yet be ruled out. This indicates that, until known, a work environment may be complex *because* a leader is adapting. Addressing the limitations above, the following section aims to substantiate a conceptual rationale, the link to the integrated characteristics of WEC, and a basis for empirical testing.

2.5.1 Adaptive Performance in Light of WEC

With growing discussions on WEC and flexible leadership, *individual adaptability* (or adaptive performance), i.e., the "extent to which individuals are responsive to changes in task requirements and in their work environments" (Shoss, Witt, & Vera, 2012, p. 911) is getting renewed research attention. The concept per se is, however, not new. A substantial amount of literature has looked into employees' adaptive performance in the last 30 years, and comprehensive reviews have summarised the results (see e.g., Baard et al., 2014; Ilgen & Pulakos, 1999). In brief, an individual's ability to readily accept changing circumstances, gain new competencies, and apply them flexibly has been substantiated as effective in coping with changing work situations (B. Griffin & Hesketh, 2003; Griffin et al., 2007; Griffin et al., 2010; Ployhart & Bliese, 2006; Pulakos et al., 2002; Shoss et al., 2012). Therefore, this ability is not only seen as a performance dimension by itself, but as a key precursor of job performance and career success in changing work settings (Baard et al., 2014; Babalola et al., 2016; Pulakos et al., 2000).

With WEC being operationalised as a frequently changing, unpredictable, and highly demanding work environment, these findings are getting renewed attention. Insights from employee studies suggest that complex contexts are especially relevant for adaptability and are also likely to evoke individual adaptive behaviour (e.g., B. Griffin & Hesketh, 2003; Pulakos et al., 2000). For example, Pulakos and colleagues (2000) in their Job Adaptive Inventory (JAI) identify the following important situations for showing adaptive behaviour: (1) handling crisis; (2) solving atypical, ill-defined, and complex problems; (3) dealing with uncertain or unpredictable environments; and (4) interpersonal situations. Pulakos et al. suggest that “in addition, new dimensions of adaptability may emerge if jobs are evaluated during periods of organisational change” (p. 622). Similarly, Ployhart and Bliese (2006) propose – but do not test – that a dynamically changing environment will be especially likely to facilitate adaptive performance. Griffin and Hesketh (2003) found that a complex job (i.e. one that challenges an individual’s skills) to be a significant predictor of employee adaptive performance. Also, employees have been found to be more likely to actively adapt the design of their jobs (job crafting) in the face of challenging working environments (Petrou, Demerouti, Peeters, Schaufeli, & Hetland, 2012; Petrou, Demerouti, & Schaufeli, 2018; van Dam et al., 2013).

These findings indicate that adaptability helps individuals to effectively perform in situations of high change and challenge, and suggest that complex contexts are likely to evoke adaptive behaviour. However, there is still no consistent explanation for *why* individuals adapt. Studies on adaptive performance have investigated a broad array of cognitive mechanisms (e.g. attention, cognitive abilities, learning, knowledge, and problem solving) and motivational-affective mechanisms (e.g. goal orientation, self-efficacy, and anxiety) in order to identify the drivers of individual adaptivity. Yet, they have not yet aligned on a consistent conceptual framework (Baard et al., 2014). In fact, there is growing evidence that adaptability is likely to be a multidimensional construct driven by both personal/individual factors (e.g. self-efficacy, hardiness) and environmental circumstances (e.g. autonomy, job complexity) (Bartone, Kelly, & Matthews, 2013; B. Griffin & Hesketh, 2003; Norton, 2010). Only recently has the topic of *forcing* adaptivity or innovation behaviour been critically discussed. While it seems essential for individuals to adapt, it appears likely that successful adaptation can only happen when individuals are intrinsically motivated to do so (Craig & Lopez, 2016). Unlocking this mechanism will thus be important for corporations to hire, retain, and develop effective workers and leaders (Norton, 2010; White & Shullman, 2010). Similarly, little is known about how individuals assess the appropriateness of their behaviour with regards to the respective changes faced (Baard et al., 2014). More research is needed into the right balance or extent of adaptivity – which environment is one adapting to and what is the adequate response? Lastly, following reverse causality thinking, it might be that an environment is perceived as complex because an individual is *not* adapting. In summary, today's research landscape on individual adaptability is broad, but rather shallow (Baard et al., 2014; Kaiser, 2010). More directed research is needed to study adaptiveness in relation to the given circumstances as well as the mechanisms that drive targeted adaptive behaviour (Baard et al., 2014). The majority of researchers have not studied managerial samples, but rather student samples (DeChurch & Marks, 2006; Fredrickson & Branigan, 2005; Kozlowski et al., 2001; LePine, Colquitt, & Erez, 2000), employees (Fay & Frese, 2001; B. Griffin & Hesketh, 2003; Griffin et al., 2007; Petrou et al., 2012; Shoss et al., 2012), or mixed samples, where singular conclusions for leaders cannot be drawn

(Oreg, 2003; Pulakos et al., 2002). This means, there is considerably less substance to understanding a leader's ability to adapt than there is for employees (e.g., Tucker, Pleban, & Gunther, 2010; Yukl & Mahsud, 2010). Given the importance that is placed on leaders to manage today's complex challenges, relying on adaptive employees alone will not be sufficient (Kaiser, 2010). Or, as the former CEO of Boeing says "the ability to be agile enough is the gut issue in leading an organisation today" (Colvin, 2006, p. 98). Where crisis, challenge, and disruptive change become the order of the day, a premium is put on agile leaders who understand and adapt to given requirements (Kaiser, 2010; White & Shullman, 2010; Yukl & Mahsud, 2010).

2.5.2 Complex Situations as Drivers of Adaptive Leadership Behaviour

Until now, only a handful of studies have examined leadership adaptability related to complex contexts (Hannah et al., 2013; Judge et al., 1999; White & Shullman, 2010; Zaccaro et al., 2009). While they still face several conceptual limitations (Kaiser & Overfield, 2010), they are providing growing evidence that leaders with a broader range of behavioural adaptivity are more successful (e.g., Denison et al., 1995; Lawrence et al., 2009; Silverthorne & Wang, 2001). For example, Silverthorne & Wang (2001) compared adaptive and non-adaptive Taiwanese business leaders, operationalised by applying more or less situational leadership contingent upon the maturity of employees. Findings indicated that leaders who adapted their behaviour based on the employees' needs had a positive influence on measures of productivity such as employee absenteeism, turnover rate, quality of work, reject rates, profitability, and units produced. Studies centring on the Competing Values Framework (CVF; Denison et al., 1995; Lawrence et al., 2009) have operationalised a leader's "behavioural complexity" when managing competing demands. One example is how well a leader balances the opposing quadrants of “People” and “Results”, reminding one of empowering and directive leadership examined in section 2.4.4. Here, high behaviourally complex managers, as assessed by the CVF, were found to be more effective, rated more positively by their subordinates, and produced more positive financial results (Denison et al., 1995; Lawrence et al., 2009). In a study by Judge and colleagues (Judge et al., 1999), regression results revealed that a leader’s ability to cope adaptively with change explained significant variation in a leader’s organisational commitment, job satisfaction, and job performance. A common theme for explaining the success of adaptivity in changing environments is the fact that a flexible leader finds the appropriate, i.e. the most functional and helpful reaction to the respective situational or employee demand (Kaiser & Overfield, 2010; Silverthorne & Wang, 2001). Others argue that in unpredictable and ambiguous situations, flexible leaders will be more successful as they will be more open to trying out a broader repertoire of behaviours and therefore are more likely to find the right response to the challenge at hand (Gebauer, 2013). Even leading researchers in this area observe that many of the conceptualisations behind flexible leadership require further clarification, and many explanation rationales behind the models are not yet fully understood (Kaiser, 2010; Kaiser & Overfield, 2010; Yukl & Mahsud, 2010). This leaves a situation where mechanisms behind relations are hard to explain in every detail. Why and when would flexible leadership benefit the functional wellbeing of employees? How does it drive organisational productivity? When might it hinder it?

In addition, several factors limit the information value these studies currently add to understanding adaptive leadership in WEC. First, although highlighting the relevance for WEC, none of the studies cited above have applied measures for the complexity of the contexts they were examining. Rather, they basically *stated* or *assumed* that the studied environments were complex. This finding mirrors again the current lack of an appropriate measure for WEC, and the previously described “bypassing” strategy. It is not clear how adaptive leadership and WEC are related (Baard et al., 2014). In fact, given the current state of research it would still be possible to assume reverse causality: A work context could be complex, *because* a leader shows flexible behaviours. Also, an environment might be perceived as more complex because a leader is *not* adapting their behaviour. To the author’s knowledge, only one study (Zaccaro et al., 2009) has combined measures of a complex environment with leadership adaptability; leaders from military and industry who had past experience in jobs with “complex” components (transition, creating change, high levels of responsibility, non-authority relationships, and obstacles) were rated by their supervisors as better performers of adaptive leadership. This may be the first empirical indication that being exposed to complex work environments will play a role for leaders to develop or show higher adaptive skills (Zaccaro et al., 2009). Yukl and Mahsud (2010), propose that a leader’s flexibility will be not only be important for, but be especially revealed in, situations that inherit some kind of change or disruption, e.g. a sudden, unusual event; immediate crises; or major, long-term changes crucial for the organisation’s survival. It is likely that the changing context of WEC will evoke some level of adaptive leadership behaviour (e.g., Baard et al., 2014; Kaiser & Overfield, 2010; Zaccaro et al., 2009). In other words, leaders should change their behaviour depending on the changing nature of WEC they face. However, there is no substantial conceptual model around this relationship and empirical research underpinning these assumptions is lacking (Baard et al., 2014; Ployhart & Bliese, 2006; Yukl & Mahsud, 2010).

One major limitation is the current inability to measure WEC. How can we measure adaptive leadership in WEC, if WEC cannot yet be measured? Baard et al. (2014) observe this gap: "A theoretical framework is required to specify what types of task changes (e.g. increase in complexity, ambiguity, or novelty) require an adaptive response, the nature of the required adaptation, and the factors driving differential effects on adaptive performance" (p. 30). Given that a preliminary WEC definition has been established in the previous section (cf. 2.3.), this framework can be a first response to Baard's call. Thus, the (preliminary) conceptualisation of WEC appears as a promising base to firstly, define WEC through specific environmental factors and secondly, study the relationship with adaptive leadership behaviour.

Although the above studies yield some empirical support for the claim that an adaptive leadership approach is effective to meet transforming conditions, a second limitation lies in the fact that there are still varying approaches to conceptualise flexible or adaptive leadership (Baard et al., 2014; Ployhart & Bliese, 2006; Yukl & Mahsud, 2010). In its current state, it is still a broad concept, which makes it difficult to measure, predict, and teach leadership adaptivity (Kaiser & Overfield, 2010; Pulakos et al., 2000). In the context of WEC, a substantial model is needed to define this relation. The above discussion has proposed that in frequently changing, unpredictable, and challenging work environments, it appears a leader will be well advised not only to allow for situations where a team is granted freedom and responsibility to work independently (Ashmos et al., 2002), but *also* to identify moments where a clear management directive will give stability and structure (Carmeli et al., 2013). Thus, a prominent conceptualisation of flexible leadership in WEC that shall be explored more in detail in this thesis is the *adaptive combination* of empowering and directive leadership behaviour. Uhl-Bien and Arena (2017) call this the balance "of knowing when to be highly visible to catalyse others and when to be invisible to enable others" (p.18). Zhang and colleagues (2015) discuss the combination of control versus autonomy, also known as the "loose–tight" principle (Sagie, 1997) in increasingly complex, dynamic, and competitive environments. Lane and Down speak of adapting leadership to address both certainty and uncertainty in turbulent environments (Lane & Down, 2010). In order to extend the discussion in section 2.4.5, this research project conceptualises adaptive leadership in WEC as *an adaptive combination of both empowering and directive leadership as a consequence of changing WEC.* It is acknowledged that flexible leadership for WEC might also include other leadership styles. Given the limited scope of this thesis and the desire for depth rather than breadth in researching adaptive leadership (Baard et al., 2014), this project will focus on the adaptive combination of empowering and directive leadership. Previous research of adaptive performance has largely been conducted in laboratory settings and with cross-sectional data (Baard et al., 2014). Thus, it seems promising to work with field-based data and longitudinal designs in order to investigate this topic and rule out alternative explanations for adaptivity in WEC (e.g. reverse causality).

In summary, given the importance that is placed on a leader's adaptability in WEC, and as a leader's adaptive work requirements differ considerably from other positions (Pulakos et al., 2000), more insight is needed into a leader's adaptability in the face of transforming WEC. It is likely that the changing context of WEC will evoke some level of adaptive leadership behaviour (e.g., Baard et al., 2014; Kaiser &

Overfield, 2010; Zaccaro et al., 2009). Yet, until now, empirical research on WEC and adaptive leadership is significantly limited. One reason is that the environmental factors to adapt to are often not clearly outlined (Baard et al., 2014). Once the integrative construct of WEC is established in Study 1, the WEC framework can for the first time serve as a definition of a complex working environment and can be related to a specific form of adaptive leadership. In order to advance the depth of this research field, this research project offers a conceptualisation of flexible leadership for WEC. Thus, there will be a focus on investigating the hypothesis that empowering and directive leadership styles are dynamically adapted to changing WEC-environments. Study 3 will empirically investigate this relationship. If empirical evidence could find an adaptive effort in WEC, this would expand the understanding of how leaders behave in complex work settings, and reveal which environmental factors trigger leadership adaptivity (Baard et al., 2014). Such insights would allow future research to explore the questions of how and when adaptive leadership behaviour enables organisational, team, and individual productivity in WEC.

The research question for Study 3 is:

Research question #6: *Are empowering and directive leadership styles adapted across time as a response to changing WEC; and if yes, how are they adapted?*

2.6 Exploring Leaders' Functional, Psychological Wellbeing in WEC

Today's leaders are put to an unprecedented test; the test of performing and functioning in contexts of Work Environment Complexity (Berman & Korsten, 2010). As outlined above, leaders are seen to play an essential role in managing substantial amounts of organisational complexity (Baard et al., 2014; Berman & Korsten, 2010; Ilgen & Pulakos, 1999; Ployhart & Bliese, 2006; Silverthorne & Wang, 2001; Uhl-

Bien et al., 2007; Yukl & Mahsud, 2010). Many believe that the way that complexity is dealt with determines the survival or destruction of companies (Burnes, 2005; Elkington & Booysen, 2015). Leaders are in focus as they represent the direct interface with all working individuals in the organisation; leaders in WEC are held responsible to secure and care for the productivity of employees; for their wellbeing, engagement, creativity, and performance (Arnold & Connelly, 2013; Hooijberg et al., 1997; Roche et al., 2014).

Linking leadership in WEC to organisational productivity (Silverthorne & Wang, 2001) and employee productivity (Denison et al., 1995; Correia de Sousa & van Dierendonck, 2014) has made some progress, and the previous sections of this thesis have considered the "right" leadership style and adaptive behaviour for the sake of leadership performance. However, complexity is not a choice (Ashmos et al., 2000); it is a phenomenon that leaders must "handle" so as to be functional and productive (e.g., Fredberg, 2014; Roche et al., 2014; White & Shullman, 2010). In fact, looking into the prominent literature, most of the suggestions on the appropriate leadership approach for WEC have in mind a leader's performance (e.g., Mumford et al., 2000). It is argued that certain leadership actions will allow a leader to "function" best in WEC for the benefits of employees and organisations (Ashmos et al., 2000; Fredberg, 2014; Uhl-Bien & Arena, 2017). This is an exceptionally heavy burden to carry. And, as detailed below, "there is considerable evidence that this turbulent environment has taken its toll on organisational leaders' mental wellbeing" (Roche et al., 2014, p. 476). Studies on *employee* wellbeing and productivity are manifold, some of which investigate changing or "complex" work environments. Yet, until now, considerably less attention has been given to the question of leader functional, psychological wellbeing in general

(Arnold & Connelly, 2013; Arnold et al., 2017), and especially in contexts of WEC (Judge et al., 1999; Nielsen & Daniels, 2012; Roche et al., 2014). Roche et al. (2014) address this gap:

> *"Leaders, while trying to be a source of positive energy and growth within an organisation, are nevertheless realistically faced with complex, challenging, and pressure-packed situations. This potentially toxic environment calls for organisations to develop a greater understanding of leaders' psychological resources that can aid their positive wellbeing and help them fight off dysfunctional outcomes" (p. 484).*

While WEC may well have potential to invigorate leaders (Uhl-Bien & Arena, 2017), it inherits an abundance of challenges (e.g., Roche et al., 2014). If we want to understand how Leadership in Work Environment Complexity can sustainably and functionally be achieved, this thesis argues that it will require greater knowledge on what makes leaders psychologically capable of thriving and coping with complex and challenging working environments. With the exception of a few studies (Judge et al., 1999; Nielsen & Daniels, 2012; Roche et al., 2014) this field is under-researched. As previously mentioned, WEC cannot currently be measured. Also, it is only recently that research is examining the *combined* influence of more than one job demand on the psychological and physiological wellbeing of individuals (van Woerkom et al., 2016). Given that WEC in its preliminary operationalisation combines different challenging work aspects, it may be that these job demands accumulate and together have an exacerbating effect on the wellbeing of individuals, as found recently in the relationship between emotional demands, workload, and employee absenteeism (van Woerkom et al., 2016). Given limited previous research in this area, this section will take a more investigative approach. This will be based on the preliminary definition of WEC (cf. Section 2.3), characterising WEC as a frequently changing, unpredictable, and demanding work environment.

To address the above, this section will explore (1) the distinct challenges that WEC may pose for the functional, psychological wellbeing of leaders and, in response, (2) how a leader's functional wellbeing or "coping" could be adequately operationalised given these challenges. These steps will be required for empirical investigation. Subsequently, once a measure for WEC is in place, (3) potential antecedents of leader psychological, functional wellbeing in WEC can be explored (Study 4).

2.7 Psychological Challenges of WEC and Leadership Coping – An Exploration

2.7.1 The Challenge of a Loss of Control

Psychological uncertainty, defined as an individual's inability to predict something accurately, is "one of the most commonly reported psychological states in the context of organisational change" (Bordia et al., 2004, p. 509). Similarly, relationships have been found between "complex" work and lower self-esteem (Babalola et al., 2016) and feelings of ambiguity (see for a review, Tubre & Collins, 2000), i.e. a state in which expectations surrounding a role or job are ambiguous or unclear to the individual. These adverse states have been associated with several negative consequences, including higher stress, higher turnover intentions, as well as detrimental effects on commitment, wellbeing and job satisfaction (Babalola et al., 2016; Bordia et al., 2004; Ilgen & Hollenbeck, 1991; Jackson & Schuler, 1985; Correia de Sousa & van Dierendonck, 2014; Tubre & Collins, 2000). At the root of these states stands the psychological feeling of a *lack of control*: "Uncertainty, or lack of knowledge about current or future events, undermines our ability to influence or control these events" (Bordia et al., 2004, p. 512). In studies of organisational change, lack of control has been shown to evoke further negative consequences, such as anxiety, psychological strain, learned helplessness, and lower performance (Bordia et al., 2004; McGonagle, Fisher, Barnes-Farrell, & Grosch, 2015). *Frequent* Change has been proposed as a core characteristic of WEC. Thus, risks of adverse psychological effects are likely to be substantially higher (Babalola et al., 2016; Rafferty & Griffin, 2006). One can assume that the nature of WEC arouses feelings of psychological uncertainty and ambiguity, which may have detrimental effects on functionality due to a feeling of not being in control (Alison et al., 2015; Bordia et al., 2004; Judge et al., 1999; McGonagle et al., 2015; Rafferty & Griffin, 2006; Tubre & Collins, 2000; Uhl-Bien & Arena, 2017).

These insights derive from employee samples (Bordia et al., 2004; Correia de Sousa & van Dierendonck, 2014) or mixed samples (Jackson & Schuler, 1985; Tubre & Collins, 2000) in the context of change management. Empirical investigation into these relationships for leaders and WEC – which has been conceptualised as more than change alone – are scarce. This is because a substantial measure for WEC is still lacking. However, threats of psychological uncertainty are likely to be just as relevant for leaders (Brodbeck, 2002; Judge et al., 1999; Karp & Helgø, 2008; Visscher & Rip, 2003). For instance, Visscher and Rip (2003) explain that "managers are (…) confronted with the limited controllability of organisations, the complexity and indeterminacy of change processes and the uncertain and ambiguous effects on their actions. In short, they are confronted with chaos" (p. 121). In fact, dealing with the unpredicted has become a fundamental leadership challenge that goes far beyond handling singular crises or ruptures (Gebauer, 2013). In turbulent contexts of WEC, a leader is likely to experience anxiety associated with unpredictability and disorder

(Karp & Helgø, 2008; White & Shullman, 2010), making WEC an "unkind" environment to work in (Alison et al., 2015). Similarly, Judge et al. (1999) call uncertainty and loss of control a "formidable stressor" for leaders (p. 108), and such conditions are known to cause decision inertia (Alison et al., 2015). This means, handling the potential loss of control needs to be addressed to make leaders capable of coping with complex working environments (e.g., Judge et al., 1999; Melchior et al., 2007).

For employees, it has been shown that feelings of uncertainty and ambiguity can be reduced through leadership behaviours that give back feelings of control, such as leader support (Correia de Sousa & van Dierendonck, 2014; Rafferty & Griffin, 2006), managerial communication and role modelling (Babalola et al., 2016), as well as participation in decision-making (Bordia et al., 2004). Leaders can help others to cope. But what will help leaders *themselves* to cope? And how could one *measure* effective leadership coping in WEC? Considerably less research has examined these questions (e.g., Judge et al., 1999). In line with the classic definition of coping, it will therefore be necessary for leaders to handle this loss of control not as a stressor, but in a more productive way (Greenglass & Fiksenbaum, 2009; Judge et al., 1999). Two steps will be used to approximate the above: first, the focus of the following section will be to substantiate how a leader's functional response to a loss of control in WEC could be operationalised, i.e. how one could determine *how well* a leader in WEC is "coping" with the given challenges. Second, and later in Chapter 6, several factors will be explored that appear as promising antecedents or predictors of successful leadership coping in WEC – determining *why* a leader is coping well or not.

2.7.2 Solving the Paradox of Control: Self-Efficacy for Adaptive Behaviour

The above discussion creates a paradox: a leader would need to feel in control to avoid being affected negatively by psychological uncertainty and ambiguity. The context of WEC, however, will often not allow the direct exercise of control in the traditional sense (Hooijberg et al., 1997; Karp & Helgø, 2008; Stacey, 2011). Hooijberg and colleagues (1997), describe this situation as one where: "(…) managerial leaders have to learn to lead in situations where they don't have command authority, where they are neither controlled or controlling" (p. 375).

Looking at WEC research from a different perspective, an indicator that a leader is coping successfully with this loss of control-situation may lie in a leader's *Self-Efficacy for Adaptive Behaviour*. Several insights make this hypothesis plausible. As outlined before, adapting one's leadership approach flexibly is proposed as a functional behaviour in WEC (Hannah et al., 2013; Hooijberg et al., 1997; Mumford et al., 2000; Pulakos et al., 2000; Uhl-Bien & Arena, 2017; Yukl & Mahsud, 2010), and adaptive leadership has been shown to be associated with positive outcomes for organisations and employees (Denison et al., 1995; Judge et al., 1999; Lawrence et al., 2009; Silverthorne & Wang, 2001). Uhl-Bien and Arena (2017) take this thought further and propose that a leader's adaptability is a more productive response to WEC, an *alternative* to exerting control. Ployhart and Bliese (2006) support this idea calling individual adaptability a form of "coping with stressful environments" (p. 9). Similarly, a recent study by van Woerkom et al. (2016) found that in work settings with accumulated work demands, the ability to flexibly use and trust in one's strengths helped individuals to cope by buffering them from negative stress-related effects. In order to overcome the control paradox, it is proposed that leaders would need to feel confident or “in control” that they possess the ability to adapt to the challenges of WEC, or as Lane and Down (2010) put it, “How leaders contend with uncertainty in the external world is partly a function of how they deal with uncertainty within themselves” (p. 525): A leader might not be able to control the environment, but they can control their own reaction to it.

Self-efficacy is a concept closely related to feelings of control (e.g., Judge et al., 1999), as it defines an individual’s judgment of “how well one can execute courses of action required to deal with prospective situations” (Bandura, 1982, p. 122; Fay & Frese, 2001; Stajkovic & Luthans, 1998). Self-efficacy determines whether coping behaviour will be initiated; individuals with high self-efficacy are more likely to produce favourable outcomes (Stajkovic & Luthans, 1998). Having seen the value of this construct for contexts of complexity, change, or uncertainty, researchers have established the construct of Self-Efficacy of Adaptive Behaviour (SEAB), as well as a measurement scale for it (B. Griffin & Hesketh, 2003; Pulakos et al., 2002). Following Bandura’s (1977) influential social learning theory, self-efficacy is a motivational construct that relates to specific tasks, interests, or events, and therefore measures should be tailored accordingly (B. Griffin & Hesketh, 2003). Thus, SEAB reflects an individuals’ confidence in the own ability to adapt successfully to changing or dynamic situations and ambiguity (B. Griffin & Hesketh, 2003; Pulakos et al., 2002). Acting as a psychological resource, SEAB is proposed as an essential antecedent to leader adaptability “because adaptable behaviour is unlikely to occur unless one first has the confidence to perform such behaviour” (B. Griffin & Hesketh, 2003). This is because higher self-efficacy creates the internal drive towards the agency needed to perform the behaviour (Hannah et al., 2008).

Indeed, SEAB has been shown to be a valid predictor of adaptive performance in general (B. Griffin & Hesketh, 2003), and more specifically in contexts linked to WEC. For example, SEAB predicted the adaptive performance of personnel in fast-paced military settings (Pulakos et al., 2002), in work contexts of high uncertainty (Griffin et al., 2007), when applying knowledge from trainings to especially complex tasks (Kozlowski et al., 2001), and when predicting the related construct of personal initiative in cognitively challenging, complex jobs (Fay & Frese, 2001). Moreover, SEAB not only predicted personal judgments of adaptivity, but also adaptive performance rated by external sources (B. Griffin & Hesketh, 2003; Pulakos et al., 2002).

Stacey (2011) calls paradox of control in complex systems, “problematic”, however “this does not mean that there is no control, however. It simply means that control has to be understood in a different way” (p. 482). It is necessary for a leader to feel that he or she has some form of control as to prevent adverse psychological effects of uncertainty or ambiguity. Extrapolating the current application of the construct, SEAB could be a functional “alternative” for control in WEC. No study has yet specifically examined a leader’s SEAB in the context of WEC. Previous research has, however, substantiated SEAB as a psychological resource and antecedent of adaptability. Therefore, a leader’s SEAB is proposed to be a promising variable to study how well a leader will personally cope with the specific challenges of Work Environment Complexity.

Proposition 1. Leader Self-Efficacy for Adaptive Behaviour is an indicator of how well a leader responds to Work Environment Complexity.

2.7.3 Challenges to Leader's Mental and Psychological Wellbeing

It should have become apparent by now that WEC is highly demanding: a leader faces a work situation where existing structures, roles, and order are called into question, where change is omnipresent, uncertainty of future outcomes is high, problems are novel and difficult, and the consequences of decisions are often not predictable. Such situations are often stressful for leaders (Arnold & Connelly, 2013) and "if they are poorly managed or unmanaged altogether, leaders can be expected to experience a range of negative effects and cognitive impairments that can leave them disoriented, disconnected, fearful, and frustrated" (Hunter & Chaskalson, 2013, p. 197). Therefore, as will be explored in more detail below, it is assumed in this thesis that leaders in WEC are likely to be confronted with stress, mental strain and diminished (psychological) wellbeing. As will be touched upon below, this does not by any means exclude the possibility that WEC can be a rich and invigorating context – but different dynamics may be at play to determine whether situations are experienced by individuals as negative (distress) or positive (eustress) (Nelson & Simmons, 2003).

Stress and mental strain are ever-growing issues amongst leaders (Campbell, Baltes, Martin, & Meddings, 2007). While sources of stress are certainly manifold; the *psychological demands* of today's work have been shown to take a toll on the mental wellbeing of leaders – even nurturing mental illness. Melchior et al. (2007), for example, found that managerial and non-managerial workers with high psychological job demands (i.e. high pressure, managing ambiguity, conflicting demands) are 75-80% more likely to suffer from depression and anxiety disorder. Andrea et al. (2009), in a large-scale study of over 3,700 employees, report similar effects. In such environments, absenteeism is likely to surge (van Woerkom et al., 2016). Highly demanding work can make individuals ill. These insights become especially relevant when relating them to the operationalisation of WEC as a frequently changing, unpredictable and highly challenging context. For many leaders, it is likely that the speed and volatility of complex workplaces becomes increasingly overwhelming (Uhl-Bien & Arena, 2017), and with constant turbulence, cycles for recovering from challenging phases are likely to become nearly non-existent (Boyatzis & McKee, 2013). Roche and colleagues (2014) call work in complexity “potentially toxic” (p. 476). Recent literature has revealed that the *combined* influence of different job demands exerts an additional, exacerbated negative effect (van Woerkom et al., 2016). Given that WEC is conceptualised as an integrated construct of different job demands, it is thus even more likely that this combination – if left unmanaged – will exert a negative influence on the psychological wellbeing of leaders. Hence, the following section will focus on counteracting this dynamic – a first step will be to identify a construct that could be used to determine how leaders flourish, engage, and maintain their wellbeing in WEC.

2.7.4 Beyond the Absence of Illness: Eudaimonic Wellbeing

Wellbeing has been studied from various conceptual perspectives (see for an overview e.g., Grant, Christianson, & Price, 2007), of which *mental or psychological health* was touched upon above. Following positive psychology, wellbeing should however be understood not as the absence of illness, but the overall quality of an individual’s experience and functioning at work (Seligman & Csikszentmihalyi, 2014). When exploring the functional, psychological wellbeing of leaders in WEC, therefore, other concepts of wellbeing may be important to look at.

A prominent distinction is made between (1) *hedonic (or subjective) wellbeing* and (2) *eudaimonic*[2] *(or psychological) wellbeing*[3] (see also for detailed reviews Ilies, Morgeson, & Nahrgang, 2005; Kahneman, Diener, & Schwarz, 1999; Keyes, Shmotkin, & Ryff, 2002; Ryan & Deci, 2001; Waterman, 1993). The *hedonic wellbeing* approach focuses on happiness and defines wellbeing in terms of attaining pleasure and avoiding pain (Ryan & Deci, 2001). It associates wellbeing with constructs such as happiness, job or life satisfaction, subjective experiences of pleasure, positive affect, low negative affect, or is defined as a general (subjective) evaluation of the pleasantness versus unpleasantness of life or a job (see e.g., Grant et al., 2007; Ilies et al., 2005; Kahneman et al., 1999; Nave, Sherman, & Funder, 2008). Or, as Robertson & Cooper (2010) put it, "In other words, for this approach, wellbeing involves feeling good" (p. 327). A criticism is that the hedonistic concept of job satisfaction is a passive state (Ledford, 1999), implying that just because we feel happy does not mean we are also productive (see e.g. Grant et al., 2007).

In contrast, *eudaimonic or psychological wellbeing* seems more applicable to explore the *functional* wellbeing of leaders as it conceptualises wellbeing as a form of an individual's productivity (Grant et al., 2007; Wrzesniewski, Dutton, & Debebe, 2003). Empirical studies have substantiated that eudaimonic wellbeing is not only a strong predictor of work performance, but a stronger predictor than hedonistic job satisfaction (Wright & Cropanzano, 2000). Eudaimonic wellbeing is a state of intense involvement that occurs when an individual is strongly engaged and experiences a special fit with one's activity, (Ilies et al., 2005; Robertson & Cooper, 2010; Waterman, 1993). It is closely related to peak experiences of motivation, absorption,

[2] Also 'eudaemonic' wellbeing (see e.g. Ilies et al., 2005)

[3] While conceptually distinct, empirical findings for hedonic and eudaimonic approaches suggest that both approaches tap overlapping constructs (Ilies et al., 2005) or are seen as distinct, yet strongly related constructs (Ryan & Deci, 2001)

interest, self-realisation, engagement, and involvement, or what Csikszentmihalyi (1975/2000) labels as “flow”. Positive psychologists know this as “eustress” - positive, productive stress which is essentially healthy psychological coping (Nelson & Simmons, 2003; Quick, Wright, Adkins, Nelson, & Quick, 2013). Therefore, eudaimonic wellbeing combines facets of wellbeing *and* engagement. Or, how Ryan and Deci (2001) put it, “the eudaimonic approach, (…) defines wellbeing in terms of the degree to which a person is fully functioning” (p. 141). In comparison with the concepts of mental health and hedonism, it defines a productive form of wellbeing beyond the absence of illness. This section aims to identify constructs that can determine how well a leader copes, even *thrives* in complex working environments despite the identified challenges. Consequently, a leader’s level of eudaimonic wellbeing is proposed as the second factor of leader coping in WEC – for his or her own sake, and in turn for the sake of the team’s and organisation’s productivity.

Proposition 2. Leader Eudaimonic Wellbeing is an indicator of how well a leader responds to Work Environment Complexity

The purpose of this section is to investigate leadership in WEC with respect to an individual-level perspective along two lines of enquiry: (1) Which challenges does a complex work environment – based on the preliminary conceptualisation of WEC – pose to the individual, psychological wellbeing of a leader? (2) How could one conceptualise a leader’s coping with or functional response to these challenges?

A study of the effects of complex work on the wellbeing of leaders is needed. Present literature in general has largely studied the wellbeing of employees and has largely ignored managers (Arnold & Connelly, 2013; Arnold et al., 2017; Nielsen &

Daniels, 2012; Roche et al., 2014). With increasing WEC, however, leaders are turned to as essential enablers and shapers of managing the organisational transformation into the economic Knowledge Age (e.g., Ashmos et al., 2002; Intezari & Pauleen, 2014). This is a heavy burden to carry. Not only do leaders' roles differ considerably from those of employees (Pulakos et al., 2000), recent findings suggest that leaders' individual wellbeing significantly influences the wellbeing of their team members (Roche et al., 2014). Stressed leaders have, for instance, been found to be more abusive, to increase followers' burnout, and to be less likely to make effective decisions (Arnold et al., 2017). Investigating leadership wellbeing and coping in WEC, should thus not only benefit the leaders themselves, but their teams, employees, and organisations. As Roche and colleagues (2014) put it: "attention now needs to focus on organisational leaders per se. Psychologically healthy, thriving leaders not only benefit themselves, but are also critical to employee wellbeing as well" (p. 476).

While organisational change processes have been of interest in the last decades, studying the effects of complex work environments on wellbeing and productivity is still in its infancy. This may be partly due to the lack of an integrative WEC-measure, which makes complex working contexts hard to quantify. This leaves a research field with no conceptual models known to the author that describe relations between the characteristics of WEC and leaders' wellbeing and coping. Therefore, this chapter has advanced this discussion through an exploration based on the preliminary operationalisation of WEC as a frequently changing, unpredictable, and challenging work environment. Following the above considerations, WEC is likely to confront leaders with substantial challenges to their functional, psychological wellbeing. In particular, the exploration above has identified that leaders are likely to experience detrimental psychological states of uncertainty and ambiguity due to a feeling of not being in control. Secondly, it is likely that the very nature of WEC can induce stress, strain, and mental health issues. Given that WEC is conceptualised as an integrated construct of *several* job demands, it is likely that – if left unmanaged – this combination may induce additional or exacerbated negative effects. Investigating these specific challenges more closely has suggested that they can be functionally addressed by examining the concepts of a leader's Self-Efficacy for Adaptive Behaviour and leader Eudaimonic Wellbeing. Thus, these two constructs are proposed to operationalise a leader's psychologically healthy, functional response to WEC, in other words: productive leader coping with WEC. Once a measure for WEC is in place, having substantiated these two core constructs will facilitate the building more substantial conceptual models around the relationships and influencing factors of leadership wellbeing in WEC. Study 4 will thus conceptually and empirically expand this discussion by exploring a set of potential predictors of leader functional wellbeing in WEC.

The research question for Study 4 is:

Research Question #7: *Which factors predict a leader's functional response to WEC?*

2.8 Conclusion

This thesis is aims to advance knowledge and research in the field of Leadership in Work Environment Complexity. Through reviewing the state of research in this chapter, at least two major areas have become apparent where this research can make a contribution. Firstly, Work Environment Complexity (WEC) has not been substantiated as an agreed-upon and measurable construct in organisational psychology (e.g., Burnes, 2005). Secondly, solid conceptual models and empirical investigations around leadership in WEC, leader adaptivity in WEC, and leader functionality in WEC are lacking. Because of this current research on leadership in WEC is inherently limited (e.g., Schneider & Somers, 2006). Consequently, this thesis sees the potential to advance research on Leadership in Work Environment by providing an integrative framework on how to measure WEC, by contributing with conceptual models that describe the relationships between leadership and WEC, and by testing them through empirical study. This research project aims to provide applicable insights into Leadership in WEC for organisational psychology's and management practice.

While researchers are more and more referring to work contexts as being complex, it remains a contested area; both conceptual clarity and empirical research is required. Contributions based on early complexity theories not only compete in their paradigms, a major limitation is that they remain abstract and thus not directly applicable to organisational research and practice (Lissack, 1999; Stacey, 2011). Also within organisational psychology and management sciences, a common agreement on what characterises a "complex" work environment and hence the establishment of a conceptually sound and empirically substantiated construct, has not been achieved (Black, 2000; Burnes, 2005; Maguire & McKelvey, 1999; Marks et al., 2001). As of today, these contributions to WEC remain largely theoretical, have sidestepped the question of measuring WEC, or have been empirically fragmented and disjointed from one another (e.g., Black, 2000; Burnes, 2005). However, the evaluation of current conceptualisations of WEC factors has revealed that there seems to be a general agreement of the common elements of complex working environments (Lissack, 1999;

Stacey, 2011). Through the course of this introduction, and fuelled by insights from both early complexity theories as well as more recent post-positivistic insights, Work Environment Complexity is proposed as (the perception of) a frequently changing, unpredictable, and demanding work environment. If this proposition holds, it should be possible to measure the integrated WEC construct empirically. Consequently, this research will be – to the best of the author's knowledge – the first to integrate existing debates on WEC into a measurable and empirically substantiated construct of Work Environment Complexity. Thus, Study 1 aims to validate the construct of WEC and identify its core content through identifying the construct's factor structure and clarifying its application to the target groups of employees and/or leaders. A major contribution of this is that a scale for measuring WEC will allow researchers and practitioners to quantify the degree of complexity that an individual faces at work. Once a measurement approach for WEC is in place, this will not only allow an advance in empirical research into organisational complexity, but will also enable an empirical link to be made to research on complexity leadership.

Without a common agreement on how to measure WEC, today's research on leadership in WEC is inherently limited (Schneider & Somers, 2006). This is seen as the second major contribution of this thesis; by establishing a common foundation on how to measure WEC, the insights described in this thesis can be substantially related to research in complexity leadership (Black, 2000; Burnes, 2005; Maguire & McKelvey, 1999; Schneider & Somers, 2006). There is an agreement that an increase in Work Environment Complexity challenges leaders and their skills (Karp & Helgø, 2008; Lichtenstein et al., 2006), and that classic leadership models are out-dated and deficient in matching these novel challenges (Burnes, 2005; Marion & Uhl-Bien, 2001;

Schneider & Somers, 2006; Uhl-Bien & Marion, 2009). Thus, “Complexity Leadership” has been listed as one of the top emerging leadership theories of the century so far (Dinh et al., 2014) and answers on “how to lead” in the face of WEC have to be found (Correia de Sousa & van Dierendonck, 2014; Lane & Down, 2010; Martin & Ernst, 2005; Schneider & Somers, 2006). However, the models behind these propositions are not yet solid, and neither is the empirical evidence to support them.

Therefore, this chapter has advanced the development of more substantial leadership models in WEC by relating current considerations around complexity leadership to the preliminary operationalisation of WEC. In summary, a line of argument supports the paradigm shift towards more *participative* or *empowering* leadership styles (e.g., Burnes, 2005; Correia de Sousa & van Dierendonck, 2014; Lee et al., 2018; Osborn & Hunt, 2007; Uhl-Bien et al., 2007), *adaptive leadership* (Uhl-Bien & Arena, 2017; Yukl & Mahsud, 2010), and has revealed the need to investigate *individual leader disposition and wellbeing* for contexts of WEC (e.g., Ashmos et al., 2000; Judge et al., 1999; Roche et al., 2014). Additionally, this chapter has opened up a more differentiated discussion on *instrumental or directive leadership* as supplementing – not opposing – forms of leadership in WEC. To date, research in complexity leadership faces the limitations that many of these approaches have remained purely conceptual (Burnes, 2005), fragmented, or disjointed from complexity research (Black, 2000). Although current research has offered valuable foundations for exploring the questions of Leadership in Work Environment Complexity and has contributed with both conceptual and singular empirical findings, much of it has evolved up to now by *bypassing* the question of how to empirically grasp WEC. One main contribution of this thesis is to relate the leadership propositions conceptually and empirically to the defined characteristics of WEC. The previous sections have established some first conceptual links between the characteristics of WEC with leadership styles, leader adaptivity, as well as leader functional wellbeing. Once a scale for WEC is established, this thesis can contribute firstly, by strengthening explanatory models behind the relations and secondly, by empirically studying questions of “optimal” leadership in WEC. Thirdly, this will enable the addition of more substantial, empirical and practical advice. In summary, providing a WEC Scale and studying propositions of leadership in WEC will allow this research to address a wide range of empirical questions concerning the effects that WEC has on leaders’ behaviour, leadership style, and wellbeing with the aim of identifying optimal ways for leaders to manage, cope with, and thrive in Work Environment Complexity.

2.9 Research Objectives and Dissertation Structure

Including this chapter, this thesis aims to contribute to the advancement of Leadership in Work Environment Complexity by pursuing the following six research objectives. More research questions and specific hypotheses are developed in subsequent chapters.

1. To reflect on the current state of research on complexity and its application to organisations and to explore how a measurement instrument of WEC can help to increase the understanding of working and leading in complex working environments.

2. To validate a scale that measures an integrated construct of Work Environment Complexity by examining its core content and factor structure.

3. To clarify the construct of WEC in its application to two groups, leaders and

employees.

4. To link WEC conceptually and empirically to leadership research. This includes developing conceptual models and empirically testing them for the choice of empowering vs. directive leadership styles as well as adaptive leadership behaviour in the face of Work Environment Complexity.

5. To investigate the particular psychological challenges that leaders may be confronted with in contexts of WEC, and to explore theoretically and empirically the predictors for individual leaders' functional wellbeing in WEC. This includes developing a model that relates the characteristics of WEC to questions of leader functionality.

6. To discuss the findings and derive implications in the areas of research, theory, and practical application, adding to the body of Leadership in Work Environment Complexity.

In order to address these objectives, this thesis is divided into seven chapters that build upon one another to theoretically, conceptually, and empirically study the subject of Leadership in Work Environment Complexity.

The first two chapters have set a theoretical framework for the construct of Work Environment Complexity and leadership research within it. Building on an evaluation the state of research, they lay conceptual pathways to empirically studying Work Environment Complexity and Leadership in Work Environment Complexity in the following chapters.

Overarching Research Question 1: *What is Work Environment Complexity (WEC) and how can it be measured?*

Overarching Research Question 2: *Which leadership approaches are suited to match the novel challenges of WEC?*

2.10 Overview of the Following Chapters

Chapter 3 – Study 1 "Development and Validation of a Work Environment Complexity Scale for Leaders". Chapter 3 marks the first in a series of empirical studies (Chapters 3-6), which aim to empirically explore the considerations derived in Chapter 1. The structure of these studies follows the standard format of quantitative theory-testing papers in the field of organisational psychology: the research topic is introduced, research questions and subsequent hypotheses are derived, the methods for research are outlined, research results are reported, and findings are discussed.

Study 1 validates a scale for measuring the construct of Work Environment Complexity in a set of empirical studies. It addresses the questions of how WEC can be measured, which core content and underlying structure can be assumed, and whether the construct can be applied to both employees and leaders. Results are discussed with regard to the application of a measurement instrument for WEC in future research and practice.

Research question Study 1: *Which factors form the integrated construct of WEC?*

Research question Study 1: *Can the same construct of WEC be applied to both employees and leaders?*

Chapter 4 – Study 2 "Leadership Styles in the Face of Work Environment Complexity". Study 2 addresses the question of the "optimal" leadership style in the face of Work Environment Complexity. It empirically investigates in a longitudinal study whether leaders in the face of Work Environment Complexity will apply more participative/empowering leadership style, and less directive/instrumental leadership style. This chapter contributes to the discussion on the seemingly opposing leadership styles (empowering vs. directive), rationales for applying them within high-complexity environments, and practical application such as leadership training.

Research question Study 2: *Is the level of WEC causal for leaders to adopt higher levels of empowering leadership?*

Research question Study 2: *Is the level of WEC causal for leaders to adopt lower levels of directive leadership?*

Research Question Study 2: *Are empowering leadership and directive leadership in WEC shown independently of one another?*

Chapter 5 – Study 3 "Adaptation of Leadership Style in the face of Work Environment Complexity". Study 3 addresses the flexible behavioural adaptation of leadership style in the face of Work Environment Complexity. It empirically examines how and when the two leadership styles, empowering and directive leadership, are adapted as a consequence of changing WEC across time. It adds to the understanding of flexible leadership, adaptation of leadership styles, and the nature of WEC that may evoke adaptive behaviour.

Research question Study 3: *Are empowering and directive leadership styles adapted across time as a response to changing WEC; and if yes, how are they adapted?*

Chapter 6 – Study 4 "Leader Wellbeing and Functionality in the face of Work Environment Complexity". Study 4 addresses the specific challenges that a high-complexity work environment is likely to place on the individual leader's psychological wellbeing and resources. Several antecedents of leader wellbeing in WEC are empirically investigated. Results are discussed in light of leadership wellbeing, functionality, and the implications for organisations and their leaders.

Research Question Study 4: *Which challenges of WEC may affect the functional, psychological wellbeing of leaders?*

Research Question Study 4: *Which constructs are suited to measure a leader's functionality in the face of Work Environment Complexity?*

Research Question Study 4: *Which factors predict a leader's Self-Efficacy for Adaptive Behaviour in the face of Work Environment Complexity?*

Research Question Study 4: *Which factors predict a leader's Eudaimonic Wellbeing in the face of Work Environment Complexity?*

Chapter 7 – General Discussion. This chapter summarises the main findings of the thesis by enriching the theoretical frameworks of Chapter 2 with the empirical findings in Chapters 3-6. This final chapter reflects on the overall strengths and limitations of this thesis, and discusses overarching theoretical implications, opportunities for future research on Leadership in Work Environment Complexity, and practical implications of the work described.

Chapter 3 – Study 1: Validation of the Work Environment Complexity Scale

3.1 Introduction

Organisations have been rapidly evolving from linear, mechanistic systems towards evermore complex workplaces that challenge leaders. Consequently, complexity has become one of the most significant management themes of the modern organisational age (e.g., Burnes, 2005; Dinh et al., 2014; Uhl-Bien & Arena, 2017). This Work Environment Complexity (WEC) therefore needs to be better understood in order to investigate what it means to work and lead in increasingly complex work environments (e.g., Burnes, 2005; Marion & Uhl-Bien, 2001; Schneider & Somers, 2006). Organisational research has debated the concept of complexity and its application to leadership, drawing in part from the early roots of complexity theories (e.g., Karp & Helgø, 2008; Stacey, 2011; Uhl-Bien et al., 2007). While they have contributed valuable insights, these discussions are largely of a theoretical nature (e.g., Burnes, 2005), and where empirical research has been done, only singular, fragmented elements of complexity have been examined (e.g., Chung-Yan & Butler, 2011). To date, an agreement on a common definition and hence the establishment of an empirically substantiated construct has not been achieved (Black, 2000; Burnes, 2005). Without this agreement, a clear link between complexity research and leadership research cannot be made (Schneider & Somers, 2006). No questionnaire has yet been developed to investigate an integrated construct of WEC, nor have the potentially differing perceptions of complexity for employees and leaders been explored. It is important to understand what constitutes WEC if we want to derive valid conclusions for organisational management and leadership practice. An integrated measure for WEC will allow quantifying the "amount" of complexity a leader faces. In alignment with previous research on scales for work environment (Amabile et al., 1996; Babalola et al., 2016; Morgeson & Humphrey, 2006), this research places a focus on the individual *perception* of a work environment, i.e. "the psychological meaning that respondents attach to events in their organisations, their organisational units, and their work groups" (Amabile et al., 1996). This will lay the foundation for further empirical study of WEC and practical applications for working and leading. The goal is to provide a concise scale for researchers and practitioners that allows for monitoring the level of WEC, e.g. along an organisational change process or for the recruiting and training of personnel. Since WEC forms one of the central challenges in modern organisations, achieving this is very desirable.

Given that there seems to be a general agreement on the common elements of complex working environments (Lissack, 1999; Stacey, 2011), it should be possible to measure these elements empirically. Therefore, this study aims to integrate existing debates into a measurable and empirically substantiated construct of Work Environment Complexity.

This leads to the two research questions of this study:

Research question #1: *Which factors form the integrated construct of Work Environment Complexity?*

Research question #2: *Can the same construct of Work Environment Complexity be applied to both employees and leaders?*

3.2 Defining the Factors of Work Environment Complexity – A Conceptual Model

When evaluating complex work environments, rather than proposing an integrated measurement of WEC, researchers have, to date, discussed and measured singular factors of WEC. The most prominent ones are Frequent Change, Unpredictability, Ambiguity, Uncertainty, Interdependence/Interaction, and Challenging Work Demands (cf. section 2.2 and Table 3). However, where research has been fragmented (Black, 2000), overlaps are likely. This study consequently aims to identify the core content of an integrated WEC construct, addressing relevant overlaps or limitations of the different facets. Table 6 summarises previous conceptualisations of the factors as well as identifying overlaps and limitations.

Table 6: Study 1 - Factors of Work Environment Complexity described in Organisational Psychology and Management Sciences Research

Factor	*Reference*	*Description*	*Overlaps or Limitations*
Frequent Change	Black, 2000; Burnes, 2005; Hannah et al., 2013; Kaiser et al., 2007; Karp & Helgø, 2008; Kunze, Raes & Bruch, 2015; Marion & Uhl-Bien, 2001; Rafferty & Griffin, 2006; Wee & Taylor, 2018	Changing and volatile conditions make work complex. In such contexts, transformation is a constant rather than a discrete event.	Conceptual overlaps with Uncertainty
Unpredictability	Chung-Yan & Butler, 2011; Intezari & Pauleen, 2014; Karp & Helgø, 2008; Marion & Uhl-Bien, 2001; Rafferty & Griffin, 2006; Tetrick & LaRocco, 1987; Yukl & Mahsud, 2010	Unpredictability makes work contexts complex as it confronts workers with unanticipated challenges, unexpected events, lack of clarity on roles or procedures, and the challenge of making decisions with unforeseeable consequences.	Conceptual overlaps with Ambiguity and Uncertainty Unpredictability and Uncertainty often used as synonyms (e.g. Gebauer, 2013)
Ambiguity	Denison et al., 1995; Hannah et al., 2013; Kaiser et al., 2007; Ashmos, Duchon & McDaniel, 2000; White & Shullman, 2010	Ambiguity makes work contexts complex because they require the management of contrasting or even paradoxical demands. Ambiguous work situations are unclear, ill defined, or vague.	Conceptual overlaps with Unpredictability, Uncertainty, Interaction, and Challenging Work Demands Specialised measurement approach of weighing opposing item pairs

Factor	*Reference*	*Description*	*Overlaps or Limitations*
Uncertainty	Alison et al., 2015; Gebauer, 2013; Griffin et al., 2007; Hochwarter et al., 2007; Karp & Helgø, 2008; Mumford et al., 2000; Rafferty & Griffin, 2006, Tummers et al., 2006	Uncertainty is described as an unsettling state that emerges from ambiguity, change, or unpredictability in work environments. Uncertain work settings are described as unclear, lack information, or confront the individual with competing, ambiguous demands, making it hard for the individual to cope.	Conceptual overlaps with Unpredictability, Ambiguity, and Frequent Change Uncertainty and Unpredictability often used as synonyms (Gebauer, 2013) Established conceptualisation of Uncertainty as a psychological state (Bordia et al., 2004; Rafferty & Griffin, 2006; White & Shullman, 2010)
Interdependence/ Interaction	Burnes, 2005; Griffin et al., 2007; Hannah et al., 2013; Morgeson & Humphrey, 2006; Mumford et al., 2000; Rafferty & Griffin, 2006; Uhl-Bien et al., 2007; Uhl-Bien & Marion, 2009	Work environments are described as complex because of the interaction with or interdependence of other stakeholders. This reflects the connectedness or dependency of one's work with the work of others.	Given precondition in leadership and team roles (Griffin et al., 2007)
Challenging Work Demands / Job Complexity	Chung-Yan & Butler, 2011; Frese et al., 1996; Hackman & Oldham, 1975; Morgeson & Humphrey, 2006; Tummers et al., 2006; Schmitz, 2014; Wang et al., 2014; Zaccaro, Banks, Kiechel-Koles, Kemp & Bader, 2009	A "complex" job is mentally challenging and requires individuals to use highly developed skills or creativity in order to solve problems. This is the opposite of simple, repetitive, and uncomplicated tasks.	Too narrow as standalone conceptualisation, falls short of describing the environment around the job (Morgeson & Humphrey, 2006)

A more detailed look into previous descriptions and conceptualisations reveals several overlaps between the constructs (i.e. Unpredictability overlapping with Ambiguity and Uncertainty), measurement shortcomings (e.g. Ambiguity), as well as conceptual limitations in their suitability for the WEC concept (e.g. Interdependence as a given precondition; Uncertainty as a psychological state/consequence). These problems will have to be overcome for an integrated construct (Morgeson & Humphrey, 2006). This research project aims to provide an integrative conceptualisation of WEC that can be quantitatively measured. It is only recently that research has examined constructs of *accumulating* job demands (van Woerkom et al., 2016). This implies that WEC might be formed by the *interaction* of several work environment facets which create a new quality of work (van Woerkom et al., 2016).

In an attempt to clarify the construct of WEC, only "core content" factors should be integrated. These are (1) prominent in the characterisations of Work Environment Complexity literature, (2) appear conceptually sound, yet distinct and (3) show no apparent limitations in relation to measurement or content (see for a similar approach, Morgeson & Humphrey, 2006). Given the fulfilment of these criteria, the three facets of Frequent Change, Unpredictability, and Challenging Work Demands appear to be conceptually sound, measurable, yet distinct enough from one another. The following hypothesis is proposed:

> Hypothesis 1: *Frequent Change, Unpredictability, and Challenging Work Demands constitute the conceptual core of Work Environment Complexity.*

Figure 5 visually represents the relations between the examined factors, highlighting the proposed conceptual model of the Work Environment Complexity construct.

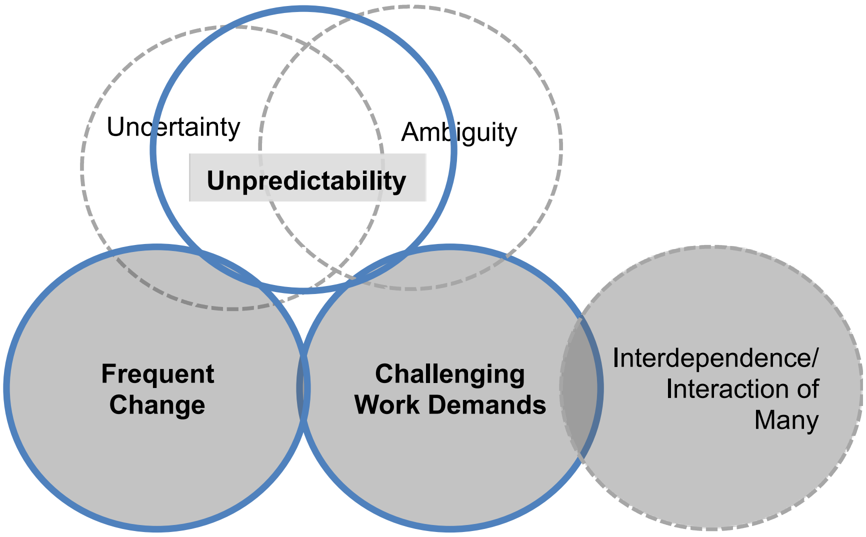

Figure 5. Conceptual Diagram of Proposed Work Environment Complexity Construct.
Notes: Blue circles represent proposed Work Environment Complexity core factors; grey circles depict factors to be excluded due to conceptual overlaps or other limitations.

Existing scales have been established to measure these three facets (Morgeson & Humphrey, 2006; Rafferty & Griffin, 2006; Tetrick & LaRocco, 1987). Currently, however, they are disjointed from each other (Black, 2000). Consequently, this study attempts to develop and validate a scale for measuring WEC as an integrated construct, which also explores the extent to which these facets are independent of one another. Whilst claiming complexity to be a predominant leadership concern, previous scholars have been intertwining employee and leader perspectives on WEC (e.g., Griffin et al., 2007). Conceptual clarity requires looking at these two populations separately (e.g., Morgeson & Humphrey, 2006). Given that leaders' work contexts differ considerably from other positions within the organisation (Pulakos et al., 2000) it is likely that the WEC construct will differ in its meaning for leaders and employees. Thus, it is proposed:

Hypothesis 2: *The meaning of WEC for leaders and employees will differ, i.e. the same construct cannot be applied to both target groups.*

In response to the growing interest in WEC in organisational research, this research presents three studies aimed at developing and validating a self-report measure of WEC for leaders. The goal is to provide researchers with a scale that is consistent with the original definitions of WEC, has good psychometric properties, and is short enough to be administered in longitudinal studies of change that include other scales and require a compact survey format. The task is intricate for two main reasons. First, a scale may not measure the same construct when administered to different categories of workers, such as leaders and non-leaders. The state-of-the-art approach to this problem is to administer the instrument to different groups and assess its factorial invariance (Hoyle & Smith, 1994) cross-sectionally across the groups (e.g., Brien et al., 2012; Grødal et al., 2017; Sung, Chang, Cheng, & Tien, 2017). Moreover, a scale that has good psychometric properties when administered once may lose validity when administered to the same participants a second time, and hence become useless for longitudinal studies. The state-of-the-art approach to this problem is to assess the factorial invariance of the scale longitudinally (Widaman, Ferrer, & Conger, 2010) including response styles (i.e., the tendency for a scale to elicit consistent idiosyncratic interpretations of its items, Pitts et al., 1996) (e.g., Breevaart, Bakker, Demerouti, & Hetland, 2012; Moneta, 2017b). As such, in the present research the WEC scale validation process requires a multi-study strategy. Building on previous scales and a pre-test (described below), two separate exploratory factor analyses were used on both an employee sample (Study 1a) and a leader sample (Study 1b) to explore the scale's factor structure. Then, a set of confirmatory factor analyses with another leader sample (Study 1c) was conducted in order to corroborate the scale's construct validity longitudinally and assess its measurement invariance across time.

3.3 Study 1a: Pre-test and Exploratory Factor Analysis with Employee Sample

3.3.1 Study 1a Method

Pre-test

Based on the identified WEC core content and building on previously established scales, an initial 9-item set was chosen, three items each reflecting one of the facets: Frequent Change (Rafferty & Griffin, 2006), Unpredictability (Tetrick & LaRocco, 1987), and Challenging Work Demands (Morgeson & Humphrey, 2006). This preliminary measure was administered to a convenience sample of 40 individuals in an online survey.

The sample comprised 38 (95%) professionals from various occupations and 2 (5%) students. The age range was 22 to 60 years (M = 34.00, SD = 9.25); 25 (62.5%) were males, 15 (37.5%) were females. 23 (57.5%) worked in large organisations larger than 500 employees, 7 (17.5%) in medium sized organisations (50-500 employees), 7 (17.5%) in small organisations, and 4 (10.0%) reported no organisation size. Participants predominantly worked in leadership positions (70.0%).

The goal of the pre-test was to secure understanding and to evaluate internal consistency. Two items that did not meet the criteria of sufficient internal scale consistency ($\alpha < .7$) and factor loadings (below .250) in an initial principal factor analysis were removed one at a time, yielding a 7-item instrument for further analyses. The removed items were from the scale Problem Solving (Morgeson & Humphrey, 2006) ("My work situation requires me to be creative" and "My work situation often involves dealing with problems that I have not met before"). After item reduction, this 7-item scale still reflects the three core content factors Frequent Change, Unpredictability, and Challenging Work Demands.

A limitation arises with the small sample size and combining both leaders and non-leaders (Morgeson & Humphrey, 2006). In previous WEC research, complexity perceptions of employees and leaders have not been clearly separated from one another. Instead, authors have studied samples of leaders (e.g., Denison et al., 1995), employees (Oldham & Cummings, 1996), mixed samples (Rafferty & Griffin, 2006), as well as students (Hochwarter et al., 2007). Therefore, in the next step, the preliminary scale was further tested in larger samples, examining employees and leaders separately.

3.3.2 Study 1a: Exploratory Factor Analysis with Employee Sample

Participants and Procedure

A questionnaire survey was distributed to employees in a German hospital that was undergoing a change process. This setting was chosen as WEC was likely to emerge in a public-sector organisation undergoing transformation (Karp & Helgø, 2008), where different job families have to work interdependently on challenging, even life-depending tasks. Participation was voluntary, and all 2,100 employees were approached to fill out a survey either online or on paper. Three hundred and fifty-four employees (16.9%) took part. After eliminating invalid or missing responses, 305 participants were retained; of these, 153 (50.2%) were nurses, 59 (19.3%) were doctors, 49 (16.1%) were in administrative functions, and 44 (14.4%) were in med-tech functions. To safeguard their anonymity, participants were not asked to report personal data such as age and gender.

Measure

WEC was measured with the 7-item Work Environment Complexity Scale (WECS) as developed in the pre-test. The WECS consisted of three items from Rafferty and Griffin's (2006) Frequent Change Scale ("Change frequently occurs in my unit"), three items from Tetrick and LaRocco's (1987) Predictability of Events

Scale, ("Unexpected events occur on my job to a great extent"), and one item from Morgeson and Humphrey's (2006) Work Design Questionnaire, Subscale Problem Solving ("The work situation involves solving problems that have no obvious correct answer"). Items that were not available in German were translated, back-translated, and retranslated as required. Answers ranged from 1 (Disagree strongly) to 5 (Agree strongly). Table 7 presents the 7-item WEC Scale.

Table 7: Study 1 - The 7-Item Work Environment Complexity Scale

The following statements refer to your perceptions of your current working environment. Please rate the extent to which you agree with the following statements:

	1 Disagree strongly	2 Disagree moderately	3 Neither disagree nor agree	4 Agree moderately	5 Agree strongly
1. Change frequently occurs in my unit. (FRCH1)					
2. It feels like change is always happening. (FRCH3)					
3. Unexpected events occur on my job to a great extent. (PRED2)					
4. I am faced with unexpected decisions concerning my work to a great extent. (PRED3)					
5. In my work it is difficult to identify when changes start and end. (FRCH2)					
6. The work situation involves solving problems that have no obvious correct answer. (PRSO1)					
7. I can predict what job demands will be placed on me in this situation. (R) (PRED1R)					

Note. (R) = reverse scored. FRCH = item originally obtained from Frequent Change Scale. PRED = item originally obtained from Predictability Scale. PRSO = item originally obtained from Problem Solving Scale.

Statistical Analysis

The factor structure of the WECS scores was analysed in SPSS23 using parallel analysis (see e.g., Henson & Roberts, 2006) based on Monte Carlo simulations of

1,000 samples, principal axis explanatory factor analysis (EFA), and by examining the patterns of factor loadings of an oblique factor rotation (Promax, kappa = 4). Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Bartlett's Test of Sphericity were obtained to examine the data suitability for factor analysis.

3.3.3 Study 1a Results

The two EFAs of the 7-item WEC revealed an indistinct picture between a one and two-factor structure. In parallel analysis, only the first observed eigenvalue of 2.892 exceeded its upper 95th percentile, indicating that one factor was extracted (see scree plot in Figure 6). This accounted for 41.3% of the variance. In the subsequent principal axis factor analysis, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) was .759, indicating good data factorability, and Bartlett's Test of Sphericity (Approximate chi-square = 477.4, p <.001) was significant, indicating that factor analysis was appropriate to use on the data (Bartlett, 1954). Two eigenvalues greater than 1 were extracted: 2.892 and 1.082. Factor 1 accounted for 41.3% of the variance, Factor 2 for additional 15.5%. The estimated correlation between the factors was .642, indicating weak discriminant validity. The structure matrix produced unclear factor loadings, as items loading on F2 showed strong cross-loadings on F1. Table 8 displays descriptive statistics and factor loadings for the two-factor and single factor solutions.

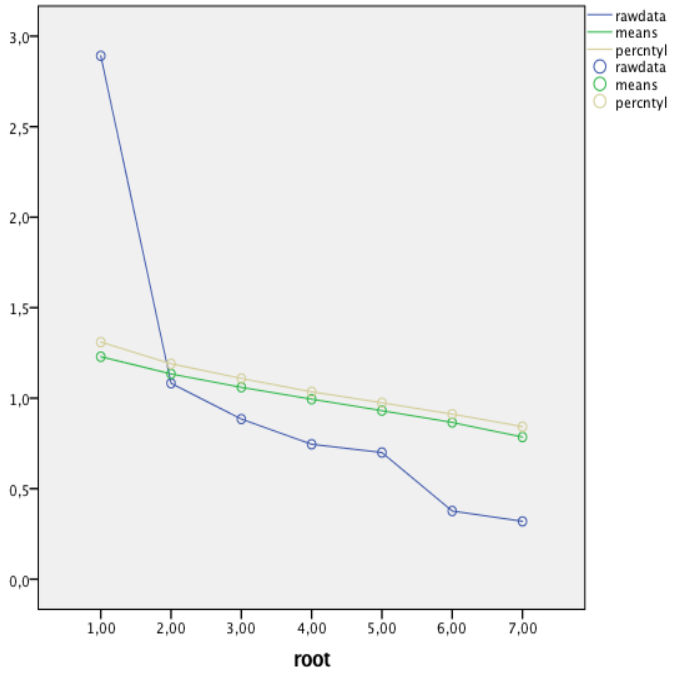

Figure 6. Employee Sample - Parallel Analysis Scree Plot of the 7-Item WEC Measure Indicating a One-Factor Solution (Study 1a).

Table 8: Study 1a - Descriptive Statistics and Factor Loadings of WECS Items

Item	*X*	*SD*	*F1*	*F2*	*Single Factor*
1. Change frequently occurs in my unit. (FRCH1)	3.84	.96	.889	.446	.745
2. It feels like change is always happening. (FRCH3)	3.62	1.03	.694	.447	.672
3. Unexpected events occur on my job to a great extent. (PRED2)	4.05	.99	.676	.765	.768
4. I am faced with unexpected decisions concerning my work to a great extent. (PRED3)	4.35	.87	.576	.642	.658
5. In my work it is difficult to identify when changes start and end. (FRCH2)	3.37	.99	.431	.503	.497
6. The work situation involves solving problems that have no obvious correct answer. (PRSO1)	3.30	1.01	.231	.297	.278
7. I can predict what job demands will be placed on me in this situation. (R) (PRED1R)	3.53	1.06	.016	.119	.055

Note. n = 305. (R) = reverse scored. FRCH = item originally from Frequent Change Scale. PRED = originally from Predictability Scale. PRSO = originally from Problem Solving Scale. Primary loadings indicated by dark grey shadow, cross-loadings (secondary loadings < 0.20 difference to primary loading) in light grey shadow.

3.3.4 Study 1a Discussion

The purpose of Study 1 was to initially explore the 7-item WEC Scale's factor structure for employees. Parallel analysis (PA) and principal axis factoring (PAF) produced somewhat diverging results. Further, with high correlation between factors, and the cross-loading content of the second factor in PAF, the WEC Scale in the employee sample displayed an indistinct picture between a one-factor and two-factor structure.

An explanation for the unclear result may lay in diverging employees' and leaders' interpretations of WEC. Work on individual judgment such as Brunswick's lens model (Bernieri, Gillis, Davis, & Grahe, 1996) has argued that the judgment of uncertain situations may vary greatly between groups depending on an individual's interpretation of environmental cues (see for a meta-analysis, Karelaia & Hogarth, 2008). Furthermore, the way that employees and leaders perceive the workplace may differ due to distinctive positioning or scopes within the organisation (Morgeson & Humphrey, 2006). Having built the content of the WEC Scale based upon research mostly in WEC *leadership*, it is hypothesised that a *leader's* judgment of WEC may be more distinct, and may reveal more discriminant validity between the two provisionally identified factors.

3.4 Study 1b: Exploratory Factor Analysis with Leader Sample

In Study 1b, EFA was conducted in order to further explore the scale's factor structure. This time, a sample of only leaders was used, investigating the above proposition of divergent views of WEC between employees and leaders.

3.4.1 Study 1b Method

Procedure, measure, and statistical analysis were identical to those of Study 1a.

3.4.2 Participants

A sample of 59 leaders (response rate of 63.1%) was recruited from the same German hospital described in Study 1a, this time including only those with formal leadership responsibility. After ruling out invalid or missing data, 53 leaders were retained; of these, 19 (35.8%) were nurses, 15 (28.3%) were in administrative functions, 11 (20.8%) were doctors, and 8 (15.1%) were in med-tech functions. Again, age and gender were not asked.

3.4.3 Study 1b Results

Parallel analysis of the 7-item WECS revealed a two-factor structure, as the first two observed eigenvalues exceeded their respective upper 95th percentiles (see scree plot in Figure 7). Factor 1 accounted for 36.0% of the variance, Factor 2 for additional 22.8%. In the principal axis factor analysis, a KMO of .663 and significant Bartlett's Test of Sphericity (Approximate Chi-Square= 81.3, p <.001) indicated good factorability. Two eigenvalues greater than 1 were extracted: 2.522 and 1.597. The estimated correlation between the factors was .297, indicating good discriminant validity. Compared to Study 1a, a clearer pattern of factor loadings emerged, indicating three items each loading on Factor 1 and 2, and only one item cross-loading on both factors. Content-wise, Factor 1 can be labelled as *Frequent Change and Events*, as the related items describe the frequency of upcoming changes and unexpected events in work situations, Factor 2 can be labelled as *Uncertain Work Demands*, as the related items describe ambiguous or demanding requirements within the given work. Table 9 presents descriptive statistics and factor loadings for the two-factor and single factor solutions.

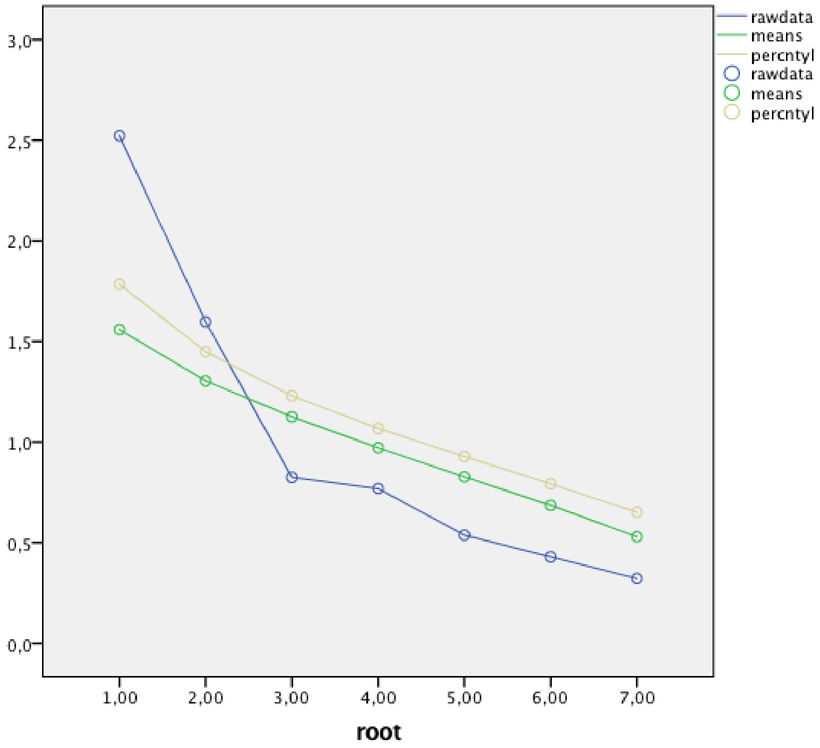

Figure 7. Leader Sample - Parallel Analysis Scree Plot of the 7-Item WEC Measure

Indicating a Two-Factor Solution (Study 1b).

Table 9: Study 1b - Descriptive Statistics and Factor Loadings of WECS Items

Item	*X*	*SD*	*F1*	*F2*	*Single Factor*
1. FRCH1	4.30	.77	.794	.338	.784
2. FRCH3	3.91	1.02	.701	.121	.555
3. PRED2	4.47	.72	.612	.115	.505
4. PRED3	4.72	.57	.360	.378	.479
5. FRCH2	3.30	.89	.312	.996	.527
6. PRSO1	3.15	1.03	.261	.520	.437
7. PRED1R (R)	2.72	1.03	-.139	.389	.067

Note. n = 53. (R) = reverse scored. Primary loadings indicated by dark grey shadow, cross-loadings in light grey shadow.

3.4.4 Study 1b Discussion

The WEC for leaders appears to be a two-dimensional instrument. Content-wise, Factor 1 can be labelled as *Frequent Change and Events*, Factor 2 can be labelled as *Uncertain Work Demands*. As hypothesised, the results of the two studies suggest diverging perceptions of WEC for employees and leaders. While Study 1a for employees failed to reveal a clear picture of the construct structure, in the leaders' sample of Study 1b, WEC was more clearly a two-factor construct. This implies that the scale is applicable especially for measuring WEC from a leadership point of view. However, a limitation of Study 1b lies in the small sample size.

3.5 Study 1c: Confirmatory Factor Analyses with Longitudinal Leader Sample

The goal of Study 1c was to corroborate the construct validity of the WEC Scale on a new leadership sample and in a longitudinal manner through confirmatory factor analysis (CFA). The application of a longitudinal design further caters to the claims of complexity researchers, that quantitative methods should incorporate the factor of time (Dinh et al., 2014; Uhl-Bien & Marion, 2009). Furthermore, this design allowed for a test of factorial invariance to examine the extent to which the scale measures the same construct across administrations repeated over time.

3.5.1 Study 1c Method

Participants and Procedure

A new sample of leaders was recruited from a different, large private healthcare organisation in Germany, including only those with formal leadership responsibility. Two major clinic groups had been recently merged into this organisation, therefore, it was undergoing significant change. For each participant, data was gathered at the beginning of the change process (Wave 1) and five months later during the change process (Wave 2) using an online survey. From all 163 top managers of the organisation, 117 leaders participated in Wave 1 (71.8%), 107 in Wave 2 (65.6%). The data did, however, reveal technical duplicates and incorrect responses, which were ruled out by data screening. This phenomenon can be ascribed to a general dissatisfaction with the ongoing organisational change process resulting for some leaders in a limited motivation to participate (see e.g., Meade & Craig, 2012). Finally, 77 leaders reported valid data on the two points of measurement and were therefore retained. Of these, 46 (59.7%) were leaders in medical top management, 31 (40.3%) were leaders in commercial top management. Again, age and gender were not asked.

Measure

All participants completed the scale developed in Studies 1a and 1b.

3.5.2 Statistical Analysis

The construct validity of the WEC Scale was evaluated by a set of three confirmatory factor analyses (CFA) using LISREL 8.8 (Jöreskog & Sörbom, 2006), testing the probability that the hypothesised factor structure is supported by the data (Cramer, 2003). Following the suggested procedure for longitudinal construct validation of Pitts, West, and Tein (1996), the data of Wave 1 and Wave 2 were firstly examined separately cross-sectionally, then secondly examined in an integrated, longitudinal model.

Two latent variables were defined for each Wave according to EFA suggestions of studies 1a and 1b; the respective items were fixed as congeneric indicators. For each factor, the factor loading for one indicator was fixed to 1.0. Factors were let free to be inter-correlated. Item covariance errors were set free among several items as suggested by modification indices, thereby only allowing for modifications within, not between factors (Schumacker & Lomax, 2004). As one item (PRED3) was cross-loaded in study 1b, three alternative models were compared: (Model 1) a two-factor model with item PRED3 loading on Factor 1, (Model 2) a two-factor model with PRED3 loading on Factor 2, and (Model 3) a one-factor model.

Model fit was inspected through several goodness-of-fit indices (Hu & Bentler, 1999; Schumacker & Lomax, 2004): (1) Chi-square assesses the overall fit of the model by estimating the difference between observed and expected covariance matrices. A non-significant chi-square indicates adequacy of a model fit. As the chi-square test is sensitive to sample size and has a tendency to inflate Type-1 errors (Bollen, 1989; Cohen, 1988), several alternative goodness-of-fit-indices were used: (2) The Root Mean Square Error of Approximation (RMSEA) measures discrepancy between the data and the model, ranging from 0 to 1, with a value below .05 indicating good fit and values between .05 and .08 indicating adequate fit. (3) The Standardised Root Mean Square Residual (SRMR) measures the discrepancy between the sample and the model covariance matrices, with values < .05 indicating good fit. (4) The Comparative Fit Index (CFI) as a relative fit index measures the model fit compared to a null model, with values above .95 reflecting good fit and values from .90 to .95 indicating appropriate fit. Further, (5) the Non-Normed Fit Index (NNFI), another relative fit index, with values > .95 indicating good fit. Nested models were compared by chi-square difference test (Jöreskog & Sörbom, 1996). Non-nested models were compared by the Akaike Information Criterion (AIC). Smaller AIC values suggest better, parsimonious fit.

In a third step, three additional models were tested in order to further assess the factorial invariance of the scale, meaning the extent to which the scale measures the same construct across the two administrations (Hoyle & Smith, 1994; Moneta, 2017b; Widaman et al., 2010): the configural invariance model with longitudinally correlated item errors, the metric invariance model, and the scalar invariance model.

3.5.3 Results Wave 1 Data

For the first Wave data, Model 1 described above yielded the best fit. The chi-square test of the confirmatory factor model was non-significant ($\chi^2 = 4.97$, $df = 8$, $p = 0.76$), indicating strict model fit. Furthermore, other goodness-of-fit statistics indicated excellent fit (RMSEA = 0.000, p[RMSEA<0.05] = 0.84, SRMR = 0.033, CFI = 1.00, NNFI = 1.06). Model-based estimates of the correlations were 0.33 between Factor 1 and Factor 2.

In addition, the fit of the two alternative models was assessed. Both Model 2, the alternative two-factor model (AIC = 60.17) and Model 3, the one-factor model (AIC = 55.78), underperformed Model 1 (AIC = 44.97) in all examined goodness-of-fit indices. Therefore, Model 1, the initial two-factor model, was retained. Table 10 depicts a comparison of fit for the three tested models.

Table 10: Study 1c - Comparison of Model Fit, Wave 1

Model	χ^2	*df*	*p*	RMSEA	RMSEA Interval	RMSEA close fit	SRMR	CFI	NNFI	AIC
Model 1 Identified two-factor model (PRED3 in f1)	4.97	8	0.76	0.000	[0.0; 0.09]	0.84	0.033	1.00	1.06	44.97
Model 2 Alternative two-factor model (PRED3 in f2)	30.17	13	0.01*	0.132	[0.07;0.19]	0.019*	0.098	0.84	0.73	60.17
Model 3 One-factor model	23.78	12	0.02*	0.114	[0.0; 0.19]	0.065	0.093	0.90	0.83	55.78

Note. $n = 77$. χ^2 = Chi-square; *df* = Degrees of freedom; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; CFI = Comparative Fit Index; NNFI = Non-Normed Fit Index; AIC = Akaike Information Criterion. Light grey shadow indicates retained model.
* $p < 0.05$; ** $p < 0.01$.

Table 11 shows the descriptive statistics and Figure 8 shows the retained CFA Model 1 with standardised factor loadings and measurement errors. For one item, the factor loading exceeded the value of 1.00, which according to Jöreskog (1999) is not unusual when CFA factors are correlated. In all, the findings corroborate the factor structure of the scale.

Table 11: Study 1c - Means, Standard Deviations, Standardised Factor Loadings, and Measurement Errors of the WEC Items, Wave 1

Item	*M*	*SD*	*Factor*	*Factor Loading*	*Measure-ment Error*
3. Unexpected events occur on my job to a great extent. (PRED2)	3.7	1.0	WEC-1	1.02	.05
1. Change frequently occurs in my unit. (FRCH1)	3.4	1.0	WEC-1	.49	.76
2. It feels like change is always happening. (FRCH3)	2.8	1.1	WEC-1	.97	.05
4. I am faced with unexpected decisions concerning my work to a great extent. (PRED3)	4.4	.7	WEC-1	.14	.98
5. In my work it is difficult to identify when changes start and end. (FRCH2)	2.8	1.0	WEC-2	.67	.55
6. The work situation involves solving problems that have no obvious correct answer. (PRSO1)	2.6	1.0	WEC-2	.56	.68
7. I can predict what job demands will be placed on me in this situation. (PRED1R) (R)	2.7	.9	WEC-2	.49	.76

Note. n = 77. Factor labels: WEC-1 “Frequent Change and Events”, WEC-2 “Uncertain Work Demands” (R) = reverse scored.

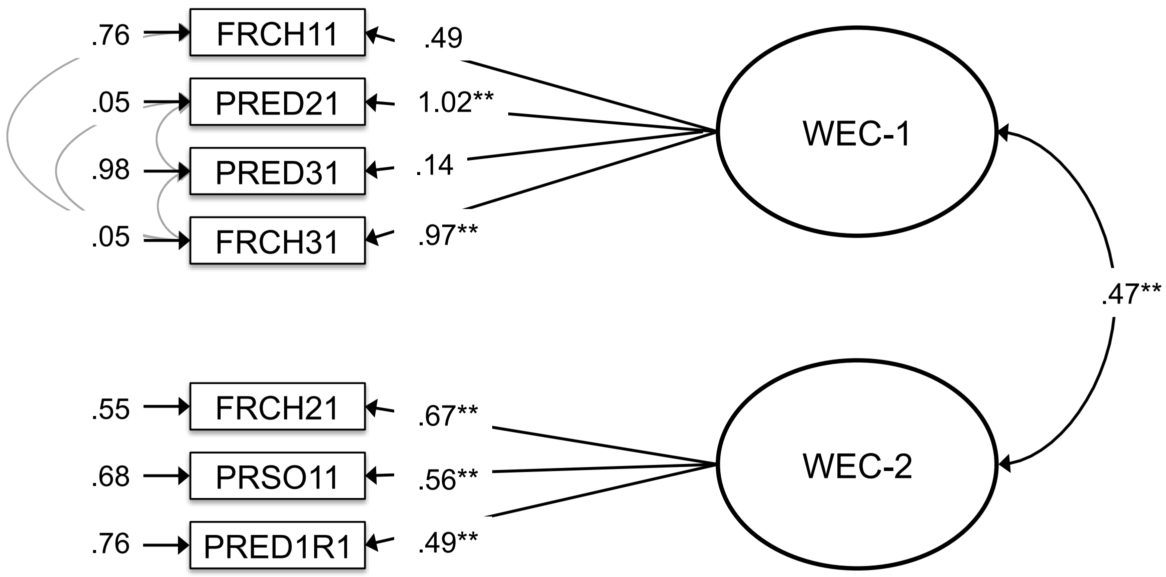

Figure 8. Standardised Factor Loadings and Measurement Errors of WEC-Items Wave 1, Estimated Using Confirmatory Factor Analysis (CFA).

Note. Factor labels: WEC-1 “Frequent Change and Events”, WEC-2 “Uncertain Work Demands”. * *p* < .05 ***p* < .01 (2-tailed). Light grey arrows indicate modifications within factors as suggested by LISREL program.

Table 12 shows the descriptive statistics and inter-correlations of WEC factor scores. The internal consistency of factor 1 WEC-1 was good, Factor 2 WEC-2 fell below the threshold of Cronbach’s alpha of .70 for acceptable internal consistency. The overall Work Environment Complexity scale with 7 items had a good internal consistency in Wave 1 with Cronbach’s alpha = .72. In an alternative calculation of the model-based estimate of composite scale reliability (Raykov, 1997) of this first Wave was good (.80) for Factor 1, WEC-1, but less satisfactory (.60) for Factor 2, WEC-2. The overall 7-item scale yielded a composite reliability of .83 in Wave 1.

Table 12: Study 1c - Means, Standard Deviations, Correlation Coefficients, and Cronbach's Alpha, Wave 1

Variable	*M*	*SD*	*1.*	*2.*
WEC-1"Frequent Change and Events"	3.6	.7	1.00 (.73)	
WEC-2 "Uncertain Work Demands"	2.7	.7	.33**	1.00 (.61)

Note. $n = 77$.

* $p < .05$; ** $p < .01$ (2-tailed).

3.5.4 Results Wave 2 Data

In Wave 2, the chi-square test for Model 1 was not significant ($\chi^2 = 18.66$, $df = 11$, $p = 0.068$), indicating strict model fit. Further, other goodness-of-fit statistics indicated good fit (p[RMSEA<0.05] = 0.15, CFI = 0.95, NNFI = 0.90). RMSEA = 0.096 and SRMR = 0.089 lay above the respective proposed cut-off values. The model-based estimates of the correlations were 0.42 between Factor 1 and Factor 2.

The two alternative models, Model 2 (AIC = 68.72) and Model 3 (AIC = 57.04), underperformed in all examined goodness-of-fit indices when compared to Model 1 (AIC = 52.66). Therefore, Model 1, the initial two-factor model, was retained. Table 13 depicts a comparison of fit for the three tested models.

Table 13: Study 1c - Comparison of Model Fit, Wave 2

Model	χ^2	df	p	RMSEA	RMSEA Interval	RMSEA close fit	SRMR	CFI	NNFI	AIC
Model 1 Identified two-factor model (PRED3 in f1)	18.66	11	0.07	0.096	[0.0; 0.17]	0.15	0.089	0.95	0.90	52.66
Model 2 Alternative two-factor model (PRED3 in f2)	39.64	12	0.00 **	0.165	[0.11;0.23]	0.011*	0.110	0.82	0.69	68.72
Model 3 One-factor model	25.04	12	0.02 *	0.120	[0.05;0.19]	0.048*	0.099	0.92	0.86	57.04

Note. $n = 77$. χ^2 = Chi-square; *df* = Degrees of freedom; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; CFI = Comparative Fit Index; NNFI = Non-Normed Fit Index; AIC = Akaike Information Criterion. Light grey shadow indicates retained model.

* $p < 0.05$; ** $p < 0.01$.

Table 14 shows the descriptive statistics and Figure 9 shows the retained CFA Model 1 for Wave 2. Although demonstrating a slightly poorer model fit as compared to Wave 1, the two-factor model in Wave 2 exhibited good model fit and outperformed the alternative models. In all, the findings corroborate the factor structure of the scale.

Table 14: Study 1c - Means, Standard Deviations, and Factor Loadings of the WEC Items, Wave 2

Item	*M*	*SD*	*Factor*	*Factor Loading*	*Measure-ment Error*
2. It feels like change is always happening. (FRCH3)	2.9	1.1	WEC-1	.99	.02
3. Unexpected events occur on my job to a great extent. (PRED2)	3.6	1.0	WEC-1	1.07	.14
1. Change frequently occurs in my unit. (FRCH1)	3.6	.9	WEC-1	.61	.63
4. I am faced with unexpected decisions concerning my work to a great extent. (PRED3)	4.5	.6	WEC-1	.15	.98
5. In my work it is difficult to identify when changes start and end. (FRCH2)	2.8	.9	WEC-2	.72	.48
6. The work situation involves solving problems that have no obvious correct answer. (PRSO1)	2.5	.9	WEC-2	.49	.76
7. I can predict what job demands will be placed on me in this situation. (PRED1R) (R)	2.5	.9	WEC-2	.36	.98

Note. n = 77. Factor labels: WEC-1 “Frequent Change and Events”, WEC-2 “Uncertain Work Demands” (R) = reverse scored.

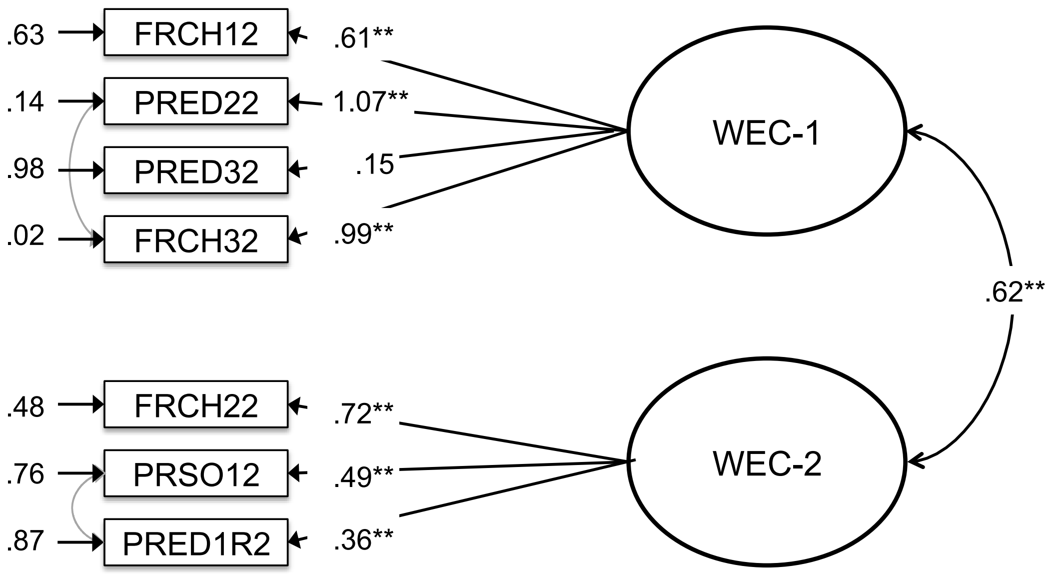

Figure 9. Standardised Factor Loadings and Measurement Errors of WEC Items, Wave 2, Estimated Using Confirmatory Factor Analysis (CFA).

Note. Factor labels: WEC-1 "Frequent Change and Events", WEC-2 "Uncertain Work Demands". * $p < .05$ ** $p < .01$ (2-tailed). Light grey arrows indicate modifications within factors as suggested by LISREL program.

Table 15 shows the descriptive statistics and inter-correlations of the WEC factor scores in Wave 2. Internal consistency of the WEC-1 factor was good, the second factor WEC-2 fell just below the threshold of α = .70. Further, estimates for internal consistency were similar Wave 1 results. The overall 7-item WEC Scale had a good internal consistency in Wave 2 with Cronbach's alpha = .72. The alternative calculation of scale reliability (Raykov, 1997) was good (.84) for factor one WEC-1, but less satisfactory (.54) for factor 2 WEC-2. The overall 7-item scale yielded a composite reliability of .84 in Wave 2.

Table 15: Study 1c - Means, Standard Deviations, Correlation Coefficients, and Cronbach's Alpha, Wave 2

Variable	*M*	*SD*	*1.*	*2.*
WEC-1"Frequent Change and Events"	3.7	.7	1.00 (.73)	
WEC-2 "Uncertain Work Demands"	2.6	.7	.32**	1.00 (.63)

Note. $n = 77$.

* $p < .05$ ** $p < .01$ (2-tailed).

3.5.5 Study 1c Discussion

Two cross-sectional CFAs replicated the identified two-factor structure of the WEC-scale as suggested by Study 1b. In both Waves, the 7-item WEC Scale reached excellent to good model fit; all alternative models were outperformed. Internal consistency was nearly identical across both Waves. This indicated construct validity for the WEC Scale cross-sectionally. The next step tested the scale's construct validity in a longitudinal model and examined its factorial invariance.

3.5.6 Results CFA Longitudinal Design (Waves 1 and 2)

Table 16 shows descriptive statistics for both Waves. The chi-square test of Model 1 was non-significant ($\chi^2 = 61.64$, $df = 66$, $p = 0.63$), indicating strict model fit. Further, other goodness-of-fit statistics indicated excellent fit (RMSEA = 0.000, p[RMSEA<0.05] = 0.90, CFI = 0.99, NNFI = 0.99), yet SRMR = 0.084, lay just above the proposed cut-off value of < 0.05. The model-based estimates of the correlations between Factor 1 and Factor 2 were 0.33 in Wave 1 and 0.44 in Wave 2. The two alternative models Model 2 (AIC = 185.08) and Model 3 (AIC = 164.66) underperformed in all examined goodness-of-fit indices when compared to Model 1 (AIC = 139.64). Therefore, Model 1, the initial two-factor model, was retained. Table 17 depicts a comparison of fit for the three tested models.

Table 16: Study 1c - Means and Standard Deviations of WECS Items, Longitudinal Model

	Wave 1 (n = 77)		*Wave 2 (n = 77)*	
Item	*M*	*SD*	*M*	*SD*
1. FRCH1	3.38	1.00	3.64	.93
2. FRCH3	2.75	1.07	2.92	1.09
3. PRED2	3.69	1.03	3.60	1.03
4. PRED3	4.40	.69	4.45	.62
5. FRCH2	2.82	1.00	2.81	.87
6. PRSO1	2.64	1.00	2.51	.93
7. PRED1R (R)	2.74	.89	2.48	.87

Note. (R) = reverse scored.

Table 17: Study 1c - Comparison of Model Fit, Longitudinal Model

Model	χ^2	*df*	*p*	RMSEA	RMSEA Interval	RMSEA close fit	SRMR	CFI	NNFI
Model 1 Identified two-factor model (PRED3 in f1)	61.64	66	0.63	0.000	[0.0; 0.06]	0.90	0.084	0.99	0.99
Model 2 Alternative two-factor model (PRED3 in f2)	101.08	63	0.00**	0.089	[0.06; 0.12]	0.03*	0.110	0.82	0.74
Model 3 One-factor model	94.66	65	0.05	0.063	[0.0; 0.10]	0.28	0.096	0.92	0.88

Note. n = 77. χ^2 = Chi-square; *df* = Degrees of freedom; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; CFI = Comparative Fit Index; NNFI = Non-Normed Fit Index.
* $p < 0.05$; ** $p < 0.01$.

Table 18 shows the descriptive statistics and inter-correlations of the WEC factor scores in Wave 1 and Wave 2. Cronbach's Alphas were satisfactory for Factor 1, WEC-1, at time 1 (0.73) and time 2 (0.73), but fell under the cut-off point of .7 for Factor 2, WEC-2, at time 1 (.61) and time 2 (.63). The model-based estimate of composite scale reliability (Raykov, 1997) was good for WEC-1 at time 1 (0.83) and time 2 (0.84), but fell under the cut-off point of .7 for WEC-2, at time 1 (.60) and time 2 (.60). In all, the findings support the factorial validity of the 7-item WEC Scale.

Table 18: Study 1c - Means, Standard Deviations, Correlation Coefficients, and Cronbach's Alpha, Waves 1 and 2

Variable	*M*	*SD*	*1.*	*2.*	*3.*	*4.*
Wave 1						
WEC-1"Frequent Change and Events"	3.6	.7	1.00 (.73)			
WEC-2 "Uncertain Work Demands"	2.7	.7	.33**	1.00 (.61)		
Wave 2						
WEC-1"Frequent Change and Events"	3.7	.7	-.10	-.01	1.00 (.73)	
WEC-2 "Uncertain Work Demands"	2.6	.7	.01	-.08	.32**	1.00 (.63)

Note. $n = 77$.
* $p < .05$ ** $p < .01$ (2-tailed)

Three additional models (labelled 4-6) were tested to assess the factorial invariance of the scale compared to the identified Model 1, which imposed no constraints on the measurement errors and/or factor loadings between the two administrations. Hence, it represents configural invariance, which means that respondents attribute approximately the same meaning to the latent construct of WEC across administrations. Table 19 shows the goodness of fit indexes of the estimated models.

Model 4 was identical to Model 1 except that it allowed the individual item errors to correlate across the two administrations (the measurement error of item PRED2 in Wave 1 was allowed to co-vary with the error of PRED2 in Wave 2). The model showed excellent fit, and the comparison in fit between this and Model 1 was non-significant (Delta $\chi^2(7) = 2.56$, $p = 0.92$), indicating that the scale does not elicit response styles. Furthermore, as this indicates that the error correlation was not a necessary condition for model fit, Model 1 was retained for further testing.

Model 5 was identical to Model 1 except that it constrained the factor loadings to be identical at Waves 1 and 2 (the loading of PRED2 in Wave 1 was forced to be identical to the loading of PRED2 in Wave 2), therefore testing for metric invariance. Metric invariance means that respondents attribute the same meaning to the latent construct of WEC across administrations. The model showed excellent fit, and the comparison between this and Model 1 was non-significant (Delta $\chi^2(7) = 2.10$, $p = .95$), indicating that the extent to which WEC relates to the items does not change between the administrations.

Model 6 was identical to Model 1 except that it constrained both the factor loadings and intercepts to be identical at Waves 1 and 2, thus testing for scalar invariance. Scalar invariance means that respondents attribute the same meaning to the latent construct of WEC across administrations and the level of the items are equal across administrations. The model showed satisfactory fit, and the comparison in fit between this and Model 5 was significant (Delta $\chi^2(12) = 53.81$, $p < .001$), indicating that the scale has metric but not scalar invariance.

Depicted in Figure 10, Model 5 was retained as the final model, reaching the best model fit and demonstrating that the scale works invariantly across two points of time except for scale location, which indicates metric invariance. The factor loadings were predominantly strong and the scale was free from response styles.

Table 19: Study 1c - Goodness of Fit Indexes of Confirmatory Factor Analysis (CFA) Models for the 7-Item WECS

Model	χ^2	*df*	*p*	RMSEA	RMSEA Interval	RMSEA close fit	SRMR	CFI	NNFI
Model 1 Configural invariance	61.64	66	0.63	0.000	[0.00; 0.06]	0.90	0.084	0.99	0.99
Model 4 Configural invariance, longitudinally correlated item errors	59.08	59	0.47	0.004	[0.00; 0.07]	0.81	0.086	0.98	0.97
Model 5 Metric invariance	63.74	73	0.77	0.000	[0.00; 0.05]	0.96	0.088	1.00	1.01
Model 6 Scalar invariance	119.81	85	0.008**	0.073	[0.039; 0.10]	0.12	0.113	0.80	0.79

Note. $n = 77$. χ^2 = Chi-square; *df* = Degrees of freedom; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; CFI = Comparative Fit Index; NNFI = Non-Normed Fit Index. Light grey shadow indicates final model.
* $p < 0.05$; ** $p < 0.01$.

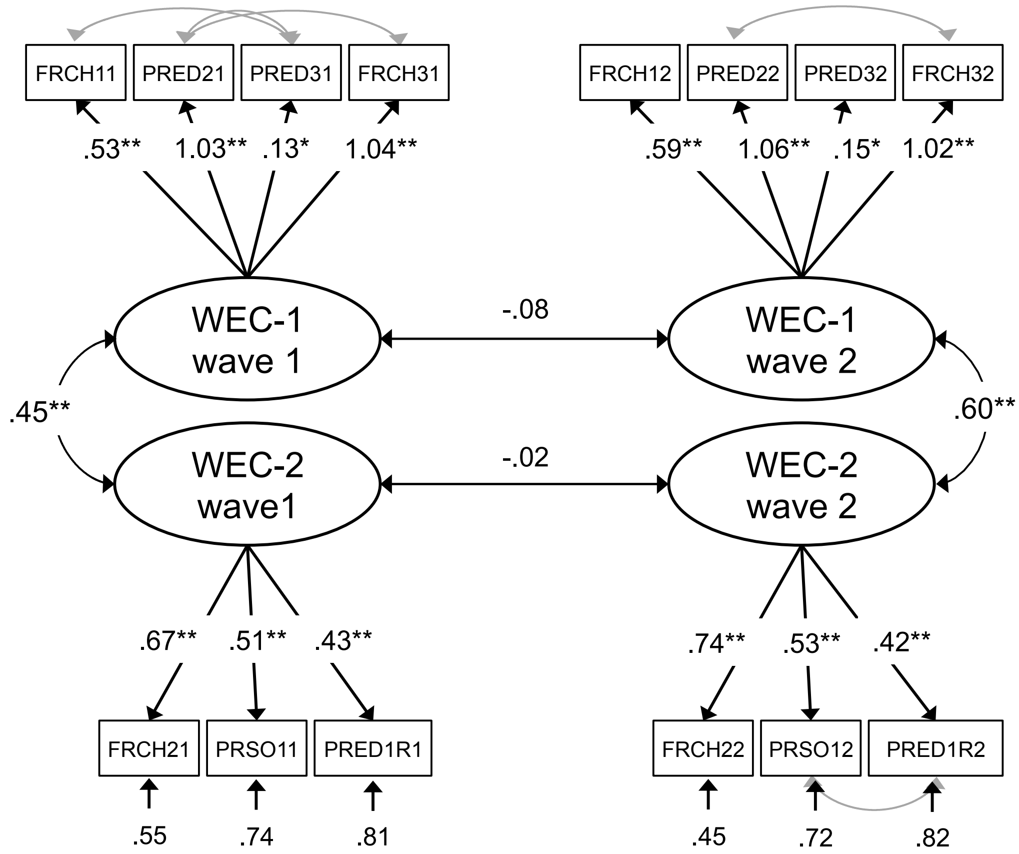

Figure 10. Standardised Factor Loadings and Measurement Errors of the Longitudinal WEC Model 5, Stating Metric Invariance.
Note. Factor labels: WEC-1 “Frequent Change and Events”, WEC-2 “Uncertain Work Demands”. Light grey arrows indicate modifications within factors as suggested by LISREL program.
* $p < .05$ **$p < .01$ (2-tailed).

3.6 Study 1 General Discussion

This study is a contribution towards understanding and measuring the nature of Work Environment Complexity for leaders in modern, complex organisations. By clarifying the core content for a WEC-measure, previously fragmented approaches have been integrated to understand what makes an environment complex for individuals in leadership positions. An empirical gap in research was closed by outlining the content of WEC as a comprehensive construct and testing it empirically through quantitative measurement. Findings suggest that leaders in modern organisations face a specific state of WEC characterised by frequent transformation and change, the occurrence of unpredictable events, and demanding yet uncertain work requirements. These characteristic fall into the categories of Frequent Change, Unpredictability, and Challenging Work Content. Based on these findings, the definition of WEC can be outlined as follows: *Work Environment Complexity is characterised as (the perception of) a frequently changing, unpredictable, and demanding work environment*. With this conceptualisation, the notion of WEC for leaders has been expanded from a prominent but narrow understanding of job complexity (completing challenging tasks) to a broader and thus more comprehensive understanding of WEC that incorporates external influences and challenges for leaders in a workplace such as on-going change and the unpredictability of future work demands.

Moreover, the results of studies 1a and 1b indicate that WEC views of employees and leaders may be divergent. In the employee sample (Study 1a), the combination of EFA-methods could not unambiguously identify either a one- or a two-factor solution. Instead, in both study 1b and study 1c leadership samples, a clear two-factor structure emerged, suggesting that the same construct may not have the same meaning for both target groups, and that the WEC Scale can be considered as a measurement tool only for studying a leader's WEC. Models of individual judgement (Bernieri et al., 1996; Morgeson & Humphrey, 2006) may explain this apparent difference between employees and leaders, which may be due to their position in the organisation. Exploring the nature of employee WEC is therefore considered an interesting path for future research.

With the aim of exploring WEC for leaders in particular, this study further contributes empirically by providing an inclusive measurement instrument for the nature of WEC that a leader may face. A 7-item WEC Scale was developed and validated and demonstrated promising psychometric properties not only in cross-sectional but also in longitudinal testing. Two WEC-factors could be identified and empirically confirmed, namely Frequent Change and Events and Uncertain Work Demands. Results revealed that the time 1 and time 2 measures of WEC were uncorrelated. This supports the characterisation of WEC as a state, as repeated measurements were taken in the course of major organisational change. In such context, if stronger correlations had been found, one could instead claim that WEC is a mindset or a personality variable. Furthermore, as the set of CFAs demonstrated, the final model withstood the test for metric invariance, indicating that WEC has factorial validity across two repeated administrations. Despite falling short of scalar invariance, having obtained metric invariance allows for testing causal relationships with the WECS-7 longitudinally (Byrne, Shavelson, & Muthén, 1989).

An important contribution of this study is therefore the possibility of quantifying the degree of complexity a leader confronts and the extent to which this degree changes over time. It provides a comprehensive scale for researchers and practitioners that allows for monitoring the level of WEC in general and along an organisational change process. Also, the WEC Scale may be useful for leadership selection as it can give insights into the level of WEC in a leader's work or position, allowing Person-Environment fit. Having established a conceptual and empirical baseline for the construct, this project has contributed to further empirical and practical research into the function of leadership in WEC. Growing discourse has centred on the topic of how to lead under work conditions of high complexity (Burnes, 2005; Schneider & Somers, 2006; Uhl-Bien & Marion, 2009). Being able to evaluate the nature and level of WEC allows further exploration of appropriate leadership styles, leader attitude, personality dispositions, as well as practical support such as leadership training. Future research could examine the consequences of working under conditions of high WEC, for example on an individual's wellbeing, motivation, engagement, work performance, or health-related issues such as burnout. This study has clarified the construct of WEC and empirically developed an instrument to enable further research on WEC and leadership.

3.7 Study 1 Limitations

As Study 1a has shown, findings cannot be applied to employees, only for leaders' WEC. Further research should explore WEC for employees, possibly developing an alternative model. Secondly, although benefitting from longitudinal and field data, leadership sample sizes were small, and hence validation using larger samples is recommended. Thirdly, the item PRED3 revealed indistinct mixed results. While loading inconspicuously well in the pre-test and EFA of Study 1a, loadings were inferior in Study 1c, simultaneously still reaching excellent overall model fit. A further examination of this item should be made to see its fit into the overall construct. Furthermore, the model's second factor WEC-2 showed lower and not particularly satisfying internal consistency. Finally, the present research collected data from three different studies and samples from two separate organisations, and used distinct data sets to develop and validate the WEC scale in order to avoid an overestimation of the psychometric properties of the scale. The statistical methodology used is sophisticated and up to the standards used to validate similar scales (e.g., Breevaart et al., 2012; Moneta, 2017b). However, all study participants across the three studies were employed in the health care industry in Germany. This limits the generalisability of findings to leaders in other organisational and national contexts. Therefore, further research should assess the WEC scale in a range of industries, testing factorial invariance between groups of leaders.

3.8 Study 1 Conclusion

In summary, the present study provides a reasonably valid and reliable WEC

Scale that can be used to address a wide range of empirical questions concerning the effects that WEC has on leaders' behaviour and wellbeing with the aim of identifying optimal ways for leaders to cope with and manage Work Environment Complexity.

Chapter 4 – Study 2: Leadership Style in the Face of WEC

4.1 Introduction

Today's work settings are not as controllable as they used to be. Over the last few decades, organisations have evolved to contexts where leaders and employees are faced with increasing complexity – work environments characterised by the interplay of frequent transformation, high unpredictability, and demanding requirements (Burnes, 2005; Osborn & Hunt, 2007; Uhl-Bien et al., 2007). Today's leadership behaviour will therefore have to match these transformed conditions of Work Environment Complexity (WEC), and traditional, hierarchical models of leadership are seen as out-dated (Karp & Helgø, 2008; Lee et al., 2018; Lichtenstein et al., 2006). As a consequence, leadership research has debated optimal leadership styles when dealing with WEC (Dinh et al., 2014; Uhl-Bien & Arena, 2017).

The previous study has successfully established the construct of WEC that can grasp and measure the nature of such complex working contexts for leaders. The WEC Scale is the first measure that allows assessing the level of complexity within a leader's work environment. With this, leadership research can overcome an inherent limitation to the study of complexity; research can now be expanded to empirically substantiate discussions on "how to lead" in WEC (e.g., Burnes, 2005; Schneider & Somers, 2006). Now that WEC can be measured, leadership styles can be studied in relation to WEC. This present study aims to empirically investigate relationships between WEC and the adoption of leadership styles.

The most prominent discussion for leading in high-complexity contexts suggests that empowering leadership (EL) behaviour can overcome the limitations of top-down and linear management approaches (e.g., Burnes, 2005; Styhre, 2002).

Discussed in detail in section 2.4.3 of this thesis, one line of argument underlines the benefits of EL in WEC (e.g., Burnes, 2005; Correia de Sousa & van Dierendonck, 2014; Marion & Uhl-Bien, 2001; Uhl-Bien et al., 2007). A central rationale that guides this call is that in the environment of WEC, characterised as demanding, turbulent, and unpredictable, leaders cannot single-handedly control complex environments (anymore), and thus need to share control by empowering and involving others (Karp & Helgø, 2008; Lee et al., 2018). The need to act flexibly and speedily, for instance, goes hand in hand with granting team members the autonomy to adapt their working approach self-reliantly (Ashmos et al., 2002; Lee et al., 2018; Styhre, 2002). In WEC, the problems to be solved and choices to be made are often radically new, ill defined, and without pre-defined solutions. Hence, the fulfilment of complex work relies more and more on the specialised expertise of employees and teams to creatively solve problems (Carson, Tesluk, & Marrone, 2007; Gebauer, 2013; Mumford et al., 2000). This will require seeing modern leaders less as instructors or controllers, and more as conductors and enablers of others (Horner, 1997; Lichtenstein & Ashmos, 2009; Mumford et al., 2000; Uhl-Bien & Marion, 2009). Burnes (2005) summarises, that "managers need to abandon top-down, command-and-control styles, organisational structures need to be flatter and more flexible, and greater employee involvement is essential for success" (p. 84). As a consequence, a multitude of researchers have suggested that modern leaders adopt more empowering leadership behaviours in the face of WEC (Horner, 1997; Karp & Helgø, 2008; Lichtenstein & Ashmos, 2009; Mumford et al., 2000; Styhre, 2002; Uhl-Bien & Marion, 2009). This study consequently tests the assumption that facing WEC causes leaders to apply more EL. In WEC literature, this idea comes with an abandonment of more traditional, controlling, and directive leadership styles (Karp & Helgø, 2008; Lichtenstein et al., 2006; Marion & Uhl-Bien, 2001). Following the above arguments, an instrumental or directive leadership style, which includes close supervision or control of employees and decisions taken by the manager, has been discussed as less appropriate for leading in WEC (e.g., Ashmos et al., 2002; Karp & Helgø, 2008). Consequently, it is likely that facing WEC cause less directive leadership (DL) to be applied.

Despite this general theoretical agreement, there has been no empirical investigation into whether facing WEC will actually lead managers to choose more empowering, and consequently less directive leadership behaviour. Several limitations are observable: First, WEC was yet not measurable. Therefore, a fundamental critique of existing studies around complex organisational behaviour is that either they are purely conceptual, or they have equated "complexity" with narrower constructs such as change, or they have simply assumed – but not measured – the complexity of a work environment. Second, there had yet not been a conceptual model to explain why the WEC facets (Frequent Change, Unpredictability, and Challenging Work Demands) and EL or DL behaviours should be linked. Third, while DL and EL are often treated as contrasting opposites, there has been little investigation of both leadership styles in parallel, let alone in contexts of WEC. In summary, to date, both the conceptual models and empirical investigation of leadership in WEC lack maturity (Dinh et al., 2014; Uhl-Bien et al., 2007). Empirical research is therefore needed to explore which form of leadership leaders choose in association with WEC. Having substantiated a measurement instrument for WEC in Study 1, this present study aims to advance knowledge on the association between EL, DL, and WEC. Relatedly, little is known about which leadership style is most effective to manage complex circumstances (Brodbeck, 2002; Marion & Uhl-Bien, 2001; Marks et al., 2001). Investigating the relationship between EL, DL, and WEC is the first step towards establishing the effectiveness of different leadership styles. If an association can be found, subsequent studies may investigate how effective EL is with regards to the wellbeing and functionality of both leaders and employees, how these outcomes relate to DL, and how leaders adapt their leadership style as a consequence of changing WEC situations. Consequently, the motivation for the present study is to empirically explore this foundational claim, of whether WEC causes leaders to adopt a more participative, less directive leadership style.

Research question #1: *Is the level of Work Environment Complexity causal for leaders to adopt higher levels of empowering leadership?*

Research question #2: *Is the level of Work Environment Complexity causal for leaders to adopt lower levels of directive leadership?*

This study addresses the question of empowering vs. directive leadership in WEC more critically, as discussed in Chapter 2. While there are strong arguments for applying a less directive form of leadership, this section argues that this behaviour may still be beneficial in certain WEC situations, e.g. where a team needs direction, structure, a managerial “backbone”, or the mere feeling that someone is in control (e.g., Brodbeck, 2002). Moreover, it is argued that DL cannot be seen as the absolute opposite of EL, as findings on the relationship of the two styles have not been consistent (Ogbonna & Harris, 2000; Somech, 2006). There is a belief in psychology literature that direction and participation contradict each other (Sagie, 1997). However, while Wendt and colleagues (2009) report a negative correlation, several other related studies indicate that DL and EL may be non-correlated (Ogbonna & Harris, 2000) or mildly positively related (Judge et al., 2004; Sarin & McDermott, 2003; Somech, 2006). This would mean that the two styles do not exclude one another, but rather, both may simultaneously be applied to achieve the optimal outcome (Judge et al., 2004). Leaders might therefore adapt their approach with respect to the given situation (Baard et al., 2014), the requirements and maturity of employees (Sauer, 2011; Silverthorne & Wang, 2001; Yukl, 2013), or the team composition (Somech, 2006).

Thus, the choice of leadership behaviour in WEC might be a question of *as well* rather than *either or*. Insights from creativity research and the study of R&D teams are supportive of this assumption, finding that creative achievements and team performance often require a combination of both directive and participative leadership behaviours (Carmeli et al., 2013; Sarin & McDermott, 2003). In order to investigate the adoption of leadership style in WEC, this study compares the application of directive leadership and empowering leadership. Such a direct comparison will increase clarity regarding the association between DL and EL and overcome a limitation highlighted in leadership research, i.e. that singular leadership styles are studied in isolation (Yukl & Mahsud, 2010).

Research Question #3: *Are empowering leadership and directive leadership in WEC shown independently of one another?*

From a conceptual perspective, it is proposed that WEC will evoke a distinct pattern of leadership behaviour (more EL, less DL), yet the two leadership styles are largely independent of one another. A conceptual model in Figure 11 displays these propositions.

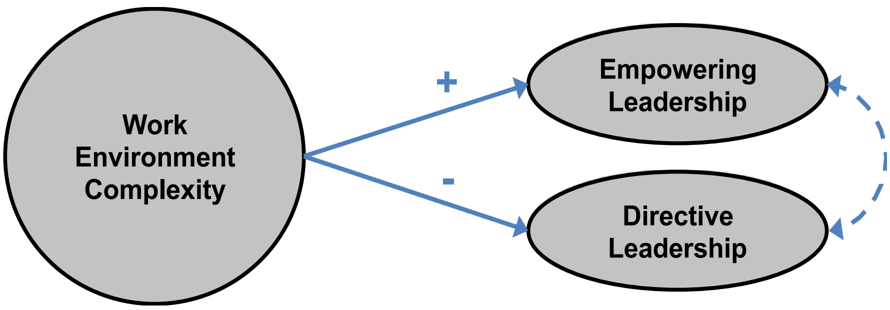

Figure 11. Conceptual Model of WEC, EL and DL.
Notes: Lines represent relations. The dotted line represents a small or absent correlation ($r < .2$) indicating independence of constructs.

A basic association between leadership styles and WEC could be tested in cross-sectional surveys. This study hypothesises, however, that WEC will have a causal effect on the adoption of leadership style. The state-of-the-art approach to this assumption is to work with a longitudinal research design that allows determining which variable causes influence on another variable. Hence, this study uses structural equation modelling (SEM) with quantitative field data in a two-wave, longitudinal study design approach for a more rigorous test of causality (MacCallum & Austin, 2000). It is proposed that the level of WEC in Time 1 will predict the level of leadership style shown in Time 2. However, reversed causality is possible: for example, leaders could be leading through less participation (Time 1), and the results of this behaviour, e.g. higher perceived workload, may in consequence change their perception of WEC (Time 2). Thus, to account for such alternative explanations of the data, this study tests the proposed model against alternative models as suggested by Jöreskog & Sörbom (1996). This is a suggested method for reducing confirmation bias, i.e. a prejudice towards confirming one's preferred model (MacCallum & Austin, 2000): instead of only analysing one's preferred, hypothesised model, one compares its characteristics statistically against several alternative models through use of so-called goodness-of-fit indexes. Such a research design is in line with authors such as Yukl and Mahsud (2010), who have criticised the use of "weak" research methods like cross-sectional survey studies with convenience samples when studying leadership behaviour. A longitudinal design also satisfies the appeals of complexity researchers to incorporate time into studies of complexity and leadership (Dinh et al., 2014; Uhl-Bien & Marion, 2009). Thus, both WEC factors as identified in Studies 1a-c (WEC-1 Frequent Change and Events and WEC-2 Uncertain Work Demands) as well both leadership styles (EL and DL) will be included simultaneously into one measurement model. This enables a comparison of causal relations directly to one another while controlling for the stability of the measures and the cross-sectional correlations between variables across two times of measurement (Waves). Specifically, the following hypotheses are posited:

Hypothesis 1a: Work Environment Complexity factor 1 in Wave 1 is positively associated with empowering leadership in Wave 2.

Hypothesis 1b: Work Environment Complexity factor 2 in Wave 1 is positively associated with empowering leadership in Wave 2.

Hypothesis 2a: Work Environment Complexity factor 1 in Wave 1 is negatively associated with directive leadership in Wave 2.

Hypothesis 2b: Work Environment Complexity factor 2 in Wave 1 is negatively associated with directive leadership in Wave 2.

The state-of-the-art-approach to investigating a causal relationship is to compare, using SEM, several so-called causal path models to each other, and to find the model with the best fit. Figure 12 presents the proposed hypotheses as a causal path model, which was tested in this study. Hypotheses 1a/b (for EL) and 2a/b (for DL) are represented by the paths from Wave 1 WEC-1/WEC-2 to Wave 2 EL and DL. In order to make assumptions on the significance of the proposed paths, other influences must be controlled for. This is done by including stability paths from Wave 1 to Wave 2 WEC factors, as well as from Wave 1 to Wave 2 empowering/directive leadership. This means that temporal stabilities of the study variables and random measurement error are controlled for in the analysis. Further, cross-sectional correlations are integrated into the model to control for the associations between variables at every measurement point, which accounts for influences on independent variables outside of the model (Schumacker & Lomax, 2004). This represents a more rigorous test of causality than could be achieved by cross-sectional analysis alone (MacCallum & Austin, 2000). The hypotheses can only be confirmed if this model's fit exceeds that of other models tested.

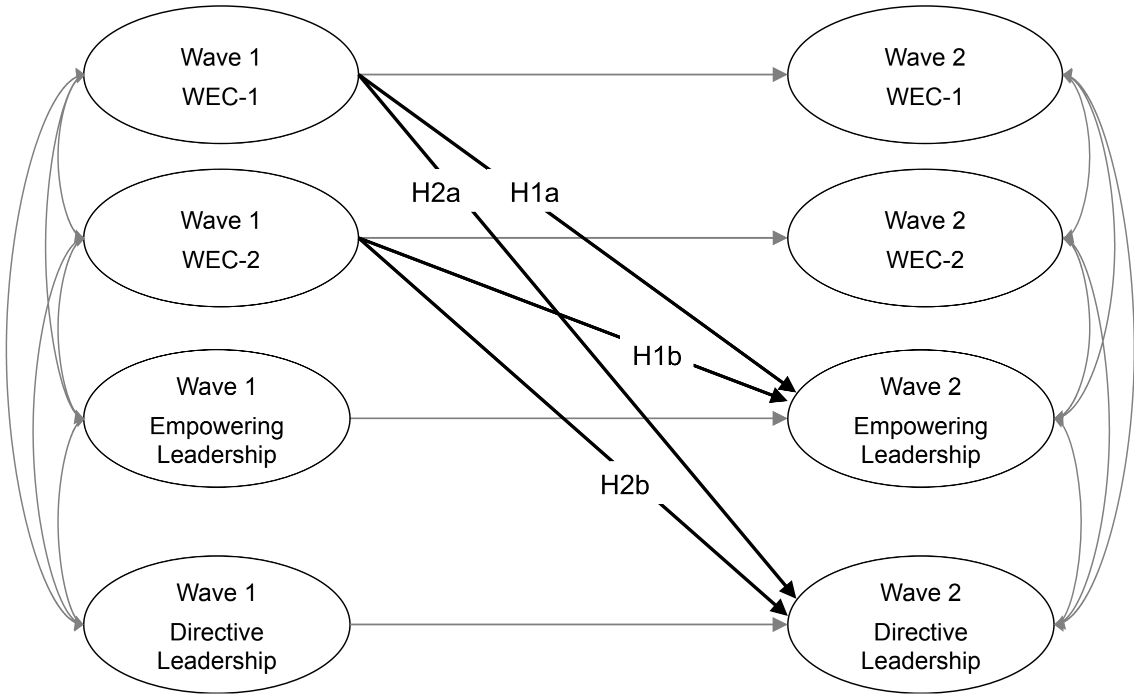

Figure 12. Hypothesised Causality Model Between WEC, EL, and DL Across Two Consecutive Points of Time.
Note. Hypotheses for the predictive relationships marked with H1a-H2b. Light grey one-directional arrows represent stability paths, two-directional arrows represent cross-sectional correlations.

Additionally, to investigate the proposition that the two leadership styles are independent, their correlation coefficients will be examined at each point of time. Following Hemphill's (2003) guidelines on the interpretation of correlation coefficients, this study thus proposes that the leadership styles are not correlated or weakly correlated at $r = < .2$. Thus, the third hypothesis is:

Hypothesis 3: *Empowering leadership and directive leadership are independent constructs, i.e. will show a correlation below r = .2 at both points of measurement.*

4.2 Study 2 Method

4.2.1 Participants and Procedure

Two different samples participated in the study. In both organisations, the same online survey was distributed as part of a voluntary change management survey. For each participant, data was gathered at the beginning of the change process in the respective organisation (Wave 1) and, in both cases, five months later during the on-going change process (Wave 2). Thus, the data is longitudinal with two points of measurement.

Sample A comprised 43 leaders from a hospital in Germany, which was undergoing a major change process. Wave 1 data of this sample was used for the EFA of Study 1b. 59 leaders originally participated in Wave 1 (response rate of 62.1%), 45 participated in Wave 2 (response rate of 47.4%). 43 leaders reported valid data on both points of measurement and were therefore retained for the study. 17 (35.8%) participants were leaders in the areas of nursing, 12 (28.3%) were in administrative leadership functions, 10 (20.8%) were doctors, and 4 (15.1%) were leaders in med-tech functions. Due to anonymity reasons of the overall survey, participants were not asked to report personal data such as age and gender.

Sample B comprised 74 leaders from a different, large healthcare organisation in Germany. This organisation was undergoing major change; two major clinic groups were merged at this point. This data was used in Study 1c, comprising 77 leaders. Three participants were further excluded from this present study due to missing data in the leadership measures. Thus, 74 leaders reported valid data on the two points of measurement and were therefore retained. 44 (59.5%) were leaders in medical top management, 30 (40.5%) were leaders in commercial top management. Again, age and gender were not asked. In total, the sample for this study comprised 117 leaders.

4.2.2 Measures

Work Environment Complexity (WEC). The WEC questionnaire was developed and validated in Studies 1a-c and measures the level of WEC for leaders. The two factors are labelled WEC-1 Frequent Change and Events (sample item: “Unexpected events occur on my job to a great extent”) and WEC-2 Uncertain Work Demands (sample item: “The work situation involves solving problems that have no obvious correct answer”). Participants could express their level of agreement on a 5-point scale from 1 (Disagree strongly) to 5 (Agree strongly). Internal consistency scores for the WEC obtained in the two-Waves design of Study 1c were Cronbach’s alpha = .72 / .73 for factor 1 (WEC-1), and .61 / .63 for factor 2 (WEC-2). The overall 7-item WEC Scale had a good internal consistency in both Waves with Cronbach’s alpha of .72. Applying an alternative measure, the model-based estimate of composite scale reliability (Raykov, 1997) was .80 / .84 for WEC-1, and .60 / .54 for WEC-2. Here again, the overall 7 item-WEC Scale showed good internal consistency with .83 for Wave 1 and .84 for Wave 2.

Empowering leadership. To measure leadership behaviour, the Ogbonna and Harris (2000) leadership style scale was chosen, as it incorporates subscales for both participative and instrumental leadership behaviour. This allows for a direct comparison of both constructs, as pursued by this study design. Empowering leadership, also referred to as participative leadership, was measured by 3 items adapted from the Ogbonna and Harris (2000) Participative Leadership Scale. Items were selected based on item loadings as reported by Ogbonna and Harris (2000), as well as the applicability to the work environment of the sample above. The scale attained internal consistency scores of .92, and .93 in previous studies, where the items were formulated from an employee’s point of view. For the purpose of this study, items were re-formulated to reflect a leader’s perspective. A sample item is “In this (work) situation, I find it especially appropriate to consult with my employees before taking action”. Participants could express their level of agreement on a 5-point scale from 1 (Disagree strongly) to 5 (Agree strongly).

Directive leadership. Directive leadership, referring to a directive and controlling leadership style, was measured by 3 items adapted from the Ogbonna and Harris (2000) Instrumental Leadership Scale. The authors reported internal consistency of .95, and .67 in previous studies. Again, items were re-formulated to evaluate a leader's perspective. A sample item is "In this (work) situation, I find it especially appropriate to decide what and how things shall be done". Participants could express their level of agreement on a 5-point scale from 1 (Disagree strongly) to 5 (Agree strongly).

4.2.3 Statistical Analysis

The proposed Causality Model (depicted in Figure 12) was tested by comparing its fit to the data with that of three alternative models. Thus, a total of four structural equation models were examined in comparison to one another.

The Stability Model (Model 1) states temporal stabilities between Wave 1 WEC and Wave 2 WEC, as well as between Wave 1 leadership style and Wave 2 leadership style. This model represents a static approach to the variable relationships, assessing the test-retest reliability of the variables WEC and leadership style across time. Changes in the variables are therefore explained merely through the measure's inherent temporal stability, method bias, and random error. Figure 13 depicts the Stability Model (Model 1).

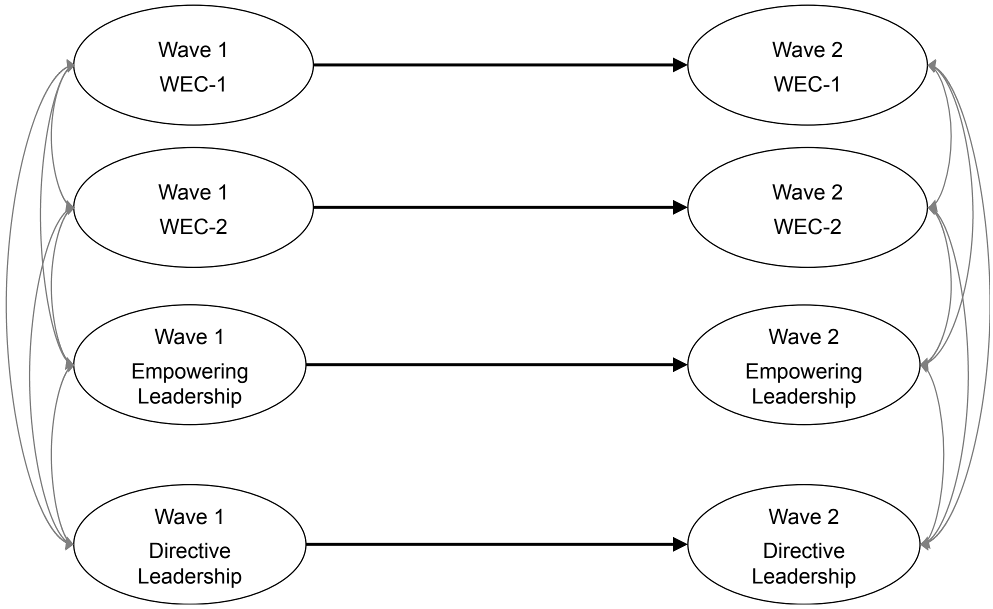

Figure 13. Alternative Stability Model (Model 1) between Work Environment Complexity, EL and DL across Two Consecutive Points of Time.

The hypothesised Causality Model (Model 2, see Figure 12 above) combines the paths of the stability model (Model 1) adding a causal, cross-lagged relationship from WEC Wave 1 to ELL (H1) and DL (H2) in Wave 2. As such, it proposes a predictive influence of WEC on leadership style across time, whilst simultaneously controlling for temporal stabilities.

The Reverse Causality Model (Model 3), in contrast, proposes a reversed causality effect: Based on the Stability Model (Model 1), it adds a cross-lagged path from the leadership styles Wave 1 to WEC Wave 2, indicating a predictive influence of the leadership styles on WEC, controlling for temporal stabilities. Figure 14 depicts the Reverse Causality Model (Model 3).

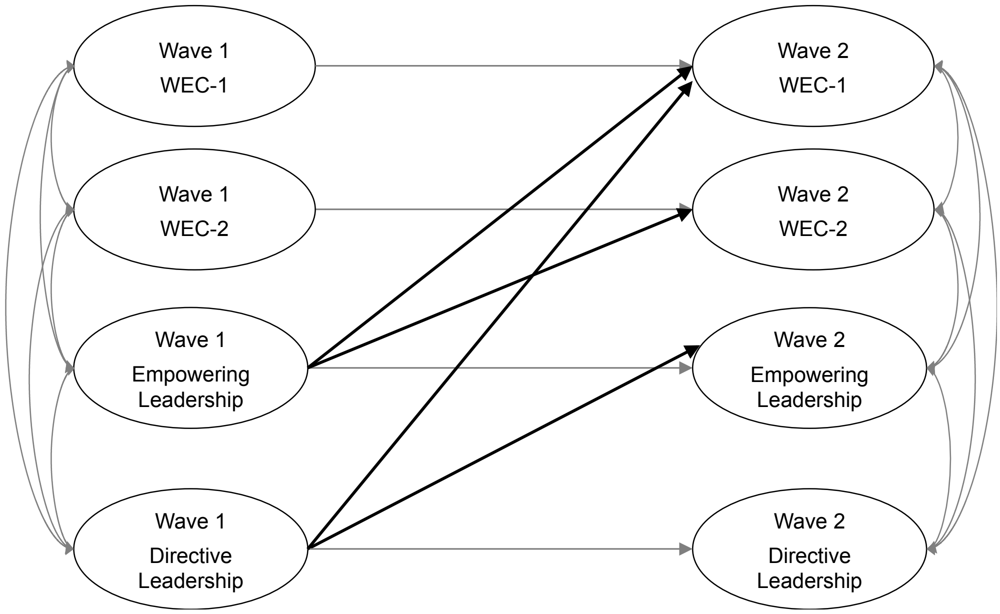

Figure 14. Alternative Reverse Causality Model (Model 3) between Work Environment Complexity, EL and DL across Two Consecutive Points of Time.

Lastly, paths of the Reciprocal Model (Model 4) are identical to the Stability Model but additionally include cross-lagged structural paths from Wave 1 WEC to Wave 2 leadership style as well as Wave 1 leadership style to Wave 2 WEC. Thus, it proposes for delayed reciprocal effects between the study variables of Wave 1 and 2, controlling for temporal stabilities. Figure 15 depicts the Reciprocal Model (Model 4).

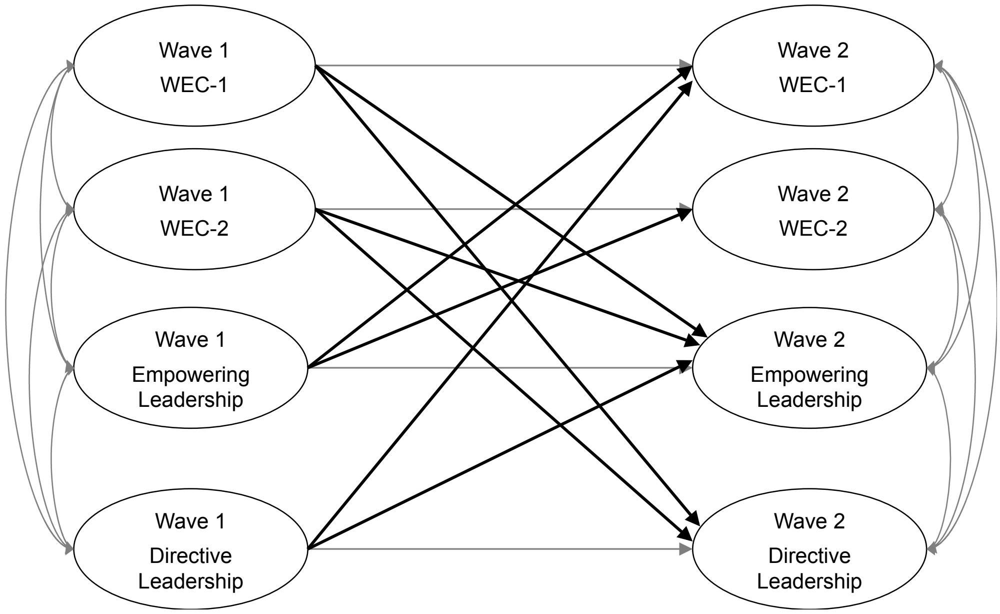

Figure 15. Alternative Reciprocal Model (Model 4) between Work Environment Complexity, EL and DL Across Two Consecutive Points of Time.

The respective model fit was inspected by using relevant goodness-of-fit indices in light of suggested cut-off values (Hu & Bentler, 1999; Schumacker & Lomax, 2004): The Root Mean Square Error of Approximation (RMSEA), with a value below .05 indicating good fit and values between .05 and .08 indicating adequate fit; supported by the respective RMSEA Confidence Intervals, and the test for RMSEA Close Fit (MacCallum, Browne, & Sugawara, 1996). The Standardised Root Mean Square Residual (SRMR) with values < .05 indicating good fit. The Comparative Fit Index (CFI) and the Non-Normed Fit Index (NNFI) with values > .95 indicating good, and values from .90 to .95 indicating adequate fit. Nested models were further compared to one another by means of the chi-square difference test (Jöreskog & Sörbom, 1996). As not all models were nested (Model 2 and 3), the Akaike information criterion AIC (Akaike, 1987) was additionally reported to compare different models. Smaller values of AIC indicate a better and more parsimonious fit.

The models were tested using structural equation modelling in LISREL 8.8

(Jöreskog & Sörbom, 2006). In all models, Work Environment Complexity (WEC-1 and WEC-2) in Wave 1 and 2, and the leadership styles (EL and DL) in Wave 1 and 2 were defined as latent variables, and their respective constituent items were defined as congeneric indicators. For each latent variable, one of the indicator factor loadings was fixed to 1.0. In all models, the individual item errors were allowed to co-vary across the two administrations (the measurement error of an EL item in Wave 1 was allowed to co-vary with the same item's measurement error in Wave 2) so as to account for the method variance of each item (Pitts et al., 1996). The covariance errors of items within the factors were set free among several items as suggested by LISREL modification indices, hereby only allowing for modifications within, not between factors (Schumacker & Lomax, 2004).

4.3 Study 2 Results

4.3.1 Data Description

Table 20 displays descriptive statistics of the study variables. All scales had satisfactory internal consistency above the generally accepted threshold of Cronbach's alpha = .7 at both measuring points with the exception of DL in Wave 2 as well as WEC-2 in both Waves. As Cronbach's alpha is becoming a more and more disputed concept (e.g., Cortina, 1993), an alternative measure for composite scale reliability was additionally calculated which is based on items' standardised factor loadings and their respective error variance (Colwell, 2016; Raykov, 1997).

WEC-1 Frequent Change and Events correlated positively and significantly with EL within Wave 1 (r = .34), within Wave 2 (r = .27), and cross-lagged across time (WEC-1 Wave 1 with EL Wave 2, r =.36). For WEC-2 Uncertain Work Demands, the correlation with EL was positive but not significant within Wave 1 (r = .13), positive and significant within Wave 2 (r = .32), and close to zero across time (r

= -.01).

With DL, WEC-1 correlated close to zero within Wave 1 (r = -.03) and across time (r = .08), the correlation within Wave 2 was negative and significant (r = -.17). For WEC-2, the correlation with DL was negative and significant within Wave 1 (r = -.16), within Wave 2 (r = -.19), and close to zero across time (r = .02).

Correlations between WEC-1 and WEC-2 were moderate and significant at Wave 1 and Wave 2 (r_{w1} = .34, r_{w2} = .40), similarly to the findings of Study 1c indicating that both were related but distinct constructs. Correlations between EL and DL were close to zero at Wave 1 and Wave 2 (r_{w1} = .01, r_{w2} = .09). In support of Hypothesis 3, this indicated that both are independent constructs.

Comparing the level of EL and DL, t-tests indicated that there was a significant difference in the scores for EL (M_{w1} = 4.03, SD_{w1} = 0.76; M_{w2} = 4.11, SD_{w2} = 0.75) and DL (M_{w1} = 3.74, SD_{w1} = 0.73; M_{w2} = 3.59, SD_{w2} = 0.72) in Wave 1 (t (232) = 2.96, p < .01) and Wave 2 (t (232) = 5.41, p < .000). This implies that on an absolute level, significantly more empowering leadership than directive leadership was shown in both waves.

Test-retest reliabilities across the waves of were weak for WEC-1 and WEC-2 (r = .15 and r = .12), EL (r = .14) and close to zero for DL (r = -.02). This indicates that they cannot be assumed to be stable across time. The implications of these results will be discussed in the Study 3, examining how leadership styles may be adapted in light of changing WEC.

Table 20: Study 2 - Means, Standard Deviations, Correlation Coefficients, and Cronbach's Alpha/Raykov's Composite Scale Reliability Coefficients (in parentheses)

Variable	*M*	*SD*	*Wave 1*				*Wave 2*			
			1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*
Wave 1										
1. WEC-1	3.87	0.76	(.76/ .78)							
2. WEC-2	2.84	0.75	.34**	(.64/.64)						
3. EL	4.03	0.76	.26**	0.13	(.70/.70)					
4. DL	3.74	0.74	-0.03	-.16*	0.01	(.73/.74)				
Wave 2										
5. WEC-1	3.89	0.72	0.15	0.07	.18*	0.00	(.76/.78)			
6. WEC-2	2.75	0.70	0.12	0.01	0.04	-0.04	.40**	(.65/.67)		
7. EL	4.11	0.75	.36**	-0.01	0.14	0.05	.27**	.32**	(.73/.75)	
8. DL	3.59	0.72	0.08	0.02	0.07	-0.02	-.17*	-.19*	0.09	(.66/.69)

Note. n = 117. WEC-1= WEC Factor 1 "Frequent Change and Events"; WEC-2= WEC Factor 2 "Uncertain Work Demands"; EL = Empowering Leadership; DL = Directive Leadership. Range of the response scale: 1-5. * $p < .05$; ** $p < .01$.

4.3.2 Model Testing

Table 21 presents the goodness-of-fit indices of all four competing models. All chi- square tests were significant indicating that all models did not strictly fit. However, the goodness-of-fit indices indicated mediocre to adequate fit for all four models. The Causality Model (Model 2, AIC = 564.59) outperformed the Stability Model (Model 1, AIC = 568.65; Delta $\chi^2(3) = 15.9$, $p < .01$). The Reverse Causality Model (Model 3, AIC = 570.14) did not outperform the Stability Model (Delta $\chi^2(3) =$ 4.63, $p = .201$) nor the Causality Model (AIC = 564.59), indicating that the reverse causal relations were not superior to the causal relation. Finally, the Reciprocal Model (Model 4, AIC = 569.29) outperformed Model 1 (Delta $\chi^2(8) = 19.63$, $p < .05$) and Model 3 (Delta $\chi^2(5) = 15.00$, $p < .05$), but not the hypothesised Model 2 (Delta $\chi^2(5) =$

3.73, p = .589). In all, the hypothesised Causality Model (Model 2) was the best fitting and most parsimonious model out of the four models.

Table 21: Study 2 - Goodness-of-fit Indices of Competing Structural Equation Models for the Two WEC-factors WEC-1, WEC-2, EL and DL

Model	χ^2	*df*	*p*	RMSEA	RMSEA Interval	RMSEA Close Fit	SRMR	NNFI	CFI	AIC
Model 1: Stability Model	455.27	273	.00	.066	[.053; .079]	.024	.11	.80	.83	.568
Model 2: Causality Model	439.37	270	.00	.065	[.051; .078]	.036	.11	.81	.84	.564
Model 3: Reversed Causality Model	450.64	270	.00	.066	[.053; .079]	.025	.11	.79	.83	.570
Model 4: Reciprocal Model	435.64	265	.00	.066	[.052; .079]	.032	.10	.80	.84	.569

Note. n = 117. χ^2 = Chi-square; *df* = Degrees of freedom; RMSEA = Root Mean Square Error of Approximation; RMSEA Close Fit = RMSEA Interval close fit test significant at $p < .05$; SRMR = Standardised Root Mean Square Residual; NNFI = Non-Normed Fit Index; CFI = Comparative Fit Index; AIC = Akaike Information Criterion. Light grey shadows indicate model with overall best and most parsimonious fit.

Figure 16 depicts the estimated Causality Model (Model 2) with standardised path coefficients and latent variable factor loadings. The standardised path coefficients supported the causality assumption for EL (H1a, H1b), yet one was in the opposite direction: WEC-1 positively and strongly predicted EL across time (H1a), whereas WEC-2 negatively predicted EL across time (H1b). For DL, the standardised path coefficients were not significant, thus did not support the hypotheses: WEC-1 did not significantly predict DL across time (H2a), neither did WEC-2 (H2b).

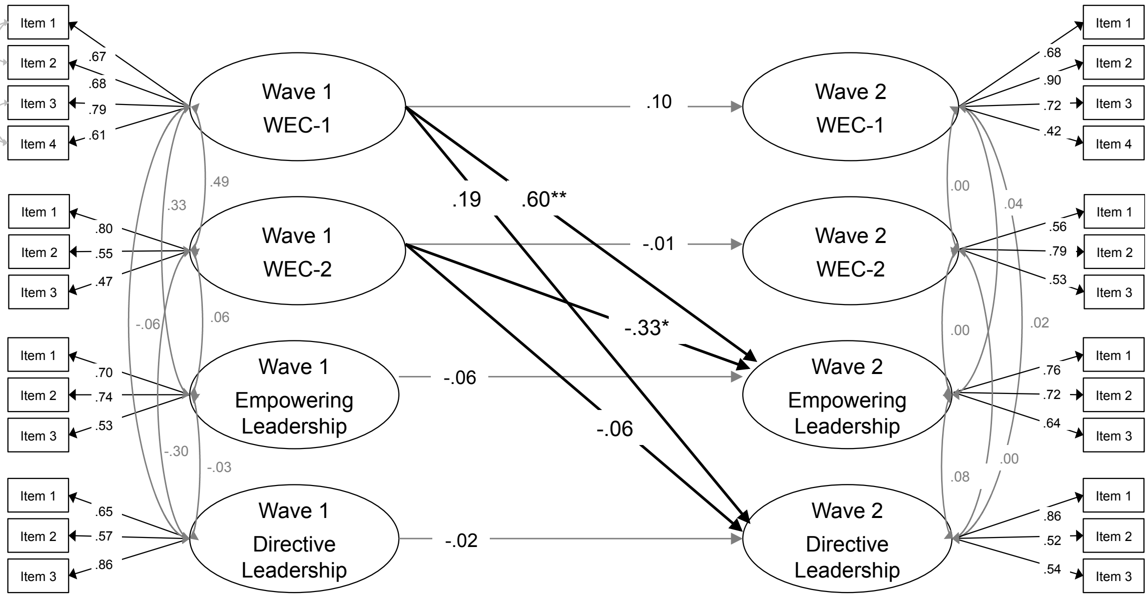

Figure 16. The Final Work Environment Complexity, Empowering Leadership, and Directive Leadership Causality Model (Model 2) with Standardised Path Coefficients and Factor Loadings of the Latent Variables.
Note: Longitudinal error covariance between the waves not displayed for ease of reading. Grey bidirectional arrows represent standardised cross-sectional correlations. Light grey bidirectional arrows represent added item error covariance as suggested by modification indices.
* $p < .05$ (2-tailed); ** $p < .01$ (2-tailed).

4.4 Study 2 Discussion

This study was the first to apply the Work Environment Complexity Scale and empirically relate it to the adoption of leadership style. It contributes to understanding leadership in WEC in several ways.

Firstly, findings suggest that WEC was causal to predict a leader's adoption of EL. In other words, results suggest that the amount of WEC a leader faces influences the amount of EL a leader will show. This study used a state-of-the art longitudinal SEM design to assess the proposition that the complexity of the work environment had an influence on the leader's choice of leadership style. As hypothesised, factor WEC-1 Frequent Change and Events in Time 1 significantly predicted a higher level of EL in Time 2. Also, *t*-test results indicated that on an absolute level, more empowering than directive leadership was shown. These findings are in line with previous WEC research arguing for the application of more EL in WEC – in other words, to “lead by loosening control” (Karp & Helgø, 2008, p. 90). Interestingly, and contrary to the hypothesis, for WEC-2 a leader showed significantly *less* EL as a result of facing Uncertain Work Demands (yielding partial support for H1b). This contradicts the broad theoretical agreement on empowering leadership as the “leadership style of choice” in the face of complex work environments. Moreover, the Causality Model indicated a *positive*, yet non-significant, path from WEC-1 to DL, indicating that more DL was shown. For WEC-2, the relation was close to zero. Thus, results suggest that WEC was not, or was hardly, causal for a leader’s adoption of (less) instrumental leadership behaviour. Further, these findings reveal support for the assumption that in WEC, participation and direction supplement each other and consequently can be shown independently of each another.

These results further suggest that the two WEC factors play different roles in the prediction of leadership style; in contexts of frequent change and unexpected events (WEC-1), leaders are likely to choose more empowering, and in tendency (yet *ns*) also more directive leadership behaviour. Future research could study the outcomes of these behaviour patterns, for example: How will (more) participative leadership influence a leader’s wellbeing and functionality when leading in contexts of WEC, and specifically in WEC-1? Will empowerment relate positively to employee variables such as increased creativity, engagement, self-efficacy, and wellbeing (Amabile et al., 2004; Donaldson-Felder et al., 2013; Zhang & Bartol, 2010) under circumstances of WEC? Will this form of complexity leadership also correlate with hard-fact results, such as performance criteria and organisational innovation? Also, research on creativity in fast-changing environments has suggested that a leader plays a central role in establishing a climate of psychological safety (Kahn, 1990).

In contrast, factor WEC-2, Uncertain Work Demands, predicted less EL, and appeared not to affect the adoption of DL. This finding stands in contrast to the predominant theoretical rationale. An interpretation could be that in the face of frequent change (WEC-1), leaders know or assume it to be beneficial to show more participative leadership behaviour, and act accordingly. When facing uncertain work demands such as novel, challenging problems (WEC-2), however, it is less clear which leadership behaviour to adopt, resulting in a decrease of EL, but no consequent increase in the alternative investigated behaviour of DL. While this supports the hypothesis on a non-significant association between the two styles (H3), an explanation is needed as to which leadership style could be most appropriate for WEC-2. This finding could mean that leaders instead turn to another leadership behaviour not covered in this research design, for example a more content-related leadership style based on functional expertise or technical know-how. These assumptions could be examined in future research.

As less of one behaviour, but not consequently more of another, is shown, this could also imply that WEC-2 evokes a leadership “vacuum”, meaning that leaders may be so overwhelmed by the challenge that they recoil from leading to some extent. Dóci and Hofman (2015), as well as Berman and Korsten (2010) have already raised such concerns. Section 2.7.1 has identified a loss of control as a potential threat to the functionality of leaders; this could potentially cause leadership withdrawal. This would, presumably, have strong detrimental effects for the success of a team or organisation, as leadership withdrawal or passivity have been found to put the wellbeing of leaders and their teams at risk (Zopiatis & Constanti, 2010). Future research could explore this phenomenon, e.g. by studying a leader’s level of confidence and control when facing uncertain work demands. Finding a “leadership vacuum” would have major implications for practitioners, for example in change management and leadership training which would have to be aimed at equipping leaders for the challenge of leading in WEC-2.

This project contributes to the understanding of leadership in WEC by, for the first time, contrasting empowering and directive leadership simultaneously in the context of WEC. Previous literature had analogised the two leadership styles as an opposing, *either or*-choice, implying that a leader in WEC could – simply put – either lead by participation (which would be beneficial) *or* by direction (which would be detrimental) (e.g., Ashmos et al., 2002; Karp & Helgø, 2008). Insights from fields outside WEC had, however, demonstrated that the relation between the two styles was not as clear (Judge et al., 2004; Lawrence et al., 2009; Wendt et al., 2009). This study has contributed empirically, finding the two styles to be independent constructs. This implies that both can be shown simultaneously. In other words, if a manager leads through more participation, this does not automatically mean he or she will lead less instrumentally. In fact, for WEC-1, both leadership styles were heightened in response (DL, however, being *ns*). While a number of theoretical arguments (outlined in Chapter 2) argue for applying less DL in the face of WEC, and this study finds that the absolute level of DL was significantly lower than EL, this study has broadened the debate on DL as an independent leadership style. It argues that there could be valid reasons for a manager to use DL, e.g. to maintain some stability and order in times of turbulence (e.g., Brodbeck, 2002); or to uphold a feeling of security (Karp & Helgø, 2008). Future research should therefore treat DL as a supplementary behaviour to EL. It could, for example, explore which (cognitive) rationales drive leaders to use the one, the other, or both leadership styles in WEC. Also, recent research has explored the effectiveness of "leadership patterns" that combine behaviours from more than one style (e.g. transactional *and* transformational leadership behaviours in combination) (Arnold et al., 2017). A similar approach could be taken to combine behaviours of both EL and DL into a new cluster, and explore its relation to effectiveness measures such as profitability, employee engagement and creative achievements in high-complexity contexts.

Another interesting finding of this study is that test-retest reliabilities across the waves were weak for WEC-1 and WEC-2, for EL, and close to zero for DL, implying that neither of the variables can be seen as stable constructs. Model testing supported this, as the temporal stability model (Model 1) underperformed against all other models. This supports the characterisation of WEC as a state and adjustable individual perception (Amabile et al., 1996), as repeated measures were gathered in the course of major organisational change. In such context, if stronger re-test reliabilities had been found, one could instead claim that WEC is a mindset or a personality variable.

Further, this indicates that leaders will not show the same leadership style steadily over time. Instead, leaders might be adjusting their style to the necessities of the given situation. This is in line with previous research investigating a leader's adaptability in complex work environments, outlined in section 2.5 (Yukl & Mahsud, 2010). Having obtained these results, further research should study whether and when managers flexibly adjust their leadership style depending on the nature of WEC. Consequently, Study 3 will investigate the adaptive response of leadership behaviour in the face of changing WEC.

Finally, this study has contributed through its methodological design, choosing to apply a longitudinal, two-wave design with field data and the simultaneous investigation of two leadership styles. Testing alternative longitudinal models through SEM constitutes a state-of-the-art method to approach the testing of causality. The causal effects would not have been revealed by a purely cross-sectional or correlative approach. This supports calls for longitudinal models and the investigation of more than one leadership style (Yukl & Mahsud, 2010), and especially in the context of complexity research (Dinh et al., 2014; Uhl-Bien & Marion, 2009).

Practical implications lie in leadership training and organisational design. Following the predominant theoretical opinion (e.g., Burnes, 2005; Correia de Sousa & van Dierendonck, 2014; Karp & Helgø, 2008; Marion & Uhl-Bien, 2001; Mumford et al., 2000; Osborn & Hunt, 2007; Styhre, 2002; Uhl-Bien et al., 2007), as well as some of the patterns uncovered in this study, leadership training for WEC should create awareness that EL appears to be a strong approach for leading in WEC – especially when facing turbulent change and frequent, unexpected events (WEC-1). Therefore, management training for WEC should strengthen a leader's skills of delegation, involving others, passing on responsibility, and perspective-sharing. Even though not all mechanisms of EL and WEC have yet been established, it is likely that this will benefit the team and employees by enhancing creativity, self-organisation, wellbeing, a sense of purpose, and by developing the skill set of team members (Amabile et al., 2004; Correia de Sousa & van Dierendonck, 2014; Lee et al., 2018; Yukl, 2013; Zhang & Bartol, 2010). In turn, a strong DL style *alone* seems not to be appropriate to lead within WEC. This could be especially relevant for training managers that have in the past led largely through a directive or controlling style, e.g. coming from traditional hierarchical organisations. The special distinctiveness of management training for WEC will, however, lie in creating awareness that the two styles can be executed simultaneously. This seems especially relevant for the understanding of DL, which has been brushed aside as being "old-fashioned" or "out-dated" (e.g., Brodbeck, 2002; Karp & Helgø, 2008). As this study has argued, DL should be seen as a supplement to EL. Findings for WEC-1 support this. However, having obtained the finding that leaders reduce EL in the face of WEC-2 Uncertain Work Demands, more thorough empirical investigation is required before concrete recommendations can be made. For this purpose, Studies 3 and 4 will explore both EL and DL in the face of complex work, including the study of specific patterns in WEC-2.

A second practical implication addresses organisational structure. When arguing that empowerment equips leaders to manage WEC, organisational decision-making practices will have to allow for and foster participative behaviour. This can, for example, be achieved by implementing non-hierarchical mechanisms of decision-making, such as democratic polls on organisational resolutions, heterogeneous cross-unit circles of problem-solving, as well as creative spaces and "laboratories". Where responsibility is passed down to many others, and where novel, creative solutions are to be found, errors and missteps are likely to occur, and an organisation's culture for handling mistakes will have to allow for trial and error. Performance management could reward leaders for participative behaviour, for example for developing the personal responsibility of team members without having to be closely supervised.

Thirdly, implications lie in the field of change monitoring and organisational diagnostics. Studies 1a-c suggest that the WEC Scale can be used as a tool for evaluating the level of complexity within an organisation. The longitudinal view in this present study has revealed findings that would not have been obvious by cross-sectional analysis alone. The suggestion is to use the WEC Scale regularly in organisational diagnostics, e.g. in staff surveys, together with determining the levels of relevant leadership styles. This would allow an organisation to assess and regularly monitor, whether the current leadership style(s) shown by managers were well-suited for the level of WEC, or whether interventions such as leadership awareness programs, change management, or training measures would be advisable.

4.5 Study 2 Limitations

Several limitations of the present study should be addressed. Firstly, this study benefitted from a longitudinal sample, but whilst a two-wave design can indicate causal effects and present a more rigorous test for causality than cross-sectional analysis (MacCallum & Austin, 2000), it cannot fully claim causality (Weston & Gore, 2006). For instance, another variable (or variables) not covered or controlled for in this study could be intervening (MacCallum & Austin, 2000). A second limitation is that the tested models in general, including the final Causality Model, only showed mediocre to adequate model fit, as suggested by the common fit indices (Hu & Bentler, 1999). This may be explained by the procedure of rigorous causality testing. This method requires adding stability paths in the model (MacCallum & Austin, 2000), even if stability is not explicitly assumed. This prerequisite may have weakened the overall model fit. Thirdly, the data had in parts already been used for the validation of the WEC construct and consisted of two comparatively small samples that were combined to a sample size of 117 leaders. While it is considered to be a strength of this study that field data was collected instead of an experimental or student sample (e.g., Dóci & Hofmans, 2015), findings should be replicated on different and larger samples. Similarly, all leaders came from a healthcare environment, which partly limits the generalisability to different fields. Expanding research into other branches is therefore advised. Fourthly, the measures of WEC-2 in both waves and for DL in Wave 2 did not reach an entirely satisfactory level of internal reliability. A closer look into this should be taken in further research. Finally, the leadership styles were obtained by self-reports, where individuals evaluated the appropriateness of their own leadership behaviour in WEC. It is the nature of self-report measures that they may be subjectively biased (Podsakoff et al., 2003). Truly proving that behaviour is actually shown will therefore require additional, external ratings, such as supervisor behaviours rated by employees or through behavioural observation studies.

4.6 Study 2 Conclusion

This study contributes empirical links between Work Environment Complexity and the adoption of leadership style, and with this sets the path for further research on the topic. The core finding is that the level of WEC appears to influence the amount of empowering leadership a leader shows, and seems to less strongly affect a leader's adoption of directive leadership. This strengthens the assumption that DL and EL are leadership styles that can be shown independently of one another in WEC. Furthermore, the two WEC factors appear to have a different influence on the respective adoption of leadership behaviour. The results will serve as a foundation for the subsequent studies in this thesis, especially with regard to the adaptation of leadership behaviour in the face of WEC (Study 3) and for examining questions of leader wellbeing and functionality (Study 4). Relevant practical implications of this current study include a call for leadership development programmes to promote balanced management skills, more participative organisational structures when facing WEC, and an application of the WEC Scale for organisational diagnostics.

Chapter 5 – Study 3: Adaptive Leadership Behaviour in Work Environment Complexity

5.1 Introduction

The previous study investigated the effect of Work Environment Complexity (WEC) on the adoption of empowering leadership (EL) and directive leadership (DL). Findings indicated that the level of WEC predicted the level of participative leadership behaviour, and altogether did not predict DL behaviour. On an absolute level, leaders in the face of complex working environments showed more EL and less DL. Furthermore, the two WEC-factors appeared to evoke different patterns of behaviour.

Additionally and interestingly, the findings of Study 2 revealed low re-test-reliabilities for the leadership measures from Wave 1 to Wave 2. This implies that leaders did not apply the same leadership style steadily across time, but appeared to modify it depending on the WEC situation they were facing. Going beyond the investigation of a pure association of leadership styles (as explored in Study 2), this finding invites a closer inspection of the topic of *adaptive leadership in WEC*. Will leadership styles be changed in response to the respective WEC-situation? It is in line with previous literature to suggest that in order to manage complex, diverging, and changing contexts, leadership behaviour has to be flexible so as to respond to situational demands (e.g., Uhl-Bien et al., 2007). Following from the discussion in Chapter 2, a complex work environment is a context especially relevant for adaptability, and also likely to evoke adaptive behaviour (B. Griffin & Hesketh, 2003; Pulakos et al., 2000). However, the conceptual model as well as the empiric evidence behind adaptive leadership and WEC are limited for several reasons. In general, considerably less is known about leaders' adaptivity than that of employees (Baard et al., 2014), let alone in the context of WEC. Second, as long as the characteristics of WEC have not been clearly outlined, the explanatory models behind *if* and *why* individuals would adapt to them, remain significantly limited (Baard et al., 2014). Section 2.4.1 has demonstrated this bypassing strategy – finding that "complexity" of a context is, to date, often simply assumed, not measured. It is not yet clear which environmental factors trigger leadership adaptivity, and whether complexity is one of them (Baard et al., 2014). Having established the WEC construct in Study 1, this present study can for the first time apply the characterisation of a frequently changing, unpredictable and demanding work context and explore the relationship with an adaptive leadership response. Thirdly, as long as longitudinal research around complexity and adaptivity has still not been conducted, a reverse causality cannot yet be ruled out. Until this is known, a work environment may be complex *because* a leader is adapting. This study will apply a longitudinal research design to overcome this limitation by comparing models that assume both causal relationships (a model with the hypothesised causal relationship and a model with reverse causality).

Finally, there are still varying approaches of how to conceptualise adaptive leadership (Baard et al., 2014; Ployhart & Bliese, 2006; Yukl & Mahsud, 2010). Having found in Study 2 that leaders do not seem to show stable levels of EL and DL across time, it is clear that more detailed investigations are needed. An example of the necessity for the adaptive balance between EL and DL in WEC is "of knowing when to be highly visible to catalyse others and when to be invisible to enable others" (Uhl-Bien & Arena, 2017, p.18). In this line of thought, this present study investigates adaptive leadership in WEC as *an adaptive combination of both empowering and directive leadership as a consequence of changing WEC across time* (see e.g., Lane & Down, 2010; Sagie, 1997; Uhl-Bien & Arena, 2017; Zhang et al., 2015). In other words, this research project empirically studies for the first time whether the changing context of WEC will evoke an adaptive response in leadership behaviour (e.g., Baard et al., 2014; Zaccaro et al., 2009). Having found in Study 2 that the two WEC factors seem to have different influence on the general adoption of leadership style, another question is whether the two factors will also evoke a different *adaptive* response. In summary, this research will expand the understanding of how leaders behave in the face of complex work settings, and will shed more light on the question of how environmental factors trigger an adaptive response. From this, practical implications could be derived, e.g. for training managers to effectively master situations of (changing) WEC. The research questions for this study are:

Research question #1: *Are empowering and directive leadership adapted across time as a response to changing WEC; and if yes, how are they adapted?*

Research question #2: *Do the two WEC-factors evoke different patterns of adaptation across time in empowering and directive leadership?*

Previous research on adaptive performance has largely been conducted in laboratory settings and with cross-sectional data (Baard et al., 2014). Thus, it appears as promising to work with field-based data and longitudinal designs in order to investigate this topic and rule out alternative explanations for adaptivity in WEC (e.g. reverse causality). If leadership behaviour were adapted to the transforming nature of WEC, this should be measurable through a longitudinal examination (Baard et al., 2014). This also fits with the need to apply longitudinal designs in complexity leadership research (Dinh et al., 2014).

In WEC, change is an inherent characteristic. Testing for a causal effect of WEC on the adaptation of leadership behaviour will require examining longitudinal data at two points in time, which reflect the level of change within WEC for each individual. As WEC is conceptualised as a state, a leader’s perception of WEC could increase over the course of some months and between two points of measurement, e.g. if new challenges or crises arise. It could also decrease, e.g., as certain transformations settle into routine behaviour or complex problems are solved. In line with the assumptions of flexible leadership research, a leader should adapt his or her behaviour to relevant changes in the environment (Gebauer, 2013; Uhl-Bien & Arena, 2017; Yukl & Mahsud, 2010). It is plausible to assume that a change in the level of a leader's WEC triggers an adaptive response. Knowing that changes in environment are likely to cause adaptive behaviour (e.g., Amabile et al., 1996; Baard et al., 2014; Griffin et al., 2007), it is assumed that when changes (delta, Δ) in WEC across time are larger, leaders will adapt their leadership style more strongly. Hence, the first hypothesis is:

Hypothesis 1: *Stronger changes in Work Environment Complexity from Wave 1 to Wave 2 (ΔWEC-1 and ΔWEC-2) will predict stronger changes in leadership behaviour (ΔEL and ΔDL).*

This hypothesis includes the possibility of two different patterns: the change in leadership behaviour could either be of a linear or curvilinear nature. A significant *linear* relationship would imply that changes in WEC predict a gradual, one-directional increase (or decrease) in leadership behaviour across time. For instance, with growing complexity across time, a leader could be responding with more empowering leadership. This assumption is supported by research suggesting that the more *challenging* a work environment becomes, the more a flexible response is needed (e.g., B. Griffin & Hesketh, 2003; Petrou et al., 2018; van Dam et al., 2013). A *curvilinear* relation, however, is also possible. It would indicate that leadership behaviour is adjusted at more than one point of time, i.e. it is adjusted *whenever* a change in WEC occurs, irrespective of whether the WEC-level increases or decreases. This could be explained by the argument that changes or ruptures in environments are likely to trigger an adaptive response (e.g., Ployhart & Bliese, 2006; Yukl & Mahsud, 2010). In this case, one could expect the leadership response to follow a U-curve shape (= highest adaptation whenever changes in WEC are strongest). Since both relationships would be indicative of an adaptive response, and as more often than not curvilinear insights are overlooked in organisational psychology (e.g., Antonakis, House, & Simonton, 2017), both patterns will be tested for.

More specifically:

H1a: *ΔWEC-1 will have a significant linear relation with ΔEL.*

H1b: *ΔWEC-1 will have a significant linear relation with ΔDL.*

H1c: *ΔWEC-2 will have a significant linear relation with ΔEL.*

H1d: *ΔWEC-2 will have a significant linear relation with ΔDL.*

H1e: *ΔWEC-1 will have a significant curvilinear relation with ΔEL.*

H1f: *ΔWEC-1 will have a significant curvilinear relation with ΔDL.*

H1g: *ΔWEC-2 will have a significant curvilinear relation with ΔEL.*

H1h: *ΔWEC-2 will have a significant curvilinear relation with ΔDL.*

Study 2 found different patterns of leadership styles related to the two WEC-factors. This finding might shed more light on the question of which environmental factors are especially likely to cause an adaptive response (Baard et al., 2014). WEC-1 Frequent Change and Events predicted a significant increase in EL as well as a weak (*ns*) increase in DL. In contrast, WEC-2 Uncertain Work Demands predicted significantly less EL, and no increase in DL. The interpretation is that it might be less clear which leadership behaviour is appropriate for WEC-2 and that this could result in a leadership “vacuum”, where managers withdraw from leading. These findings suggest that WEC-2 represents a particular challenge for leaders. Knowing that especially challenging contexts evoke adaptivity (B. Griffin & Hesketh, 2003; Petrou et al., 2018; van Dam et al., 2013), facing WEC-2 might result in an especially strong adaptation of leadership style. Therefore, the second hypothesis for this study is:

Hypothesis 2: Adaptation of leadership style will be stronger for changes in WEC-2 than for WEC-1, i.e. the explained variance of ΔEL and ΔDL will be higher in WEC-2 than in WEC-1.

From a conceptual perspective, a change or delta (Δ) in Work Environment Complexity across time is likely to evoke a change or delta (Δ) in leadership behaviour across time (i.e. higher/lower levels of a leadership style). The more change there is within WEC, the higher the adaptive response is likely to be. Further, due to its challenging nature, the adaptation response for WEC-2 is hypothesised to be especially high. Figure 17 depicts a conceptual model of these propositions.

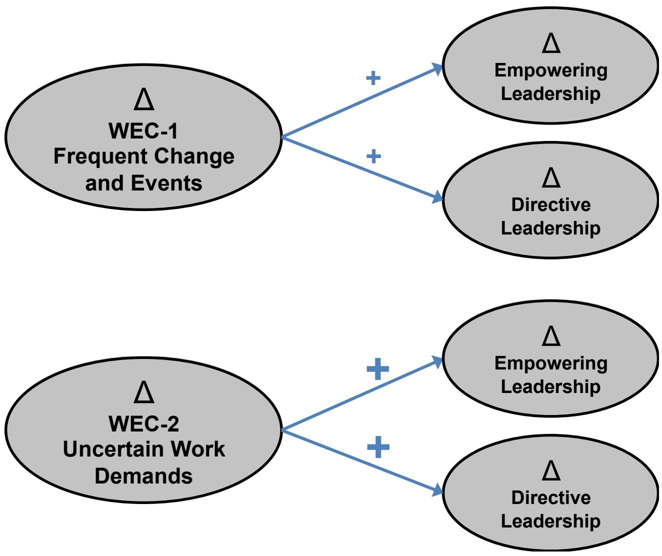

Figure 17. A Conceptual Model of Work Environment Complexity and Adaptive Leadership.
Notes: Delta (Δ) represents changes in the constructs across time. Larger “plus”-symbols represent a larger effect.

5.2 Study 3 Method

Participants, procedure, and measures were identical to those of Study 2. The longitudinal sample consisted of 117 leaders with data from two points in time (Wave 1 and Wave 2).

5.2.1 Statistical Analysis

To test the hypothesis of an adaptive response of leadership style when changes in WEC occurred, for each participant the delta (Δ) value of WEC-1, respectively WEC-2, between the two points of measurement was calculated. For this, the WEC-scores of Wave 1 were subtracted from those of Wave 2. This yielded two new variables, ΔWEC-1 and ΔWEC-2, representing the *change in WEC* across time. A positive delta value indicates that WEC for the individual has increased from Wave 1 to Wave 2, and larger values depict larger increase. A negative delta value suggests that WEC has decreased across time, with larger negative scores indicating larger decrease. A delta value of 0 indicates that the level of WEC has not changed between the two points of time. Similarly, the delta scores for EL and DL were calculated, yielding the variables ΔEL and ΔDL to indicate the *change in leadership behaviour* (i.e., higher/lower levels of leadership behaviour).

Hierarchical Multiple Regression (HMR) analyses were calculated with change in leadership style (ΔEL and ΔDL) as dependent variables. To control for ceiling effects, the WEC-scores of Wave 1 were included into the regression as control variables. The predictors were included stepwise: in step 1 the control variable was included, in step 2 ΔWEC-1 or ΔWEC-2, respectively, was included to test for linear regression. In step 3, the squared value of ΔWEC-1 or ΔWEC-2, respectively, was included to test whether the squared variable explains significant variance in the dependent variables beyond the variance explained by a linear term. This would provide evidence for a curvilinear relationship (Cohen, Cohen, West, & Aiken, 2013). A significant linear term would imply that changes in WEC predict a gradual increase or decrease in leadership behaviour across time. A significant curvilinear term would indicate that leadership behaviour was adjusted at more than one point in time (U-curve). As curvilinear tests can be sensitive to outliers, the data were scanned for outliers based on standardised residuals > |3| and they were removed.

While both WEC factors were inspected separately, interaction effects between the two factors were additionally tested to control for moderative effects and to investigate the joint influence of both factors. A significant interaction term would thus indicate that the *interaction* of both factors caused behavioural adaptation.

5.3 Study 3 Results

5.3.1 Outlier Analysis

The outlier analysis detected two outliers, which were removed from the respective analyses: One outlier case was removed from the HMR analyses of ΔEL and ΔWEC-1 / ΔWEC-2 (n = 116), the second (different) outlier was removed from the analysis of ΔDL and ΔWEC-1 (n = 116). No outlier was removed from the ΔDL and ΔWEC-2 analysis (n = 117). As such, descriptive statistics contained all data (n = 117).

5.3.2 Descriptive Results

Figure 18 shows the means of the variables in the initial study (i.e. not the delta variables) across Wave 1 and 2. Paired-samples t-tests revealed that none of the mean differences were significant. However, the graph indicates that from Wave 1 to Wave 2, WEC-1 slightly increased ($t(116) = -0.19$, $p = .849$); WEC-2 decreased ($t(116) = 0.94$, $p = .348$); EL increased ($t(116) = -0.84$, $p = .403$); and DL decreased ($t(116) = 1.57$, $p = .119$). For demonstration purposes, also an overall measure of complexity was calculated, integrating the two factors[4]. This combined WEC score decreased minimally across time, the mean differences not being significant ($t(116) = 0.48$, p =

[4] Summing up the two factors as equal contributions to WEC, independent of their number of items, following the equation: $\dfrac{M_{WEC\text{-}1} + M_{WEC\text{-}2}}{2}$

.630).

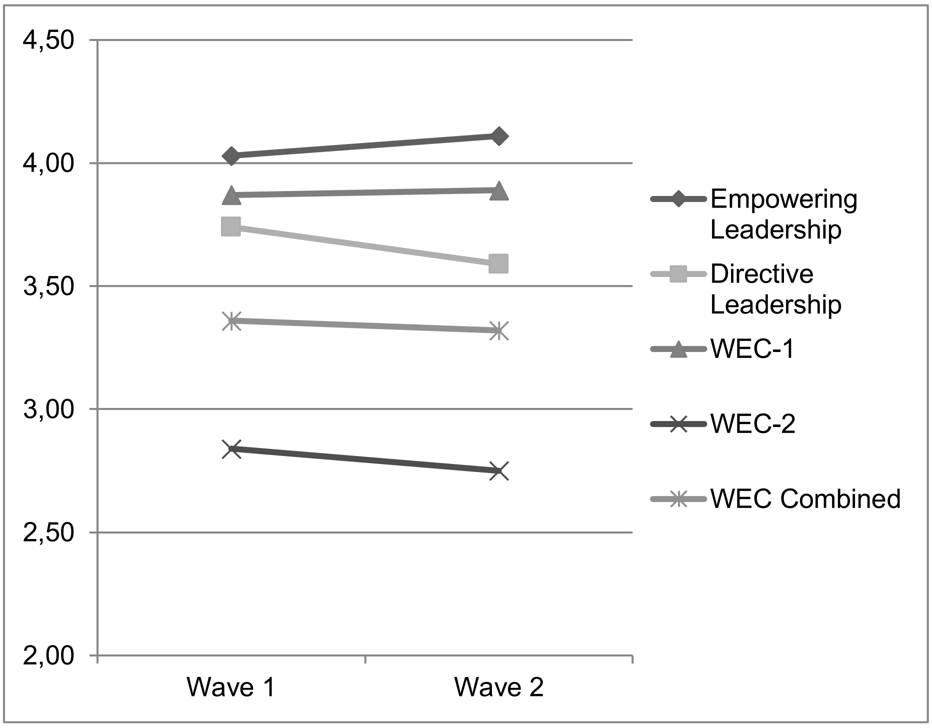

Figure 18. Study Variable Means Mapped across Waves 1 and 2.
Note. n = 117. WEC-1 = WEC factor 1 Frequent Change and Events, WEC-2 = WEC factor 2 Uncertain Work Demand*s*, WEC Combined = Integrated WEC score, calculated from both factors.

Table 22 shows the descriptive results for the study variables. The means of the delta variables were centred on zero (ΔWEC-1, ΔWEC-2, ΔEL), or slightly negative (ΔDL). Noticeable is the range for the delta variables. ΔWEC-1 and ΔWEC-2 displayed a range of 5, indicating that for the most extreme cases, WEC changed strongly between Wave 1 and 2. With a delta of 6, ΔEL and ΔDL also indicated wide variation in the leadership style for the most extreme-scoring individuals between Wave 1 and 2. However, these results must be interpreted with caution, as they represent only the most extreme scorers, and identified outliers were excluded from the respective HMR analyses.

Table 22: Study 3 - Means, Standard Deviations, and Range of the Study Variables

Variable	*M*	*SD*	*Min*	*Max*	*Range*
WEC-1 Wave 1	3.87	0.76	2.00	5.00	3.00
WEC-1 Wave 2	3.89	0.72	2.00	5.00	3.00
WEC-2 Wave 1	2.84	0.75	1.00	4.33	3.33
WEC-2 Wave 2	2.75	0.70	1.00	5.00	4.00
Empowering Leadership Wave 1	4.03	0.76	2.00	5.00	3.00
Empowering Leadership Wave 2	4.11	0.75	1.00	5.00	4.00
Directive Leadership Wave 1	3.74	0.74	1.67	5.00	3.33
Directive Leadership Wave 2	3.59	0.72	2.00	5.00	3.00
WEC Combined Wave 1	3.36	0.61	1.88	4.67	2.79
WEC Combined Wave 2	3.32	0.59	1.50	5.00	3.50
ΔWEC-1	0.02	0.97	-2.25	2.75	5.00
ΔWEC-2	-0.09	1.01	-2.00	3.00	5.00
ΔEmpowering Leadership	0.08	0.99	-3.50	2.50	6.00
ΔDirective Leadership	-0.15	1.04	-2.67	3.33	6.00

Note. n = 117. WEC-1 = WEC factor 1 Frequent Change and Events. WEC-2 = WEC factor 2 Uncertain Work Demands, WEC Combined = Integrated WEC score, calculated from both factors, ΔWEC-1 / ΔWEC-2 = Change in WEC across Waves 1 and 2, ΔEmpowering/Directive Leadership = Change in leadership behaviour across Waves 1 and 2.

5.3.3 Regression Results

Factor WEC-1 Frequent Change and Events

Table 23 shows the regression results. Contrary to Hypotheses 1a/1e, neither the linear (β = .10, p = .44) nor the curvilinear term (β = .04, p = .71) of ΔWEC-1 predicted ΔEL. This indicates that there was hardly any change in EL caused by the change in WEC-1, depicted in Figure 19. In line with Hypothesis 1b, the linear term (β = -.26, p < .05) predicted ΔDL, yet there was no indication for a curvilinear relationship (H1f; β = .04, p = .69). This indicates that DL was decreased the more WEC-1 increased, and vice versa. Figure 20 depicts this relation. The overall variance (R^2) explained was .009 for ΔEL and .041 for ΔDL.

Table 23: Study 3 - Hierarchical Multiple Regression Analyses Predicting the Change (Δ) in EL and DL from the Change (Δ) in WEC Factor 1 "Frequent Change and Events"

Predictor	β	t	p	*Overall* R^2	ΔR^2
		Δ *Empowering Leadership*			
Step 1 Control (WEC-1 Wave 1)	.05	0.53[a]	.60	.002	.002
Step 2 ΔWEC-1 (linear term)	.10	0.78[b]	.44	.008	.005
Step 3 ΔWEC-1^2 (curvilinear term)	.04	0.37[c]	.71	.009	.001
		Δ *Directive Leadership*			
Step 1 Control (WEC-1 Wave 1)	.07	0.70	.49	.004	.004
Step 2 ΔWEC-1 (linear term)	-.26	-2.05	.04	.040	.036
Step 3 ΔWEC-1^2 (curvilinear term)	.04	0.41	.69	.041	.001

Note. n = 116. WEC-1 = WEC factor 1 Frequent Change and Events, ΔWEC-1 = Change in WEC-1 across Waves 1 and 2, ΔEmpowering/Directive Leadership = Change in leadership behaviour across Waves 1 and 2. ΔR^2 = Change in R^2. Light grey shadows indicate significant predictive term.

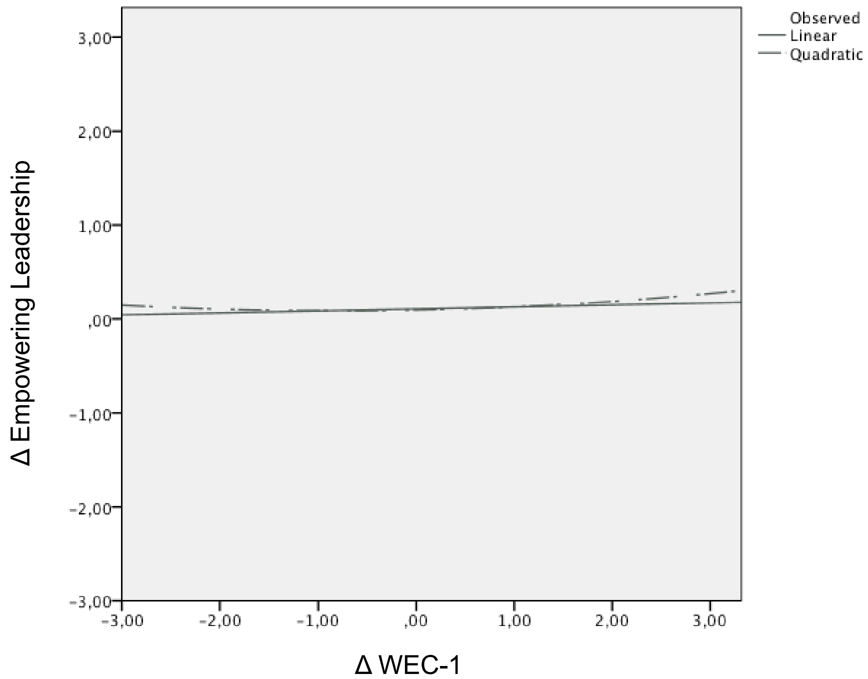

Figure 19. Linear and Quadratic (Curvilinear) Terms Predicting the Change (Δ) in EL from the Change (Δ) in WEC Factor 1, Frequent Change and Events (H1a/H1e).

Note. Both terms are statistically insignificant (grey colouring).

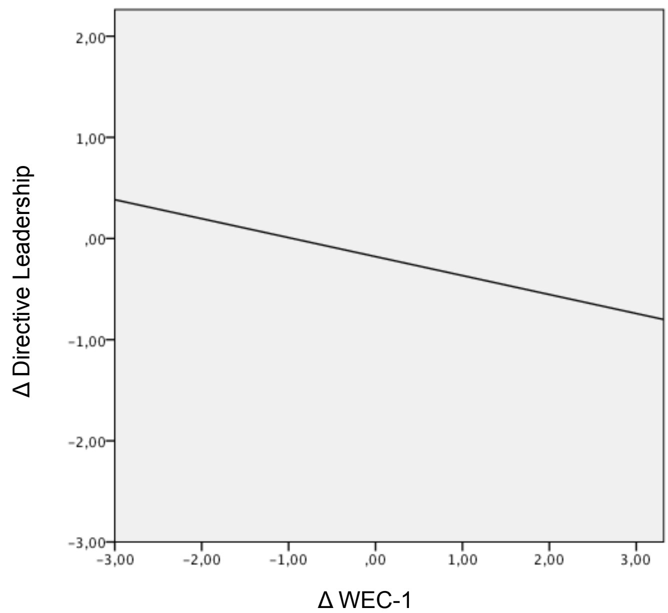

Figure 20. Significant Linear Term Predicting the Change (Δ) in Directive Leadership from the Change in WEC Factor 1, Frequent Change and Events (H1b).
Note. The quadratic (curvilinear) term is non-significant (H1f).

Figure 21 combines both patterns for WEC-1, Frequent Change and Events: EL was not changed as a result of changing WEC-1. DL, however, decreased significantly when changes in WEC-1 increased.

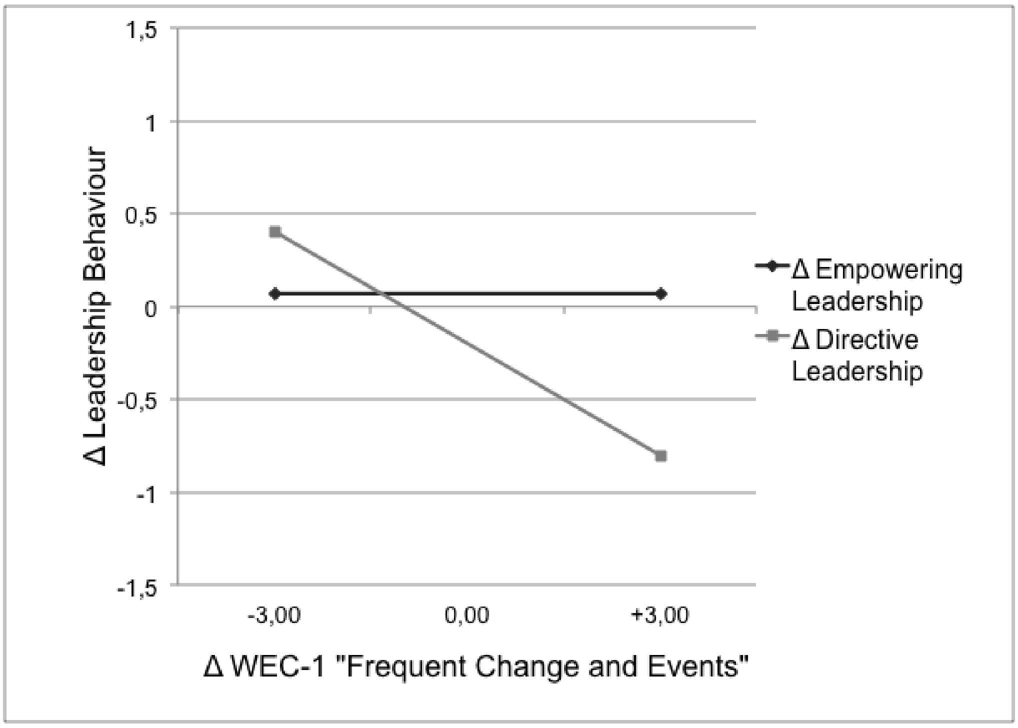

Figure 21. Changes in DL and EL Predicted by Changes in WEC-1.

Factor WEC-2 Uncertain Work Demands

Table 24 shows the regression results. For EL, the linear term was significant on a $p < .10$ level ($\beta = .25$, $p = .07$), and the curvilinear term did not explain significantly more variance (H1g; $\beta = -.09$, $p = .36$). This implies that when WEC-2 increased, the level of EL was increased, depicted in Figure 22. With a significance level of $p < .10$, this partly supports Hypothesis 1c. for DL, the linear term was non-significant (H1d; $\beta = -.15$, $p = .27$). In line with Hypothesis 1h, however, the curvilinear term for ΔDL was significant ($\beta = .22$, $p < .05$). Described by a U-curve in Figure 23, this indicates that leaders showed the highest amount of DL when WEC-2 changed the most – either when WEC grew or lessened. The curve inflection point, the lowest point in the U-curve, was at -.39 for ΔDL and .50 for ΔWEC-2. The overall variance (R^2) explained was .057 for ΔEL and .072 for ΔDL. This supports Hypothesis 2, indicating that changes in leadership behaviour were explained to a greater extent by changes in WEC-2 than by changes in WEC-1.

Table 24: Study 3 - Hierarchical Multiple Regression Analyses Predicting the Change (Δ) in EL and DL from the Change (Δ) in WEC Factor 2, Uncertain Work Demands

Predictor	*β*	*t*	*p*	*Overall R^2*	ΔR^2
			Δ Empowering Leadership (n = 116)		
Step 1 Control (WEC-2 Wave 1)	-.15	-1.60[b]	.11	.022	.022
Step 2 ΔWEC-2 (linear term)	.25	1.83[c]	.07	.050	.028
Step 3 ΔWEC-2^2 (curvilinear term)	-.09	-0.92[d]	.36	.057	.007
			Δ Directive Leadership (n = 117)		
Step 1 Control (WEC-2 Wave 1)	.13	1.36[a]	.18	.016	.016
Step 2 ΔWEC-2 (linear term)	-.15	-1.12[b]	.27	.027	.011
Step 3 ΔWEC-2^2 (curvilinear term)	.22	2.36[c]	.02	.072	.046

Notes. WEC-2 = WEC factor 2 Uncertain Work Demands, ΔWEC-2 = Change in WEC-2 across Waves 1 and 2, ΔEmpowering/Directive Leadership = Change in leadership behaviour across Waves 1 and 2. ΔR^2 = Change in R^2. Light grey shadows indicate significant predictive term.
[a] *df* = 115. [b] *df* = 114. [c] *df* = 113. [d] *df* = 112.

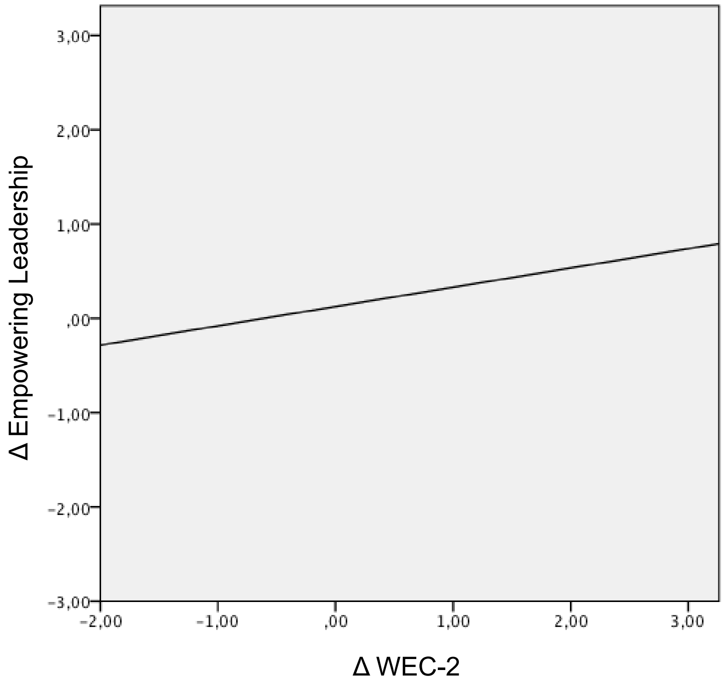

Figure 22. Linear Term Predicting the Change (Δ) in EL from the Change in WEC Factor 2, Uncertain Work Demands Significant at $p < .10$ (H1c).
Note. The quadratic (curvilinear) term is non-significant (H1g).

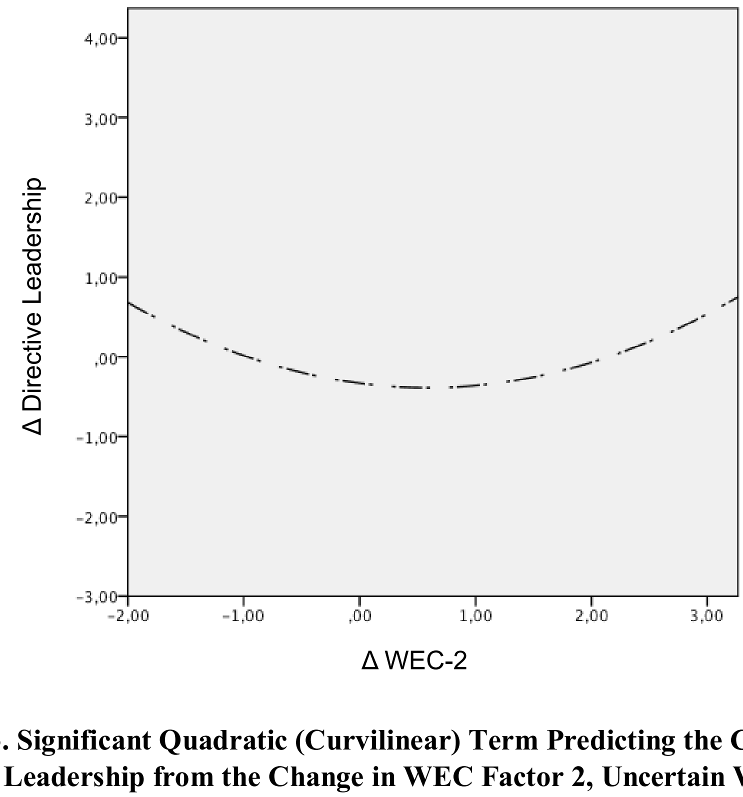

Figure 23. Significant Quadratic (Curvilinear) Term Predicting the Change (Δ) in Directive Leadership from the Change in WEC Factor 2, Uncertain Work Demands (H1h). Curve inflection point at ΔDL = -.39 and ΔWEC-2 = .50.
Note. The linear term is non-significant (H1d).

Summarised in Figure 24, changes in WEC-2 Uncertain Work Demands predicted changes in both leadership styles: EL was increased when changes in WEC-2 grew. The adaptive response for DL was strongest when changes in WEC-2 were strongest (U-curve).

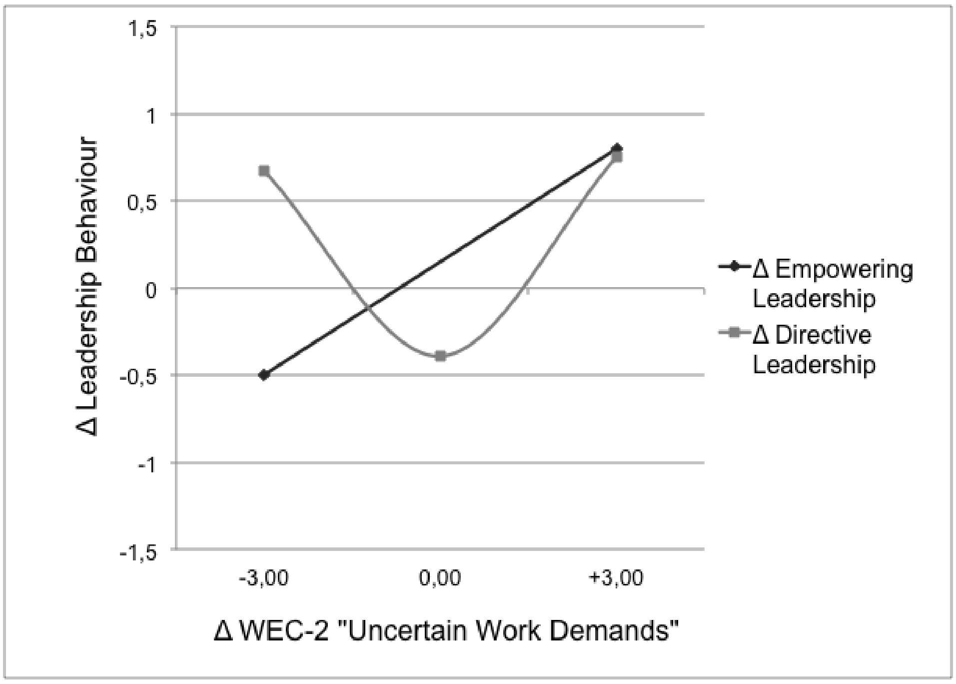

Figure 24. Changes in DL and EL Behaviour Predicted by Changes in WEC-2.

5.3.4 Interaction Effects

Additionally, joint effects of the two WEC factors on the adjustment of leadership styles were investigated. For this, interaction terms between both WEC-factors were tested in an additional HRM analysis. Results indicated that the *interaction* of factors did not predict change in either EL or DL. Table 25 presents these results.

Table 25: Study 3 - Hierarchical Multiple Regression Analyses Predicting the Change (Δ) in EL and DL through Interaction Effects of Both WEC Factors

Predictor	*p*	*Overall R^2*	ΔR^2
Δ Empowering Leadership			
Step 1 (control variables) WEC-1 t1 WEC-2 t1	.14	.34	.034
Step 2 (linear terms) ΔWEC-1 ΔWEC-2	.16	.65	.031
Step 3(curvilinear terms) ΔWEC-1^2 ΔWEC-2^2	.78	.69	.004
Step 4 (interaction term) ΔWEC-1x ΔWEC-2	.74	.70	.001
Δ Directive Leadership			
Step 1 (control variables) WEC-1 t1 WEC-2 t1	.23	.016	.026
Step 2 (linear terms) ΔWEC-1 ΔWEC-2	.02	.095	.069
Step 3(curvilinear terms) ΔWEC-1^2 ΔWEC-2^2	.98	.095	.000
Step 4 (interaction term) ΔWEC-1x ΔWEC-2	.68	.097	.001

Notes. n = 116. WEC-1= WEC factor 1 Frequent Change and Events; WEC-2= WEC factor 2 Uncertain Work Demands, ΔWEC-1 = Change in WEC-1 across Waves 1 and 2, ΔWEC-2 = Change in WEC-2 across Waves 1 and 2, ΔEmpowering/Directive Leadership = Change in leadership behaviour across Waves 1 and 2, t1= Wave 1 data; t2 = Wave 2 data, ΔR^2 = Change in R^2. Light grey shadows indicate significant predictive term.

5.4 Study 3 Discussion

So far, little research has investigated adaptive leadership in Work Environment Complexity (Baard et al., 2014), despite this there is agreement that in changing and complex settings, leaders will be successful if they adapt their behaviour depending on the situation (Hannah et al., 2013; Uhl-Bien & Arena, 2017; Yukl & Mahsud, 2010). The present study has closed this empirical gap by studying to what extent leaders change their behaviour due to changes in WEC across time. This was achieved through analysis of a quantitative longitudinal sample of 117 leaders. To the author's knowledge, this was the first empirical investigation of whether the characteristics of a changing, complex environment impact the adaptation of leadership styles.

Results indicate that, by and large, there was significant adaptive response of leadership behaviour as a consequence of changes in WEC. Significant regression terms were obtained for the relations of DL and factor WEC-1, for EL and WEC-2 (significant at $p < .10$), and DL and WEC-2, yielding reasonable support for Hypotheses 1b, 1c, (linear relation) and 1h (curvilinear relation). Hypothesis 1a/1e, however, could not be supported, i.e. there was no significant adaption for WEC-1 and EL. On the whole, this adaptive response implies that leaders were balancing both EL and DL to meet the specific demands of the circumstances (Yukl & Mahsud, 2010). In other words, this study is the first to suggest that change in characteristics of a complex work environment can trigger a significant change in leadership behaviour. These findings contribute to determining which environmental factors are associated with adaptive leadership (Baard et al., 2014).

The amount of EL was hardly adapted to changes in WEC-1, and slightly increased when changes in WEC-2 became stronger across time. This partly supports the assumption that the more challenging a work environment becomes, the more leaders will choose to show participative leadership behaviour. Secondly, however, it also suggests that a high level of EL is shown more or less independently of the inherent changes in WEC. In other words, there seems to be less necessity for leaders to adapt an empowering leadership style when WEC is changing. This finding is largely in line with the previous Study 2, where a high level of EL was found to be a leader's general response to facing WEC, and especially when facing frequent changes and unexpected events (WEC-1). Finding a steady and comparably high level of EL independent from inherent WEC-changes can thus be understood as supporting evidence for EL as "the leadership of choice" in the face of WEC (e.g., Burnes, 2005; Correia de Sousa & van Dierendonck, 2014; Karp & Helgø, 2008; Marion & Uhl-Bien, 2001; Mumford et al., 2000; Osborn & Hunt, 2007; Styhre, 2002; Uhl-Bien et al., 2007).

Results revealed that DL, especially, was altered as a result of changing WEC; regression terms were significant for both factors. Thus, a leader's application of an instrumental leadership style was significantly dependent on the level of change in WEC across time. Findings suggest that, firstly, a leader would show considerably less DL behaviour when WEC-1 increased, and vice versa. This is in line with the findings of Study 2, which showed that the more challenging a work environment became, the less leaders would choose to apply DL. The present study adds to these findings, suggesting that this is not only true when WEC-1 is consistently high, but also when WEC-1 increases over time.

One of the most significant findings of the study emerges in the case of WEC-2, Uncertain Work Demands. Here, DL showed the greatest increase whenever large *changes* in WEC-2 were experienced – irrespective of whether WEC-2 increased or decreased. In other words, when the level of uncertainty regarding one's work, the novelty of problems, and ambiguity of job demands were very turbulent, leaders responded by exercising more control over their environment. Drawing on literature of leadership adaptation in WEC, several explanations for this pattern can be considered: One – positive interpretation of this "directive intervention" could be that in the case of strong turbulence within WEC-2, leaders will find it appropriate to show DL in order to give structure, order, and clear direction to their team – or as Uhl-Bien and Arena (2017) say, a leader will find this a situation where it is necessary to be "highly visible to catalyse others" (p. 18). An alternative, and more deficit-oriented interpretation could be in line with Karp and Helgø (2008) who made the assumption that when turbulence within WEC-2 is too strong, leaders may no longer be able to keep "at bay the anxiety caused by not being in managerial control" (p. 85), and will therefore increase instrumental behaviour so as to reduce their own feelings of uncertainty. At this point, this study cannot give conclusive answers to this, and further research will have to be conducted in order to examine the underlying mechanisms of this specific behaviour. Exploring the motivations and reasons that drive a leader to strongly increase DL when facing strong changes in WEC-2 is therefore considered an interesting path for future research. Altogether, this also speaks to the assumption that each leadership style serves different purposes; supporting previous research outside of WEC (Judge et al., 2004; Zhou, 2003). Had both DL and EL been equally adjusted to WEC, this could – in contrast – suggest that they are interchangeable. This study's findings imply, however, that leaders seem to differentiate the use of EL and DL depending on the environment's characteristics. Further research could investigate this differentiation; and the outcomes that each leadership style may achieve.

This study had hypothesised that WEC-2 Uncertain Work Demands presents a greater challenge to leaders than WEC-1 and will thus result in a greater adaptive response of both leadership styles. Finding both DL and EL significantly adapted to changes in WEC-2 yields reasonable support for this hypothesis. This result is noteworthy, as it may help explain the alleged "leadership vacuum" in WEC-2 brought up in Study 2: In this previous study, it was found that in the face of Uncertain Work Demands, EL decreased and DL behaviour was not consequently increased. This led to the interpretation that managers would withdraw from leading because the challenge of facing WEC-2 would overwhelm them. This present study's results, however, reveal that when *changes* in WEC-2 were strong, leaders would, in fact, respond both with more instrumental control (i.e., show higher levels of DL) as well as more participative leadership behaviour. With this active response, the risk of a leadership vacuum in the most turbulent moments of WEC-2 can be seen as partly reduced, and thus the concerns of Study 2 are diminished. It shows that both leadership styles can be – and perhaps should be – applied simultaneously. Future research could investigate the outcomes of such adaptive leadership in changing WEC contexts. It would be interesting to see, for example, how the (adaptive) combination of leadership styles relates to a leader's wellbeing and functionality, as well as variables of employee, team, and organisational productivity.

Several implications arise from this research for practical application. Firstly, the results are especially relevant for equipping managers in the face of complex work situations and for training them optimally to respond. This present study adds to the recommendations for management training made in Study 2. Generally speaking, a leader seems well advised to apply a strong participative approach when facing complex challenges. As this study has shown, this holds particularly true when turbulences within WEC are high. Thus, leadership training for WEC should strengthen leaders' participative leadership skills in general and, in addition, advise managers to maintain high levels of empowering behaviour consistently across time, even if – or especially when – turbulences occur. A participative style should be supported by coaching in directive leadership, as a balance of both styles may be essential to form the optimal leadership response. Therefore, leaders should be educated in how they can show both leadership styles simultaneously, depending on their goals (see also Judge et al., 2004). It is likely that, when applied correctly, DL will give a team orientation, direction, and structure in turbulent work contexts (Uhl-

Bien & Arena, 2017). Leaders could be trained in taking a clear stand on decisions when work situations are ambiguous and in supervising employees where they are not capable of fulfilling job demands themselves. An important element for management training will be to create the awareness that the two styles have to be flexibly adapted or "fine-tuned" to specific situations and especially changes in WEC. Following Pulakos et al. (2000), leaders could be prepared for this adaptive response through training scenarios that simulate the changing demands they may encounter.

Secondly, implications for practice lie in the area of change monitoring. This study has found the changes in WEC across time to be relevant for deciding which leadership approach to apply. Organisations could not only evaluate the general level of WEC, as suggested in Study 2, but should monitor the *changes* in WEC continuously, e.g. by monitoring every couple of months. This would allow for concrete organisational interventions when changes occur.

Finally, both Studies 2 and 3 suggest that the second WEC facet, Uncertain Work Demands, appears to be especially challenging for leaders. It may therefore help if HR personnel or the company's CEOs communicate actively which job demands a leader is required to fulfil and, in particular, what is expected of a manager when exploring novel solutions to ambiguous problems. This involves clarifying questions such as: How should we treat situations that we have never encountered before? How much freedom has a manager got when trying to find new solutions to unclear problems, where do boundaries lie? How do we handle mistakes made? Such guidelines may be helpful for leaders when managing the challenging demands of WEC-2.

5.5 Study 3 Limitations

The results of the present study have to be considered in the light of some inherent limitations. As the sample had been the basis for Study 2 already, the limitations addressed previously also apply for the current project. This study has added another perspective and supplementary insights on leadership behaviour above those of Study 2. Nevertheless, it would be beneficial to replicate and validate the findings with another, possibly larger leadership sample from another branch, and overcome the limitations of self-reported data by including external measurements of leadership behaviour. Next, while most adaptive effects obtained in this study were statistically significant, they can only partly explain the variance of leadership adaptability as a result of the change in WEC. As the R^2 values indicate, considerable parts of variance were not accounted for by changes in WEC. Thus, it is necessary to examine further factors that may explain a manager's behaviour adaptation in WEC. Factors might include an employee's maturity (Silverthorne & Wang, 2001), the heterogeneity of teams (Somech, 2006), a leader's personal skillset (Yukl & Mahsud, 2010), or cognitive disposition (Hannah et al., 2013). This study has shown that leaders adaptively respond in the face of changing WEC, but many unanswered questions remain regarding the antecedents of such behaviour (Baard et al., 2014). This point became apparent when trying to explain the curvilinear effect of DL and WEC-2. While two possible explanations have been offered, the empirical testing of these is desirable. Future research could explore leaders' motivators and drivers to show adaptive behaviour in the face of WEC. Finally, despite showing that leadership behaviour was adjusted, this study cannot evaluate *how successful* this modification was for the leader, the employees, or the organisation. Looking into the consequences of flexible leadership behaviour in WEC has been largely under-researched (Baard et al., 2014; Yukl & Mahsud, 2010).

5.6 Study 3 Conclusions

Prominent leadership scholars have called for more research into adaptive leadership in changing and complex work contexts. Yukl and Mahsud (2010), for example, state that:

> *"Many aspects of flexible and adaptive leadership have not yet been investigated extensively, and research is needed on several aspects of flexible and adaptive leadership. More research is needed on skills and traits that determine how well a leader identifies changes in the situation, understands what types of responses are appropriate, and is able and willing to provide the type of leadership that is needed." (p. 90).*

This study has contributed empirically by finding that leaders will respond by adapting their leadership behaviours to changes in Work Environment Complexity and that dynamically intertwining both empowering and directive leadership appears vital for adapting to different situational requirements in WEC. This investigation has expanded the understanding of leadership behaviour and adaptive response in the face of complex working environments. This sets the paths for further research in the topic. In organisational practice, these findings are relevant for training flexible leaders, communicating expectations on leadership roles, and for organisational change monitoring.

Chapter 6 – Study 4: Predicting Psychological Leadership Functionality in WEC

6.1 Introduction

Understanding effective leadership in Work Environment Complexity has made both conceptual and empirical progress. From an interactional or behavioural perspective, the previous studies in this thesis have made empirical contributions regarding the "right" leadership style, or better, an adaptive combination of styles when leading in WEC. However, the majority of debates on how to lead in the face of WEC is focused on a leader's performance for the sake of others (e.g., Mumford et al., 2000). Due to their exposed roles, leaders are seen to play an essential part in managing organisational complexity (Baard et al., 2014; Berman & Korsten, 2010; Ilgen & Pulakos, 1999; Ployhart & Bliese, 2006; Pulakos et al., 2002; Silverthorne & Wang, 2001; Uhl-Bien et al., 2007; Yukl & Mahsud, 2010). A manager's responsibilities thus include steering the organisation's development towards productivity, effectiveness, and success (Ashmos et al., 2000; Horner, 1997; Silverthorne & Wang, 2001; Uhl-Bien et al., 2007) as well as securing and caring for the productivity wellbeing, engagement, creativity, and performance of employees (Arnold & Connelly, 2013; Hooijberg et al., 1997; Roche et al., 2014).

Less attention has been paid in research discourse to the question of how leaders *themselves* are affected when managing the challenge of WEC (Nielsen & Daniels, 2012; Roche et al., 2014). In contrast, the discussion in section 2.7 found that the context of WEC is likely to place considerable risks to the wellbeing and functionality of leaders. These include: a potential loss of control; feelings of uncertainty, anxiety, and ambiguity; threats to a leader's psychological wellbeing; strain from psychological stress; and diminished mental health (Arnold & Connelly, 2013; Bordia et al., 2004; Karp & Helgø, 2008; Roche et al., 2014). Furthermore, it is only recently that research has examined the combined influence of more than one job demand on the psychological and physiological wellbeing of individuals (van Woerkom et al., 2016). Given that WEC combines different challenging work aspects (Frequent Change, Unpredictability, *and* Challenging Work Demands), it is likely that these job demands will accumulate and together have an exacerbating effect on an individual's wellbeing (van Woerkom et al., 2016). Where leaders are confronted with substantially new and challenging, complex work environments, the implications for the individual leader need to be explored more in detail. With the exception of a few specific studies (Judge et al., 1999; Nielsen & Daniels, 2012; Roche et al., 2014), this field is largely under-researched. However, Lewin's equation still holds strong (Lewin, Heider, & Heider, 1936): behaviour is a function of person and environment. If we want to understand in depth what successful leadership in WEC means, it will require looking into what makes a leader psychologically capable of leading in such contexts. If a leader is psychologically well, this will not only be beneficial for the leader, but is also likely to positively affect the employees and the organisation (e.g., Quick et al., 2013; Roche et al., 2014). At its core, this study aims to expand insights into what makes leaders themselves able to thrive and cope with WEC; a question of leader functional, psychological wellbeing.

For this purpose, two outcomes variables have been derived in the explorative framework of Chapter 2 that appear well-suited to investigate a manager's functionality and ability to cope in complex contexts: Leader Self-Efficacy for Adaptive Behaviour (SEAB) and Leader Eudaimonic Wellbeing (EUWELL).

6.1.1 Leader Self-Efficacy for Adaptive Behaviour

SEAB reflects an individual's confidence in their own ability to adapt successfully to changing or dynamic situations and ambiguity (B. Griffin & Hesketh, 2003; Pulakos et al., 2002). Due to the unpredictable and turbulent nature of WEC contexts, an individual leader is likely to experience psychological states of uncertainty and ambiguity due to a feeling of not being in control (e.g., Bordia et al., 2004). Additionally, WEC confronts managers with a so-called paradox of control (Stacey, 2011) – the inability to exert control in its traditional managerial sense (Hooijberg et al., 1997; Karp & Helgø, 2008). These psychological states can have detrimental effects on the wellbeing and functionality of leaders if they are not adequately matched (e.g., Correia de Sousa & van Dierendonck, 2014). An adaptive behavioural response has been discussed as a critical factor for successful leadership in WEC (e.g., Uhl-Bien & Arena, 2017). In order to cope effectively, leaders would need to feel confident or "in control" and that they possess the ability to adapt to the challenging sides of WEC. The idea behind this is that while a leader might not be able to control external environmental factors of the work, he or she would be able to confidently control their own reaction to these environments. SEAB has been substantiated as an essential antecedent of leader adaptability and has been shown to be a valid predictor of adaptive performance in contexts related to WEC (Fay & Frese, 2001; B. Griffin & Hesketh, 2003; Griffin et al., 2007; Kozlowski et al., 2001; Pulakos et al., 2002). Self-efficacy is not a generalised trait, but, according to Bandura (1977), a motivational construct that relates to a specific task. Therefore, this thesis works with the more tailored construct of SEAB that more narrowly examines an individual's self-efficacy of adapting their behaviour in WEC. In this sense, SEAB is seen to serve as a psychological resource for leaders and a functional response to the challenges of WEC. This leads to the following proposition:

Proposition 1. Leader Self-Efficacy for Adaptive Behaviour is an indicator of how well a leader responds to Work Environment Complexity.

6.1.2 Leader Eudaimonic Wellbeing

In line with positive psychology, EUWELL describes wellbeing beyond the absence of illness (Seligman & Csikszentmihalyi, 2014) and “defines wellbeing in terms of the degree to which a person is fully functioning” (Ryan & Deci, 2001, p. 141). It reflects a state of intense involvement, motivation, and engagement (Ilies et al., 2005; Robertson & Cooper, 2010; Waterman, 1993), closely related to Csikszentmihalyi’s concept of “flow”(Csikszentmihalyi, 1975/2000). For WEC, challenging work demands have been identified as a core characteristic (cf. Study 1). Where working environments become increasingly complex, the risks of psychological strain, (di)stress, frustration, anxiety, and diminished mental health for leaders grow rapidly (Roche et al., 2014; van Woerkom et al., 2016). Highly demanding work can make individuals ill (Melchior et al., 2007), and for those in managerial positions these risks are often potentised (Arnold & Connelly, 2013). If the challenging nature of WEC is “poorly managed or unmanaged altogether, leaders can be expected to experience a range of negative effects and cognitive impairments that can leave them disoriented, disconnected, fearful, and frustrated” (Hunter & Chaskalson, 2013, p. 197). In turn, there may be potential in the stimulating and positively challenging nature of WEC which could, instead, be routed into eustress – positive, productive stress – essentially healthy coping (Nelson & Simmons, 2003; Quick et al., 2013). EUWELL constitutes this state; a feeling of high performance, wellbeing, and functionality channelled into constructive outcomes (Ryan & Deci, 2001). Evaluating the level of Leader EUWELL in the face of WEC should provide insights into how productively a leader personally copes with, even thrives in the demanding facets of complex work. Consequently, the second proposition for this study is:

Proposition 2. Leader Eudaimonic Wellbeing is an indicator of how well a leader responds to Work Environment Complexity.

Based upon the considerations in Chapter 2, Figure 25 summarises the proposed interrelations of WEC characteristics, potential challenges, and variables of leadership functionality.

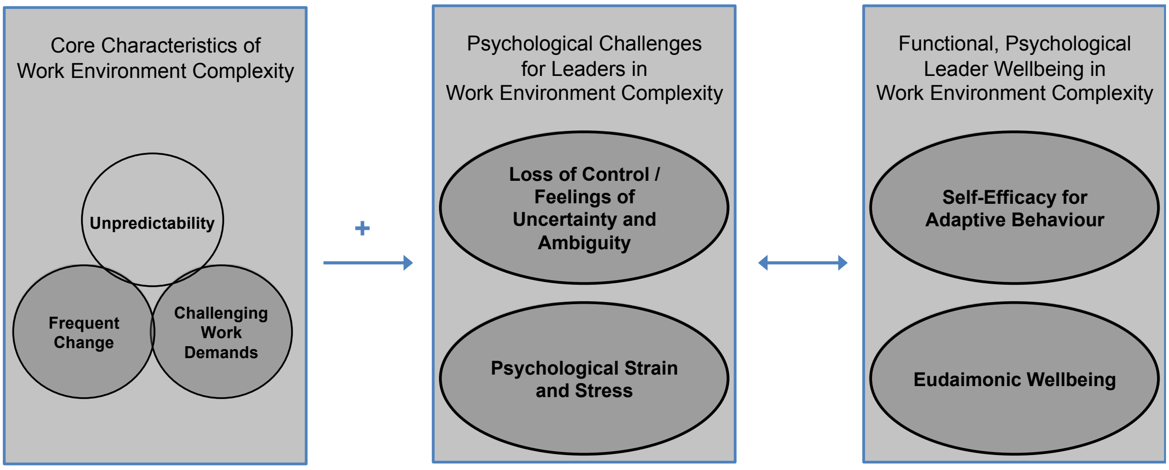

Figure 25. A Model of WEC-Characteristics, Psychological Challenges for Leaders and Functional Psychological Leader Wellbeing.

Regarding the expected relation between the two variables, one would assume that both are related, as feelings of control and mastery of one's situation are both part of the concept of SEAB (B. Griffin & Hesketh, 2003) as well as woven into the concept of EUWELL (Ryan & Deci, 2001). Thus, one could argue that SEAB is essentially only a facet of EUWELL, and it would be sufficient to investigate the latter only. This thesis argues for examining both in parallel. Conceptually, the two are distinct: EUWELL constitutes a general state, while SEAB constitutes a specific motivational construct (Bandura, 1977; B. Griffin & Hesketh, 2003). With this, SEAB can be understood as an approximation of specific functional (adaptive) behaviour (B. Griffin & Hesketh, 2003). EUWELL, in comparison, refers to a persistent affective-cognitive state not focused on a particular behaviour (Schaufeli, Bakker, & Salanova, 2006). To empirically test the assumption that both are related yet distinct concepts, it is thus proposed that the correlation between the two does not exceed $r = .85$ (Shaffer, DeGeest, & Li, 2016).

Hypothesis 1: SEAB and EUWELL will be related by a correlation below .85, indicating that both are related yet distinct indicators

6.1.3 Predicting Psychological Leadership Functionality in WEC

As empirical insights to date are considerably scarce, at the core of this study lies the intention to broaden the understanding of possible predictors of leader SEAB and EUWELL in WEC. Having substantiated the combination of these two variables as an indicator of functional wellbeing, and a measure for WEC in Study 1, this present study aims to empirically explore three sets of possible antecedents and their value in predicting a leader's psychological functionality in WEC. Leader wellbeing is likely to be influenced by various factors, amongst them the work environment in which one acts, individual or dispositional factors, as well as the leadership style or behaviour a leader exerts (Arnold, Turner, Barling, Kelloway, & McKee, 2007). Thus, the proposed antecedents to be explored are (1) the context of WEC itself, (2) a leader's disposition or attitude of "embracing the complexity", and (3) leadership styles, specifically empowering leadership (EL) and directive leadership (DL). The following sections outline these antecedents as well as underlying rationales for the propositions. The research question for this study is:

Research Question #1: *Which factors predict a leader's functional response to WEC?*

6.1.4 The Predictive Value of Work Environment Complexity for Leadership Functionality

When predicting a leader's functionality in WEC, the nature of *Work Environment Complexity itself* is a first important factor to inspect. To date, the discussion on the dynamics behind WEC and functional wellbeing is controversial. While potential threats and challenges to an individual's functionality in WEC appear to be prominent and have been elaborated upon in sections 2.7.1 and 2.7.3, causing authors such as Roche et al. (2014) to call WEC a "potentially toxic environment" (p.484), other researchers have highlighted the benefits that may arise from a complex work context for the wellbeing, engagement, and potential of individuals (e.g., Uhl-Bien & Arena, 2017).

Empirical findings into the relation of WEC and leader wellbeing/functionality are limited in several ways. First, most previous research has been conducted with employees, not with leaders. While many studies explore a leader's influence on employee wellbeing, the leader's individual functional wellbeing is hardly ever in focus (e.g., Roche et al., 2014). Second, there has yet been no investigation of SEAB and/or EUWELL in contexts of WEC. Third, existing studies have either assumed – not measured - "complexity" or have operationalised WEC more narrowly, e.g. as the fulfilment of challenging tasks (Morgeson & Campion, 2003). With this, more research around the influence of WEC on leader functionality/wellbeing is needed.

First, why could WEC be positive for a leader's functionality? A multitude of studies have examined the relation between work characteristics and individual (employee) wellbeing, finding that elements of work "complexity" can have positively activating, motivational, and stimulating effects (Chung-Yan, 2010; Chung-Yan & Butler, 2011; Ilgen & Hollenbeck, 1991; Morgeson & Campion, 2003). As there had been no comprehensive measure for WEC, the studies cited below, however, rely on more narrow definitions of “complexity”, such as jobs that challenge cognitive skills. The underlying rationale is that individuals are drawn to jobs that offer some potential for activation and motivation and try to avoid jobs that offer too little stimulation or variety. Rooted in the job enrichment movement, the influential Job Characteristics Model (JCM; Hackman & Oldham, 1980) for example, explains a job’s motivation potential or “complexity” with the prevalence of the job characteristics skill variety, task identity, task significance, autonomy, and job feedback. A job that has these characteristics, Hackman and Oldham state, induces meaningfulness, responsibility and knowledge of job results: positive psychological states in the individual (Hackman & Oldham, 1975). The equation is that the more of these states, the better. In comparison, a job that does not offer these characteristics induces no positive state; hence it has no (or hardly any) motivational potential to offer. Thus, individuals are positively drawn to job characteristics that can induce positive states in them. Following this rationale that more complex work has more motivational potential for the working individual, higher “job complexity” in this conceptualisation has, for example, been found to positively predict employee wellbeing, job-related attitudes, job satisfaction, affective commitment and mental health, and to negatively predict turnover intentions (e.g., Grebner et al., 2003; see for a review also Morgeson & Campion, 2003).

In comparison, it seems likely that individuals are motivated to avoid jobs that are overly simple or monotonous. In fact, simple, repetitive jobs in which individuals feel they cannot use their skills have been linked to poor psychological health, boredom, demotivation, and a higher probability for workers to disengage from work cognitively (e.g., Chung-Yan & Butler, 2011; Clegg & Wall, 1990; Morgeson & Campion, 2003). Even job tension, which is generally perceived as something negative, has been found to be necessary to some extent for employee job satisfaction

(Zivnuska, Kiewitz, Hochwarter, Perrewé, & Zellars, 2002). Jobs with no (or hardly any) tension at all, in contrast, are likely to leave individuals under-stimulated and frustrated: very low levels of job tension have been associated with significantly lower job satisfaction and higher turnover rates (Zivnuska et al., 2002). In summary, it seems justifiable to assume that some degree of job complexity is motivational for all individuals (Chung-Yan & Butler, 2011; Ilgen & Hollenbeck, 1991). What does this mean for WEC in its newly established operationalisation? Similar effects may apply – WEC is defined as a work environment that is characterised by frequent change, unpredictability and challenging work demands, and thus arguably a certain amount of WEC should also fulfil these positive motivational cues. Frequent change may offer variety in what a day or task looks like; some degree of unpredictability offers surprise, novelty, or positive tension; and challenging tasks may encourage a worker's usage of multifaceted skills. Likewise, this work setting should fulfil individuals' desire to avoid overly repetitive or monotonous work. It is thus proposed that work with certain degrees of WEC will positively stimulate and engage individuals.

However, while earlier models like the JCM see the relation between "complexity" and positive employee engagement as linearly positive, there is growing evidence that this assumption of a linear relation needs to be revisited (Morgeson & Campion, 2003). Although the complexity of a job can be engaging to a certain degree, as an employee can apply a broader set of skills, is likely to feel positively challenged, and able to grow (Morgeson & Campion, 2003), it would be ill-conceived to assume that a complex work environment offers only positive stimulation. In contrast, this thesis proposes that at some point a complex work environment can be perceived as overwhelming and that this effect might be best described by an inverted U-function (Chung-Yan & Butler, 2011). Why and when, therefore, would a certain degree of WEC start being detrimental to an individual's functionality? WEC, as conceptualised in this thesis, describes a new quality of work, as it combines several work characteristics: Unpredictability, Frequent Change, and Challenge. As discussed already in section 2.7, by themselves these are already likely to trigger psychological overstrain, overload, and a loss of control. This is because the emotional demands in work of change, uncertainty and related work characteristics are likely to exert negative influence on employee wellbeing. Highly demanding work can make individuals ill: job insecurity, stress, burnout, and anxiety are among the likely consequences (see section 2.7 for details).

In addition, recent research suggests that especially such a *combination* of different demands is likely to exacerbate a negative impact (van Woerkom et al., 2016). This phenomenon might be explained by the Conservation of Resources (COR) theory, (Hobfoll, 1989; see also van Woerkom et al., 2016): While employees try to cope with the demands of one aspect of the work, their resources may be depleted to cope with another. Therefore, the inflection point for the function could be described at the point where the total amount of job demands exceeds an individual's resources (van Woerkom et al., 2016). While there is some healthy tension in being challenged and stretched in the usage of one's skills (Zivnuska et al., 2002), the higher this imbalance becomes, the less likely it becomes that an individual will succeed in their work. The task may be so challenging, so complex, that there is little chance of achieving a positive outcome with one's skills at hand. At this point, the positive stimulation of complex work that employees are originally drawn towards might wear off; instead, stimulation, activation, and tension might overgrow to an extent where they affect the individual negatively, as individuals want to avoid the feeling of not being able to handle a situation. Einhorn and Hogarth (1981) observed this phenomenon as a typical conflict of motivational dynamics that occurs in behaviour: "Good things satiate and bad things escalate" (p. 70; see also Coombs & Avrurin, 1977). The “good things” might be positive activation and motivation induced by work characteristics like change and challenge. The “bad things” might be that high levels of work complexity might promote the feeling that one is not capable of being successful with one’s resources; followed by perceptions of work overload (Chung-Yan & Butler, 2011), unmanageable work pressure or emotional overstrain (van Woerkom et al., 2016), loss of control (Bordia et al., 2004), limitations in information processing (Janssen, 2001), or cognitive overload (Dóci & Hofmans, 2015). This means that work characteristics can act both as motivator or resource and as stressor (Karanika-Murray, Antoniou, Michaelides, & Cox, 2009) depending on their intensity, the work situation, and an individual’s resources. Individuals seek stimulation in their work, but want to avoid both under-stimulation (boredom, no usage of skills, cognitive disconnect) and over-stimulation (anxiety, loss of control, low probability to succeed). With a new understanding of WEC, it is worth revisiting the assumption that more complexity equals more positive outcomes.

These indicators suggest describing the effects of complexity on employees’ wellbeing in terms of a curvilinear, inverted U- shape, indicating that both too much and on the other side too little complexity in the workplace may have detrimental effects (e.g., Champoux, 1980; Chung-Yan, 2010; Chung-Yan & Butler, 2011; Shaw & Gupta, 2004). This “inverted-U” phenomenon has been found in relation to several constructs of positive psychology, finding that “positive phenomena reach inflection points at which their effects turn negative” (Grant & Schwartz, 2011, p. 61). In a similar vein, authors speak of the so-called “understimulation-overstimulation phenomenon”, as described here, for the interaction of job tension and performance (Zivnuska et al., 2002):

> *“The central argument employed in this line of research […] is that a job that provides no tension (or close to no tension) might fail to offer much in the way of excitement, resulting in understimulation and frustration. Similarly, jobs that*

> *offer substantial levels of tension might overwhelm incumbents, leading to overstimulation and dysfunctional outcomes"* (Zivnuska et al., 2002, p. 1345).

Similar supporting evidence for an inverted–U curve has been found for the relation of stress and performance: optimal performance occurs when the individual is neither under- or over-challenged (Srivastava & Krishna, 1991). Also, activation theory (Malmo, 1959) suggests that stimulation is a powerful motivator only until a certain threshold of activation, an optimal level, is reached.

Much less is known about the influence of a challenging or complex work environment on the wellbeing and functionality of *leaders*. Yet, also for managers, authors have suggested that complex situations will only be well-managed or positively interpreted as "eustress", when there is an adequate demand-skill balance (Correia de Sousa & van Dierendonck, 2014; Quick et al., 2013). Empirical findings of this relationship are limited and partly controversial. In one of the rare managerial studies, Janssen (2001) explains the inflection point between job challenge and wellbeing/performance, using activation theory: increasing (quantitative) job demands will increase a manager's activation, yet extreme demands/activation impair a manager's information processing and performance declines. This study, however, found the inverted-U relation of medium challenge and manager wellbeing/performance to be true only for leaders who felt they were paid fairly (Janssen, 2001). Nielsen and Daniels (2012) found that leaders who were challenged in their jobs above their average levels, reported higher levels of psychological and cognitive aspects of wellbeing. Dóci and Hofmans (2015), in contrast, found that when leaders encountered tasks that were overwhelmingly (cognitively) complex, they acted in less transformational ways. In line with the demands-abilities model, the authors explained this decrease to be due to leaders feeling less in control and less confident about embracing the complex situation's demands (Dóci & Hofmans, 2015).

With regard to predicting leader SEAB through WEC, even less empirical research has been done. Study 3 of this thesis has already found empirical evidence that leaders would adapt their leadership style when levels of WEC changed. In the case of DL and WEC-factor 2, leaders showed more DL when changes in WEC were especially strong. These findings are in line with the notion that complex work environments are likely to evoke adaptive behaviour (e.g., Baard et al., 2014; B. Griffin & Hesketh, 2003; Ployhart & Bliese, 2006; Pulakos et al., 2000; Yukl & Mahsud, 2010; Zaccaro et al., 2009). Griffin and Hesketh (2003) found employees' levels of SEAB to be positively related to "complex" jobs. These may be first indicators for arguing that higher degrees of complexity or challenge in work environments will lead individuals to show or develop SEAB. The relation of SEAB and a potential over-challenge of complex jobs is yet to be tested.

With respect to the above, this study proposes an inverted-U relationship for WEC and Leader Functionality (EUWELL & SEAB): where there is a low level of WEC, a leader's work in general may be offering little motivating potential for EUWELL or SEAB as it might under-challenge/under-use a leader's skills. Thus, growing levels of WEC are expected to be invigorating for all leaders up to a certain point, as WEC can provide some degree of stimulation. However, once complexity begins to exceed the resources or skills available to leaders it will change from a motivator to a stressor. At this inflection point, EUWELL and SEAB should decrease with growing WEC. In summary, the following hypotheses are proposed:

Hypothesis 2: WEC will predict Leader EUWELL described by an inversed U-shaped relation, i.e., EUWELL will be highest with a moderate level of WEC.

Hypothesis 3: WEC will predict Leader SEAB described by an inversed U-shaped relation, i.e., SEAB will be highest with a moderate level of WEC.

Figure 31 depicts the model proposed for the relationship between WEC and functional leader wellbeing (i.e., SEAB and EUWELL). The following sections explore potential dispositional factors as moderators of the relation between WEC, EUWELL, and SEAB.

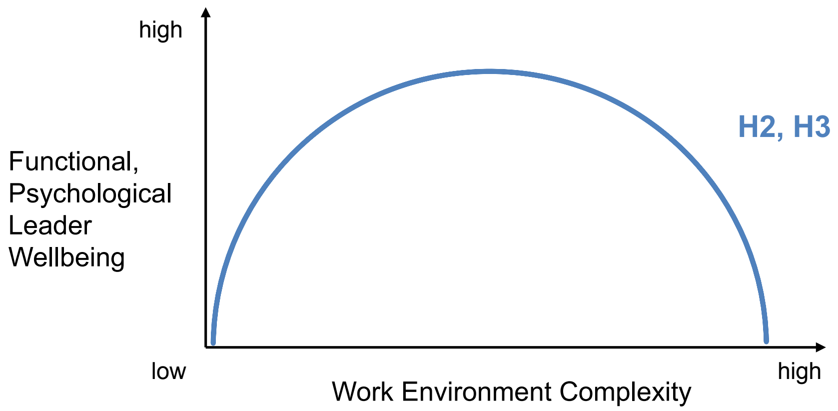

Figure 26. Proposed Model of Work Environment Complexity and Leader Functional, Psychological Wellbeing, Described by an Inverted-U Relation (Hypotheses 2 and 3).

Exploring Moderators in the Equation of WEC and Leader Functionality

Further expanding the exploration of curvilinear relations, research suggests that psychological wellbeing in complex jobs may also be influenced by other conditions or dispositional factors (Morgeson & Campion, 2003). Recently, more sophisticated models (while still applying a narrow conceptualisation of "job complexity") have thus found moderating effects of personal dispositions (e.g., preference for complexity, proactive personality, perceived demands-abilities fit) and job characteristics (e.g., job autonomy) in order for job complexity to fulfil its positive influence on employee wellbeing (Chung-Yan, 2010; Chung-Yan & Butler, 2011; Shaw & Gupta, 2004). A 2012 study (Moneta, 2012) finds, for instance, that workers are most likely to experience flow in environments that offer creative or complex challenge if these individuals have high intrinsic motivation. In line with Csikszentmihalyi's theory of optimal flow (Csikszentmihalyi, 1975/2000) and the concept of the challenge-skill balance (see e.g., Csikszentmihalyi & Larson, 1987; Massimini, Csikszentmihalyi, & Carli, 1987; Moneta, 2017a; Moneta & Csikszentmihalyi, 1996; van Woerkom et al., 2016), it may be assumed that positive effects like EUWELL will be highest when there is an optimal balance of the amount of WEC and the person's disposition or abilities to manage this environment (see also Ceja & Navarro, 2009, 2012). The point of optimal skill-demand balance would thus constitute the curve inflection point: the tip of the inverted-U. This invites the investigation of moderators that can influence the relation between WEC and leader functionality.

In alignment with this rationale, Figures 27 and 28 from a study by Chung-Yan (2010) present the relationship between psychological wellbeing/mental health (cf. Figure 27) and job satisfaction (cf. Figure 28) with job complexity as a *curvilinear* relationship, here moderated by the amount of *job autonomy*. Similar findings come from a second study by Chung-Yan and Butler (2011). Here, the effect of job complexity on job satisfaction and turnover intentions was moderated by a person's *proactive personality*. For individuals with low proactive personality, both very low and very high complexity led to lower job satisfaction and higher turnover intentions. Here, interestingly, for employees with high proactive personality, job satisfaction was highest (Figure 29) and turnover intentions lowest (Figure 30), when the level of job complexity was especially high.

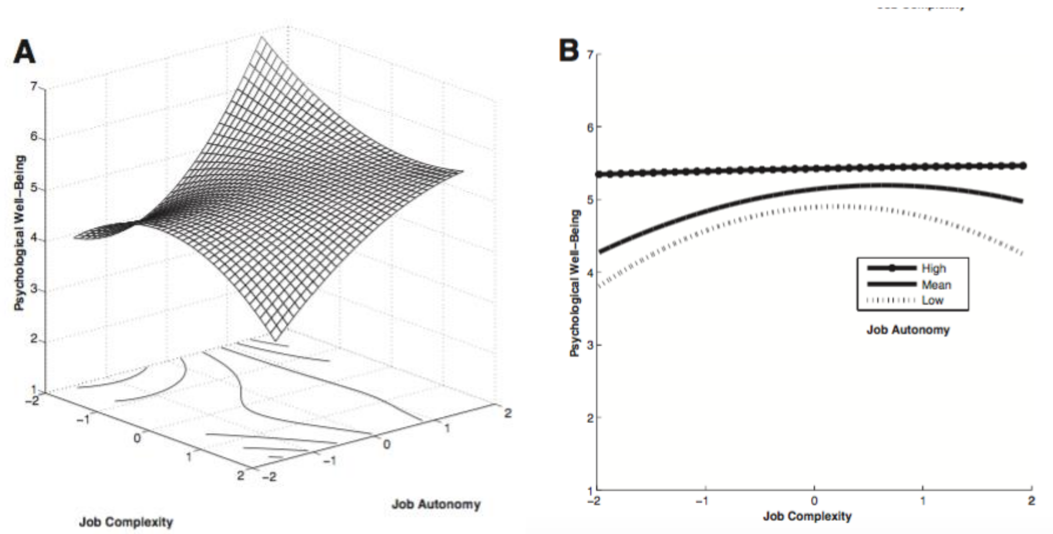

Figure 27. Interaction Between Job Complexity and Job Autonomy on Psychological Wellbeing
(adapted from Chung-Yan, 2010). *Note*. Psychological Wellbeing Conceptualised as Mental Health.

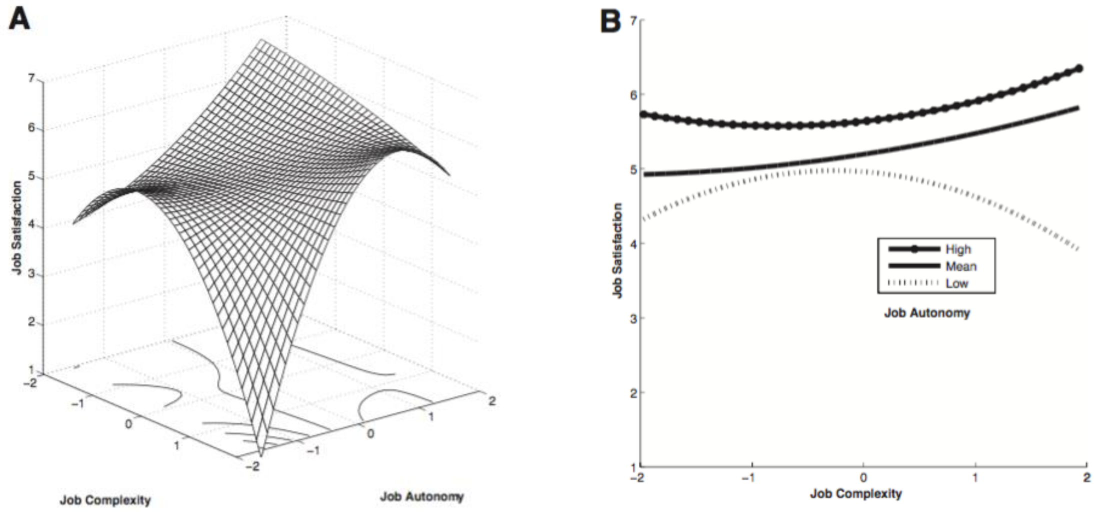

Figure 28. Interaction Between Job Complexity and Job Autonomy in Job Satisfaction
(adapted from Chung-Yan, 2010).

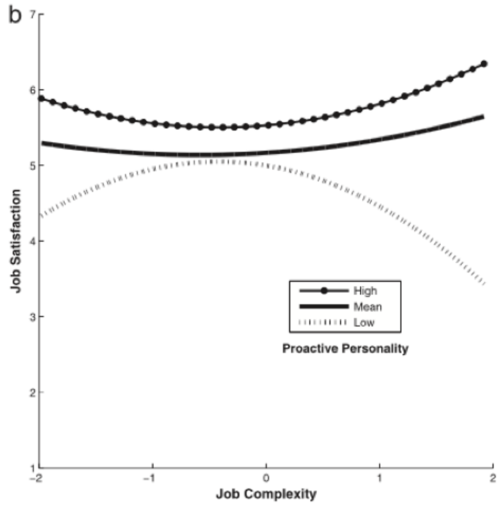

Figure 29. Interaction Between Job Complexity and Proactive Personality in Job Satisfaction
(adapted from Chung-Yan & Butler, 2011).

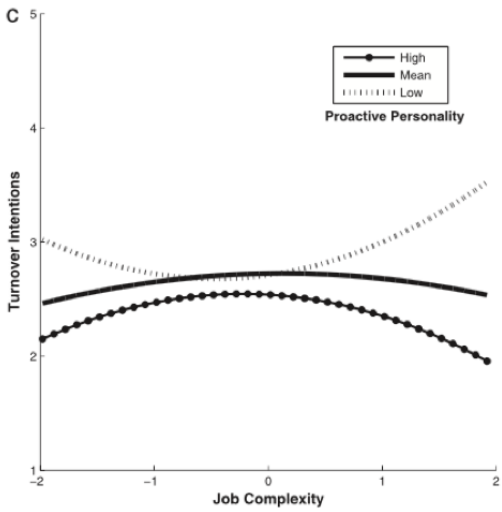

Figure 30. Interaction Between Job Complexity and Proactive Personality in Turnover Intentions
(adapted from Chung-Yan & Butler, 2011).

Keeping with nonlinear dynamical systems (NDS) theory (see also Chapter 2), other researchers have taken another distinctive perspective. By use of the experience sampling method (ESM) with flow diaries on PDAs, they revealed that not only are chaotic patterns very common in an employee's work (Ceja & Navarro, 2012), these chaotic patterns were nonlinearly associated with high levels of employee motivation, self-efficacy beliefs, intrinsic personal goal orientation, perception of high work control (Arrieta et al., 2008), and flow (Ceja & Navarro, 2009). NDS authors conclude that the occurrence of wellbeing-related phenomena like flow can best be explained by nonlinear models such as a “cusp curve” (see also Ceja & Navarro, 2009, 2012). Similar to the basic assumptions of challenge-skill balance, Ceja (2011) finds: “Employees who are engaged in complex tasks that challenge them to use their talents and strengths and develop new skills are most likely to find their work enjoyable and intrinsically worthwhile, which, in turn, improves productivity” (p. 50). Yet, the cusp model goes beyond this relation, modelling through so-called “bifurcation points” the occurrence of sudden ruptures or changes in the experience of flow, especially at high levels of challenge. The cusp model is thus a mathematical model that is inherently more elaborate than a linear – or curvilinear – relationship. What is more, this model finds that even small iterations or inequities between challenge and skill can lead to radical (positive or negative) changes in an individual’s engagement when challenge is high (Ceja, 2011). Figure 31 depicts the cusp curve, representing the interaction of perceived challenge, skills, and flow (enjoyment, interest and absorption).

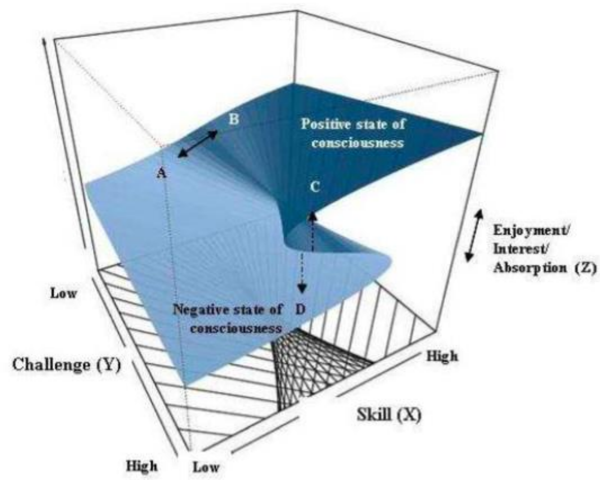

Figure 31. Cusp Model of Flow Experience at Work (adapted from Ceja, 2011), Depicting the Interaction of Challenge, Skill, and Flow.

In summary, work complexity, as conceptualised by authors so far, can have positive effects on *employee* wellbeing and may be a predictor for positive work-related outcomes – if work demands and individual resources are in balance. This discussion invites further consideration to firstly, expand the notion of a linear relation between complexity and wellbeing to investigate a curvilinear (inverted-U) association; secondly, to investigate the interaction effects of WEC characteristics and an individual's dispositions or skills (e.g., Shaw & Gupta, 2004).

While these findings have contributed to understanding how WEC may influence a leader's wellbeing and functionality, shortcomings are obvious and more investigation is needed. The first limitation is that most research has been conducted with employee, not leader, samples. As a managerial role differs considerably from other positions within an organisation (e.g., Pulakos et al., 2000), previous findings on employee functionality and the influence of complex jobs cannot be directly transferred. Study 1 of this thesis supports this limitation, finding that the meaning of WEC for employees and leaders differs so strongly that the same construct cannot be applied to both groups. Therefore, testing with leaders is needed. A second limitation is that previous studies only apply narrow conceptualisations of WEC as "complex jobs". These largely describe jobs that are either "not simple" or cognitively challenging, yet fail to incorporate factors of a broader work environment (cf. section 2.2.6). Also here, the generalisability of previous findings is restricted. Study 1 has validated the WEC Scale for leaders. Revisiting the above studies with a comprehensive construct of WEC is needed, not least because the study of accumulating job demands is emerging (van Woerkom et al., 2016). This concept assumes an exacerbation effect if an individual experiences multiple job demands simultaneously (as is present in WEC) that cannot be met by their resources. This would imply that the potential negative effect of an over-challenge on an individual is worse than a simple additive effect of job demands (van Woerkom et al., 2016). WEC, as conceptualised for the first time in this thesis, constitutes a new quality of "complexity" that has not been measured by a single construct thus far. Finally, several studies have examined the hedonic concept of job satisfaction, mental health, or performance as dependent variables. Yet, investigations of EUWELL and SEAB are entirely lacking, leaving empirical gaps.

The above discussion is important for two reasons. First, the relation between WEC and EUWELL and SEAB needs to be further understood; especially how leaders respond to high levels of complexity. Second, the idea of the challenge-skill match in WEC needs to be tested by investigating dispositional factors relevant for WEC. The latter will be expanded on below.

6.1.5 The Predictive Value of a Leader's Disposition and Mindset of "Embracing the Complexity" on Leadership Functionality

"*You feel ready, but ready for what*?" –

This statement from a CEO of IBM's Complexity Study (Berman & Korsten, 2010, p. 14) sums up in one sentence what a growing community of researchers and practitioners see as an essential component in predicting a leader's functional response to WEC: A *mindset* or *disposition* of leaders to "*embrace the complexity*" - implying that a leader will be productive and psychologically well-equipped in WEC if they accept and proactively work with, rather than combat or avoid dealing with the complexity, uncertainty, and paradox that lies in their work (Ashmos et al., 2000; Ceja & Navarro, 2012; Crooke et al., 2015; Fredberg, 2014; Judge et al., 1999; Karp & Helgø, 2008; Mumford et al., 2000; Ramos-Villagrasa et al., 2012). This discussion deepens the above, proposing that certain dispositional factors will moderate the relation between WEC and the degree of leader functionality.

Two discussions on a leader's "optimal" disposition for WEC are especially prominent: first, some authors propose that a leader has *Uncertainty Tolerance* or acceptance of complexity (e.g., Ashmos et al., 2000; Lichtenstein & Ashmos, 2009; White & Shullman, 2010), second, some authors propose that a leader has a *proactive motivation to approach* rather than avoid complex environments (e.g., Judge et al., 1999; Mumford et al., 2000). These propositions are based on the need for leaders in WEC to master novel, unprecedented, and adaptive situations (e.g., Brodbeck, 2002; Burnes, 2005; Karp & Helgø, 2008; Lane & Down, 2010; Uhl-Bien & Arena, 2017). An overview of the literature is evaluated in this section and also in Table 5 in Chapter 2.

6.1.6 Uncertainty Tolerance

Where uncertainty, ambiguity, and change are fundamentally inherent to complex work environments (e.g., Ashmos et al., 2000), the belief is that managers are most functional if they acknowledge and "embrace" the chaotic, uncontrollable, and paradox character of WEC (Ceja & Navarro, 2012; Crooke et al., 2015; Fredberg, 2014; Karp & Helgø, 2008; Visscher & Rip, 2003). Uncertainty Tolerance (UT) conceptualises an individual's interpretation of uncertainty or unpredictability as something to accept or even be comfortable with and has been found to be negatively related to work-related anxiety and strain, and positively related to managerial coping with change (e.g., Judge et al., 1999). White and Shullman (2010) call this disposition an "aptitude for ambiguity"; the acceptance of uncertainty. The opposite end of the scale describes individuals who are low on UT and become anxious when faced with ambiguous circumstances, interpret uncertainty as something threatening, and often react by trying to overly control or reinstall some form of "order" (Carleton, Norton, & Asmundson, 2007).

In line with the argumentation in section 6.1.4, leaders might want to avoid the feeling of being overchallenged by the demands of WEC and not in control. Leaders in complex contexts have to acknowledge that they cannot get a complete picture of the situation. Therefore, they should not spend excessive energy on trying to control ambiguous circumstances (Ashmos et al., 2000). As such, most functional leaders are presumably those who aim less to control complex systems in the first place (Gebauer, 2013): leaders with high UT, who accept or even enjoy uncertainty . Such a "non-prescriptive" disposition might allow leaders to spend more productive energy on effective leadership (e.g., Karp & Helgø, 2008), cope more successfully with complex challenges (Judge et al., 1999), perceive less strain (Roche et al., 2014), and in turn to see opportunities – not threats – in organisational complexity (Berman & Korsten, 2010; Crooke et al., 2015; Gebauer, 2013; Lichtenstein & Ashmos, 2009; Marion, 2012). Also, individuals who show higher UT have been found to be more open to adjusting their judgments if diverging information arises, as they are less in need of so-called cognitive closure (Webster & Kruglanski, 1994). Not least, leaders with high UT should respond to uncertain circumstances with less anxiety or worry, which should directly link to their mental and psychological health (Carleton et al., 2007). It would thus follow that managers with a tolerance towards complex and unstructured contexts will respond more productively and flexibly in tackling the challenges of complex environments (Marion, 2012; Mumford et al., 2000; White & Shullman, 2010). In this line of thought, Marion (2012) proposes that

> *"leaders of complexity are not uncertainty avoidant, rather, they perceive complexity as a tool that can benefit the organisation. Conversely, leaders who avoid uncertainty, seek to be in control of conditions, to stabilize dynamics, to supress the very dynamics that complexity depends on" (p. 198).*

Individual psychological predispositions that foster successful coping, functionality, and adaptivity in WEC have been largely neglected in research to date (Baard et al., 2014; Judge et al., 1999; Ployhart & Bliese, 2006; Yukl & Mahsud, 2010). This is presumably also due to the fact that to date there had been no measure for WEC. Some related studies, however, are suggestive of the linkage between an "embracing mindset" and leader psychological functionality in complex work settings (Ashmos et al., 2000; Fredberg, 2014; Judge et al., 1999; Roche et al., 2014).

With economic performance in mind, Fredberg (2014) argues, in an interview study with twenty CEOs, that it is their role to embrace and acknowledge paradoxes that naturally occur in management positions. The ability to do so, they explain, will create competitive advantage, as the most innovative solutions or synergies are to be found by working with the "paradoxical tension" between a multitude of options, decisions, and priorities. In essence, Fredberg (2014) paints the picture of successful managers seeing the opportunity, not the threat, of complex circumstances. One of the rare empirical studies by Ashmos et al. (2000) supports this claim, finding that organisations whose CEOs pursued a "complexity absorption" response (i.e. a managerial view of embracing the ambiguity and uncertainty in complex work settings) financially outperformed those with "complexity reduction" responses (i.e. a managerial view of trying to control, predict, and apply simplified if-then approaches to handle the complexity).

Other researchers have investigated the effect of UT-related dispositions on a leader's psychological functionality. In a sample of 697 leaders and entrepreneurs, Roche et al. (2014) found both a leader's mindfulness and psychological capital (i.e., hope, efficacy, resilience, and optimism) to be negatively related to mental health symptoms such as anxiety, depression, and emotional exhaustion. Furthermore, Judge et al. (1999) substantiated the idea that a leader's Positive Self-Concept (i.e. locus of control, generalised self-efficacy, self-esteem, and positive affectivity) as well as Risk

Tolerance (i.e., openness to experience, tolerance for ambiguity, and low risk aversion) predicted a leader's adaptive ability to cope with change. This, in turn, explained significant variance in a leader's organisational commitment, job satisfaction, and job performance. Preliminary findings in a study by White and Shullman (2010) found that a leader's ability to manage uncertainty significantly predicted their ability to deal with change, current performance, and the potential to advance in their career. While the above studies have not applied a more comprehensive construct of WEC to assess a work environment's level of complexity, these findings indicate that a leader's Uncertainty Tolerance may be positively related to functional coping in WEC.

For employees, tolerance of uncertainty has further been found to positively predict adaptive behaviour (Fay & Frese, 2001; Griffin et al., 2007; Griffin et al., 2010; LePine et al., 2000; Mumford, Baughman, Threlfall, Uhlman, & Costanza, 1993; Oreg, 2003; Zaccaro et al., 2009) and, where applied, showed consistent positive, significant relationships with Self-Efficacy for Adaptive Behaviour (e.g., B. Griffin & Hesketh, 2003; Pulakos et al., 2002). Studies with leaders on SEAB are, however, less common. Yet, examining the related concept of resilience (the ability to remain performing under challenging conditions), Bartone, Kelly, and Matthews (2013) found that military leaders with high resilience were rated as more adaptive by their supervisors. Using the above as indicators, and drawing from the fact that UT is a differential variable that applies to all individuals (Webster & Kruglanski, 1994), it is proposed that high leader Uncertainty Tolerance will be a positive resource promoting leadership functionality especially under high levels of WEC (e.g., Chung-Yan & Butler, 2011; Shaw & Gupta, 2004). Thus, the following interactions are proposed:

Hypothesis 4: Leader Uncertainty Tolerance (UT) will moderate the relation between WEC and EUWELL in such a way that under conditions of high WEC, leaders with high UT report higher EUWELL than leaders with low

UT.

Hypothesis 5: Leader UT will moderate the relation between WEC and SEAB in such a way that under conditions of high WEC, leaders with high UT report higher SEAB than leaders with low UT.

The moderated relationships also include curvilinear relationships.

Again, following the propositions above, up to a certain point, WEC is expected to be invigorating for all people, because it can provide some degree of stimulation, independent of their level of UT. But once complexity begins to exceed the resources available to leaders (i.e. low UT), it will change from a motivator to a stressor. UT is expected to influence the level of EUWELL and SEAB especially under high levels of WEC. WEC should be related to EUWELL and SEAB in an inverted-U pattern for low UT individuals, with an inflection point at moderate WEC levels. Under conditions of high WEC, a decline in EUWELL and SEAB is expected for low-UT leaders. In contrast, high UT should act as a resource and should influence how well leaders cope with high levels of WEC (challenge-skill match), maintaining high scores on EUWELL and SEAB in moderate and high WEC. Individuals with high UT would, for instance, be more likely to interpret a complex environment as an opportunity rather than a threat and feel comfortable working in more ambiguous and unpredictable settings. Thus, it is expected that under high WEC, high UT leaders show significantly higher levels of SEAB and EUWELL as compared to low-UT leaders. Given that Hypotheses 2 and 3 propose a curvilinear relation of WEC, SEAB and EUWELL, the moderation analyses for UT in an exploratory attempt will test for both linear and curvilinear relationships (WEC and WEC^2).

6.1.7 Approach vs. Avoidance Motivation

In a similar vein, a proactive disposition is proposed to be a predictor of functional leadership in high WEC (Mumford et al., 2000). It is suggested that managers who are curious, risk-taking, proactive, and willing to approach novel problems are more open and inquisitive when faced with novel circumstances, and may actively seek out working in such contexts (Hannah, Woolfolk, & Lord, 2009; Judge et al., 1999; Mumford et al., 2000). This may be explained by the observation that certain dispositions (e.g. intrinsic motivation) positively draw individuals toward appreciating the challenge of demanding tasks in "complexity as an opportunity to acquire mastery" (Moneta, 2012, p. 492).

The concept of work-related Approach vs. Avoidance Motivation (also promotion vs. prevention focus, Ferris et al., 2013; Higgins, 1997), discriminates between a proactive "Approach Motivation which guides behaviour towards achieving success or fulfilling one's full potential in work, and an Avoidance Motivation which guides behaviour away from failures or negative outcomes at work" (Johnson, Chang, Meyer, Lanaj, & Way, 2013, p. 425). Contrary to an intuitive interpretation, the two dimensions are conceptualised not as opposite, but orthogonal dimensions, which implies that an individual can have facets of both motivations. Typically, the two are slightly negatively correlated, i.e. it is likely that a person scores high on one motivation and lower on the other (Ferris et al., 2013; Johnson et al., 2013).

Several studies with employees and students have substantiated that Approach Motivation relates positively with employee creativity and innovation behaviour, and predicts job satisfaction and work performance (see for a recent review, Cui & Ye, 2017; Johnson et al., 2013). For employees, high personal proactivity has been found in the context of "complex" jobs to be associated with higher job satisfaction (Chung-Yan & Butler, 2011). Avoidance Motivation, in contrast, negatively predicted an employee's job satisfaction, and instead fostered work strain (Johnson et al., 2013). While the authors expect the causal direction of effect to go from work focus to behaviour, a reverse causality cannot be ruled out (Johnson et al., 2013). Only recently has it further been observed that a *leader's* Approach Motivation as perceived by employees will foster employees' creativity and ownership (e.g., Hartman & Conklin, 2014; Henker, Sonnentag, & Unger, 2015).

Empirical insights on effects of Approach or Avoidance Motivations in relations with complex work contexts are very scarce, and are restrained by the more narrow conceptualisation of a "complex job", not a comprehensive WEC construct (cf. section 2.2.6). Also, no research on the relation to EUWELL or SEAB is known and no study yet has empirically examined a leader's Approach/Avoidance Motivation with respect to leadership processes (Cui & Ye, 2017; Kark & Van Dijk, 2007). Yet, recent articles suggest that leaders' motivational disposition will influence their preferences for more innovative (Approach Motivation) or more conservative (Avoidance Motivation) work environments (Hartman & Conklin, 2014; Kark & Van Dijk, 2007). A dynamic and change-rich environment may thus be perceived by leaders as a better fit to an Approach-focused mindset; a more stable working environment matching a risk-averse Avoidance Focus (Kark & Van Dijk, 2007). It might thus be that an individual's motivational focus either strengthens the desire to experience a stimulating work environment (= Approach Motivation) or exacerbates an individual's desire not to be overchallenged by WEC (= Avoidance Motivation). Extrapolating the above insights, it may follow that leaders with high Approach Motivation are likely to perceive complex situations as less stressful, be more comfortable with the potential risks of novel situations, develop adaptive skills, and cope more effectively with the characteristics of WEC (Hannah et al., 2009; Judge et al., 1999; Marion, 2012). In turn, managers with high Avoidance Motivation are likely to be risk-averse, prefer routine and security, feel strain from meeting uncertain contexts, and would rather try to avoid or withdraw from complex situations (Kark &

Van Dijk, 2007). Thus, it is proposed that a leader's Approach Motivation will exert a positive influence, and that a leader's Avoidance Motivation is likely to exert a negative influence on leadership functionality in context of high WEC (Chung-Yan & Butler, 2011; Shaw & Gupta, 2004).

Hypothesis 6: Approach Motivation (APP) will moderate the relation between WEC and EUWELL in such a way that under conditions of high WEC, leaders with high APP report higher EUWELL than leaders with low APP.

Hypothesis 7: APP will positively moderate the relation between WEC and SEAB in such a way that under conditions of high WEC, leaders with high APP report higher SEAB than leaders with low APP.

Hypothesis 8: Avoidance Motivation (AVO) will negatively moderate the relation between WEC and EUWELL in such a way that under conditions of high WEC, leaders with high AVO report lower EUWELL than leaders with low AVO.

Hypothesis 9: Avoidance Motivation will negatively moderate the relation between WEC and SEAB in such a way that under conditions of high WEC, leaders with high AVO report lower SEAB than leaders with low AVO.

The moderated relationships also include curvilinear relationships.

As discussed above, WEC is expected to be invigorating for all people up to a certain point. In contrast, the influence of the two dispositional variables (high) APP and (low) AVO should influence how well leaders cope under *high* levels of WEC. Thus, under high WEC it is expected to see a decline in SEAB and EUWELL for individuals with low APP or high AVO. Due to a better challenge-skill match, under conditions of high WEC, a high APP and/or low AVO should have a positive impact on EUWELL and SEAB. Again, as Hypotheses 2 and 3 propose a curvilinear relation of WEC, SEAB and EUWELL, the moderation analyses for APP/AVO will include both linear and curvilinear relationships (WEC and WEC^2). Figure 32 summarises the proposed moderating effects of dispositional variables on the relation of WEC, EUWELL, and SEAB.

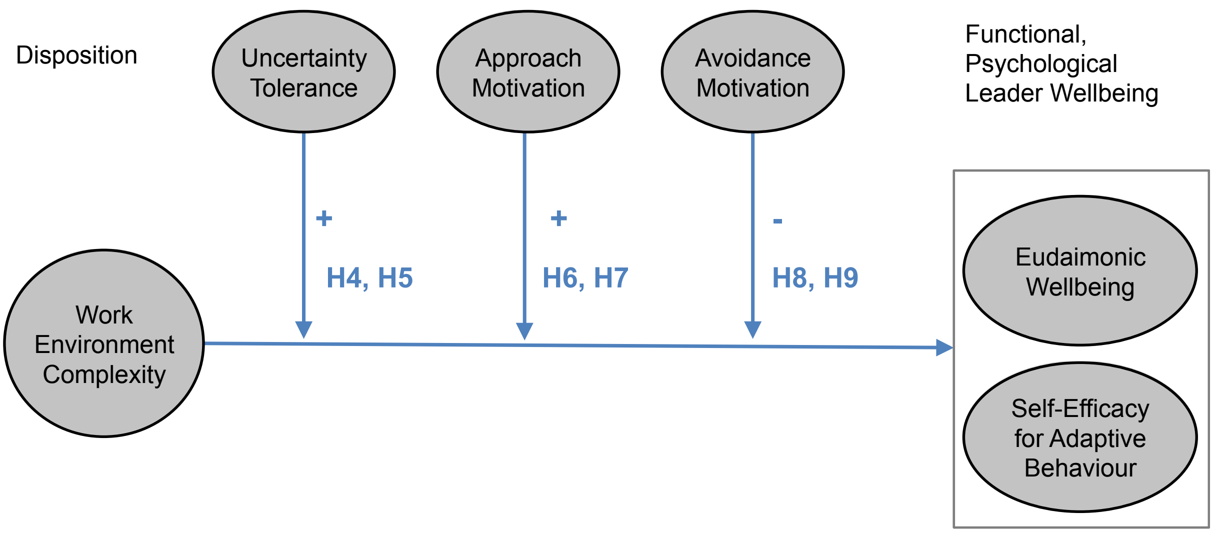

Figure 32. Proposed Model of WEC and Leader Functional, Psychological Wellbeing, Moderated by Leader Dispositional Variables (Hypotheses 4-9).

6.1.8 The Predictive Value of Leadership Styles for Leadership Functionality

It has not yet been investigated how the choice of leadership style, specifically EL and DL, will affect a leader's personal functionality in WEC. This is surprising, as the specific environment in which a manager is leading may well determine how stressful a certain leadership style is to adopt (Arnold & Connelly, 2013). Also outside the context of WEC, authors state a "dearth of research" (Zopiatis & Constanti, 2010) when describing effects of leadership styles on leader psychological or functional wellbeing, while many authors have acknowledged it as an interesting topic to be studied (Arnold & Connelly, 2013; Ilies et al., 2005). It appears that most research has instead focused on investigating leadership styles with regard to a leader's impact on organisational or employee outcomes (Arnold & Connelly, 2013; Nielsen & Daniels, 2012; Roche et al., 2014).

Some empirical progress has been made when studying the relationship between leadership styles and leader mental health or stress symptoms. For instance, a study by Corrigan, Diwan, Campion & Rashid (2002) found that exerting a transformational leadership style is negatively associated with leader burnout and positively related to feelings of personal accomplishment. In a second study, comparing the demonstration of different leadership styles (transformational, contingent reward, and passive/avoidant leadership) and their effect on the probability that leaders suffer burnout, Zopiatis and Constanti (2010) found that the two more "active" styles - transformational leadership and contingent reward leadership (in parts) - were negatively related to burnout indicators. In contrast, a passive/avoidant leadership style (a reactive style of "not leading") predicted significantly higher levels of burnout. The authors conclude that not only is a passive/avoidant leadership style "the most ineffective of the three leadership styles" (Zopiatis & Constanti, 2010), leaders with a passive approach of "not leading" are significantly more at risk to suffer poor mental wellbeing. Recent findings support this pattern (Arnold et al., 2017): Passive leadership patterns predicted high levels of burnout, whereas a balanced active leadership pattern (a combination of transformational and transactional behaviour) protected leaders from experiencing burnout and exhaustion.

While the mechanisms are yet not fully understood, it is plausible that these results can be explained by the conservation or depletion of resources, as stated, for example, by the Conservation of Resources theory (COR, Hobfoll 1989; see e.g. Arnold et al., 2017). It states that individuals are motivated to conserve or increase positive resources (e.g. emotions, conditions), and that a loss of resources impairs wellbeing (Hobfoll, 1989). A leader who is able to create positive interactions or mitigate negative ones (e.g. conflict, bullying) through his or her actions is likely to receive positive resources back, e.g. positive employee reactions or reciprocal support (Arnold et al., 2017). Also, actively engaging in leadership behaviour is tied to a sense of personal accomplishment (Zopiatis & Constanti, 2010). Passive leaders who refrain from exerting influence, in contrast, are unlikely to experience this positive emotion (Zopiatis & Constanti, 2010). Also, employees of passive/distant leaders report the lowest levels of trust, commitment and perceived fairness when compared to other leadership styles (Doucet, Fredette, Simard, & Tremblay, 2015). Generally, acting passively as leader has been found to be largely ineffective as well as encouraging for negative employee behaviours like bullying, stress, and neglect of safety regulations (Arnold et al., 2017; Zopiatis & Constanti, 2010). Passive leaders would thus face more situations of negativity, which deplete their resources without gaining back positive ones (Arnold et al., 2017). The consequence is feeling emotionally exhausted, mentally unwell, and paralyzed in a spiral of negativity which would yield lower levels of leaders' functionality (Arnold et al., 2017; Zopiatis & Constanti, 2010).

Since these studies are not WEC-related, do not apply the leadership styles of this investigation, and have not examined EUWELL or SEAB, their transferability to the aim of this study is limited in several aspects. However, they can be understood as an indication that more *active* leadership styles will be more beneficial to a leader's functionality as opposed to simply "not leading". In line with this, Lane and Down (2010) propose in their article on leadership in turbulence that "anxiety and fear can lead to retrenchment; conversely, confidence and courage can lead to new opportunities" (p. 513). Hannah and colleagues propose that leaders would need the "requisite agency" to "step up to complex challenges" (2008, p. 2). Similarly, in the above section 6.1.7, more pro-*active* personality dispositions were identified as potentially more beneficial for meeting the challenges of WEC, as compared to an avoidant or passive disposition (Kark & Van Dijk, 2007). Yet, these hypotheses remain to be empirically investigated.

A central theme that has emerged in the exploration of leadership functionality in WEC so far is how much the individual leader's skills match the challenges of WEC. In line with the skill-demands rationale of flow theory, it is reasonable to assume that this also applies to the application of leadership style (Arnold & Connelly, 2013): When leaders feel challenged (= complex work environment) yet capable of handling such challenge (= applying the appropriate *leadership style*), the occurrence of positive and flow-related phenomena like engagement, interest, and absorption should naturally follow (Ceja, 2011; Hektner, Schmidt, & Csikszentmihalyi, 2007; Moneta, 2017a). While WEC-researchers have highlighted EL as the "preferable" style in comparison to DL, this would suggests, in contrast, that the functionality of leaders may depend more on the ability to *act at all* – or as Berman and Korsten (2010) suggest for leaders in complexity to "act despite uncertainty" (p. 32). As such, both leadership styles, or both in combination, could equally fulfil this function (see e.g., Arnold et al., 2017). This assumption also goes in line with a discussion that has prevailed throughout the course of this thesis, highlighting the value of both EL and DL in WEC as independent constructs. For this reason, it should also be possible for leaders to show both EL and DL in parallel. Previous research only speculates as to how leadership styles and leader functionality in WEC may be related, this requires an explorative approach. First indicators suggest that irrespective of the style, *any* active leadership action rather than passivity or "not leading" may equip a leader to be functional in contexts of high WEC (e.g., Arnold & Connelly, 2013). Thus, the following hypotheses are proposed:

Hypothesis 10: EL moderates the relationship between WEC and EUWELL, in such a way that under conditions of high WEC, leaders with high EL report higher EUWELL than leaders with low EL.

Hypothesis 11: EL moderates the relationship between WEC and SEAB, in such a way that under conditions of high WEC, leaders with high EL report higher SEAB than leaders with low EL.

Hypothesis 12: Directive leadership moderates the relationship between WEC and EUWELL, in such a way that under conditions of high WEC, leaders with high DL report higher EUWELL than leaders with low DL.

Hypothesis 13: DL moderates the relationship between WEC and SEAB, in such a way that under conditions of high WEC, leaders with high DL report higher SEAB than leaders with low DL.

The moderated relationships also include curvilinear relationships.

WEC is expected to be invigorating for all people up to a certain point. In contrast, higher levels of leadership shown (EL and DL) should influence how well leaders cope under *high* levels of WEC. Thus, under high WEC we expect to see a decline in SEAB and EUWELL for individuals with low levels of EL or DL. Due to a better challenge-skill match, under conditions of high WEC, a high level of EL and/or DL should have a positive impact on EUWELL and SEAB. Again, the moderation analyses will test for both linear and curvilinear relationships (WEC and WEC^2). Figure 33 depicts the proposed moderating effects of leadership styles on the relation of WEC, EUWELL, and SEAB.

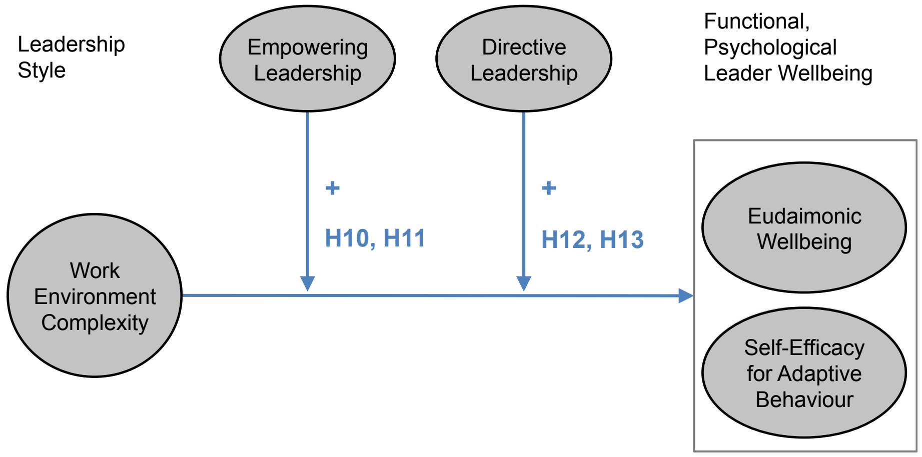

Figure 33. Proposed Model of WEC and Leader Functional, Psychological Wellbeing, Moderated by Leadership Styles (Hypotheses 10-13).

In summary, the dynamics between a complex work environment, dispositional factors, leadership style; and leaders' functional wellbeing are not well understood. The present study therefore explores several topics. Firstly, how WEC itself influences leader wellbeing – previous research is limited but suggests that a curvilinear, inverted-U shape could describe the relation. This can be tested by the use of Hierarchical Regression Analysis and by comparing linear and curvilinear (squared) influence of the WEC factors on leader functionality. Secondly, it is likely to find that other factors influence leaders' wellbeing, especially under high complexity conditions. Therefore, this study tests whether personality factors (Uncertainty Tolerance, Approach Motivation, Avoidance Motivation), and the choice of leadership style (EL, DL) moderate leaders' functional wellbeing when confronted with high WEC. Such moderation effects can be best investigated by the use of a Hierarchical Regression Analysis. As the first proposition involves curvilinear interactions; all models below will be tested for both linear and curvilinear effects.

6.2 Study 4 Method

Participants and procedure were identical to those of Study 3: The data comprised 117 leaders from two longitudinal samples (= four leadership samples in total), which were summarised to one longitudinal sample with two points of time (Wave 1 and Wave 2).

6.2.1 Measures

All variables were formulated so that participants could express their level of agreement on a 5-point scale from 1 (Disagree strongly) to 5 (Agree strongly). Scales were shortened from their original length, in order to make the overall battery more concise and to remove items that did not fit the work or organisational context studied. If so, this item selection was based on factor loadings as reported in the literature in order to choose the items loading highest on the respective constructs.

6.2.2 Dependent Variables

Eudaimonic Wellbeing. EUWELL represents a construct of functional engagement, combining facets of dedication and absorption. It was measured by three items of the Utrecht Work Engagement Scale (UWES, Subscale Dedication), Schaufeli, Bakker and Salanova (2006) and one item of the Work-related Flow inventory (WOLF, Subscale Absorption), Bakker (2008). A sample item is "My job inspires me" (Dedication). The authors reported an internal consistency of Cronbach's alpha ranging between .75 and .90 for the initial UWES Dedication subscale, and .75-.86 for the initial WOLF Absorption subscale. Construct validity was demonstrated for the UWES in a large-scale cross-national validation study (Schaufeli et al., 2006) and across several occupational samples for the WOLF (Bakker, 2008).

Self-Efficacy for Adaptive Behaviour. SEAB measures the degree to how confident individuals feel about behaving adaptively in a work context. It was measured with four items from the Self-Efficacy for Behaving Adaptively Scale, Griffin and Hesketh (2003), originally based on the eight dimensions of adaptive behaviour identified by Pulakos et al. (2000). Four items were not applied, as they did not fit the work context studied. A sample item is “I feel confident that I can ‘drop everything’ and take an alternate course of action to deal with a new and critical priority”. The authors reported internal consistency ranging between .80 and .92 for the SEAB scale.

6.2.3 Independent Variables

Work Environment Complexity, *empowering leadership*, and *directive leadership* measures were those described in Study 2.

Uncertainty Tolerance. Uncertainty Tolerance measures the degree to which an individual feels comfortable with, rather than fearful of uncertain events. It was measured with two items from the Intolerance of Uncertainty Scale-Short Version (IUS-12), subscale Prospective Anxiety/Unacceptability and Avoidance of Uncertainty by Carleton, Norton, and Asmundson (2007). A sample item is “I cannot stand being taken by surprise” (R)[5]. The authors reported an internal consistency of .85 for the initial scale as well as indicators for good convergent and discriminatory validity in relation to other measures of anxiety and worry (Carleton et al., 2007).

Approach and Avoidance Motivation. Approach Motivation guides an individual’s behaviour towards achieving success or fulfilling one’s potential in work. Avoidance Motivation guides behaviour away from failures or negative outcomes at work. The two motivations were measured with the Work-Based Regulatory Focus Scale , Ferris, Johnson, Rosen, Djurdjevic, Chang, and Tan (2013). Approach Motivation was measured with three items, a sample item is “My goal at work is to

[5] (R) = Reverse scored.

fulfil my potential to the fullest in my job", Avoidance Motivation was measured with two items, a sample item is "I am fearful about failing to prevent negative outcomes at work". Reported values of internal consistency for the initial six-item scales were .84 for work-based promotion (Approach Motivation) and .80 for prevention focus (Avoidance Motivation). In support of the scale's validity, Johnson and colleagues (2013) found the two work-related motives related in expected ways, with markers of general approach and avoidance temperaments, and that they are distinct from other individual difference variables (e.g. conscientiousness).

6.2.4 Statistical Analysis

The direct (main) predictive effects (Hypotheses 1 and 2) were analysed through Hierarchical Regression Analysis. The proposed predictors (WEC and WEC^2) were entered stepwise to identify the contributions of a linear and curvilinear effect of WEC in the overall variance explained (change in R^2). For a robust prediction, bootstrapping (5,000 samples, 95% Confidence Interval) was performed on all regressions (Field, 2013). Bootstrapping is a random sampling procedure that takes samples from the observed data. The precision of the statistics is not only estimated from one sample, but thousands, making this approach usually more accurate than traditional approaches (D. B. Wright, London, & Field, 2011).

Moderation effects were analysed through Hierarchical Regression Analysis (OLS Regression) as described by Dawson (2014): To test for moderation effects, variables are included unstandardised, and their interaction term is calculated by multiplying the respective predictors. For curvilinear predictive effects (hypothesised for WEC), the WEC factors were squared and the interaction was calculated with the squared WEC variables and the (unsquared) moderators (Dawson, 2014). Control variables, if applied, were z-standardised. The hierarchy of regression follows the following steps: (1) include control variables (if any), (2) include main effects, (3) include interaction terms, (4) include curvilinear interaction terms. The stepwise inclusion of predictors into the model enables identification of significant changes in variance (R^2) in each step. Moderation results were visualised for more comprehensive interpretation, following the guidelines by Aiken and West (1991), and through use of the PROCESS-Macro in SPPS (Hayes, 2012). The graphics map levels of a continuous variable as low (- 1 SD), medium (mean) and high (+ 1 SD) (Dawson, 2014).

In leadership research, authors have discussed the difficulty of detecting moderators in multiple regressions due to several methodological challenges, amongst these are small sample sizes (Villa, Howell, Dorfman, & Daniel, 2003). To strengthen statistical power, and following a recommendation by Villa et al. (2003), the influence of the moderating variables were tested in separate analyses. For the curvilinear effects proposed, the data were scanned for outliers based on standardised residuals > |3|, and were removed from the respective analyses (casewise diagnostics).

The analyses were conducted separately for the two administrations, and separately for the two factors WEC-1 and WEC-2. As such, each moderation hypothesis was tested four times, resulting in a total testing of 40 moderation effects[6]. For eased interpretation, only the most relevant findings will be discussed: Significant moderation results will be discussed when results exceed what could have been expected from a Bonferroni probability alone (5%). A comprehensive overview of results can be obtained from the author upon request.

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6 $(1) DV = b_0 + b_1 x$

$(2) DV = b_0 + b_1 x + b_2 x^2$

$(3) DV = b_0 + b_1 x + b_2 x + b_3 m + b_4 xm$

$(4) DV = b_0 + b_1 x + b_2 x + b_3 m + b_4 xm + b_5 x^2 m$

6.3 Study 4 Results

6.3.1 Outlier Analysis and Descriptive Results

The outlier analysis detected two outliers, which were removed from the respective analyses: One outlier case was removed from the HMR analyses of UT and EUWELL in Wave 1 (n = 116), and the second (different) outlier was removed for all regressions involving EUWELL in Wave 2 (n = 116). No outlier was removed from the analysis of SEAB (n = 117). As such, descriptive statistics contained all data (n = 117).

Table 26 displays descriptive statistics for the study variables. All scales had satisfactory internal consistency above .70 at both measuring points with the exception of DL and APP in Wave 2, and WEC-2 in both waves, as discussed already in Studies 3 and 4.

As expected, the two dependent variables, EUWELL and SEAB, were correlated significantly with one another at r = .64 in Wave 1 and r = .42 in Wave 2, indicating that they were related yet distinct concepts (Shaffer et al., 2016). In accordance with previous research on APP and AVO (Ferris et al., 2013; Johnson et al., 2013), the two variables were correlated (negatively) to a small and non-significant extent with r = -.16 in Wave 1 and r = -.08 in Wave 2.

Table 26: Study 4 - Means, Standard Deviations, Correlation Coefficients, and Cronbach's Alpha

Variable	*M*	*SD*	*Wave 1*									*Wave 2*								
			1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*	*9.*	*10.*	*11.*	*12.*	*13.*	*14.*	*15.*	*16.*	*17.*	*18.*
Wave 1																				
1. WEC-1	3.87	0.76	(.78)																	
2. WEC-2	2.84	0.75	.34**	(.64)																
3. Unc. Tolerance	3.94	0.86	.06	-.25**	(.72)															
4. Approach	4.31	0.53	.05	-.35**	.44**	(.71)														
5. Avoidance	3.62	0.97	-.12	0.05	-.15	-.16	(.78)													
6. EL	4.03	0.76	.26**	.13	.24*	.12	.09	(.70)												
7. DL	3.74	0.74	-.03	-.15	.07	.30**	.07	.01	(.73)											
8. EUWELL	4.41	0.56	.12	-.23*	.31**	.58**	-.09	.03	.39**	(.84)										
9. SEAB	3.87	0.76	.25**	-.32**	.42**	.58**	-.14	.24**	.27**	.64**	(.75)									
Wave 2																				
10. WEC-1	3.89	0.72	.15	.07	.13	-.03	-.08	.18*	.00	.00	.07	(.76)								
11. WEC-2	2.75	0.70	.12	.01	.10	.01	-.05	.04	-.04	.06	.06	.40**	(.65)							
12. Unc. Tolerance	3.91	0.87	-.14	-.11	.07	-.03	-.24*	.06	-.10	-.07	-.09	.13	-.23*	(.71)						
13. Approach	4.20	0.53	-.02	-.20*	-.01	.03	-.05	.01	-.05	-.07	.00	.07	-.21*	.24**	(.65)					
14. Avoidance	3.57	1.03	.08	-.05	.13	.03	.05	.00	.05	.14	.04	.00	.27**	-.22*	-.08	(.75)				
15. EL	4.11	0.75	.36**	-.01	.08	.12	-.23*	.14	.05	-.11	0.06	.27**	.32**	-.10	.10	.25**	(.73)			
16. DL	3.59	0.72	.08	.02	.00	.20*	-.02	.07	-.02	.04	0.11	-.17	-.19*	-.05	.26**	-.04	.09	(.66)		
17. EUWELL	4.28	0.54	.07	-.04	-.01	-.04	-.22*	.12	.00	-.11	-.03	-.01	-.30**	.25**	.46**	-.08	.22*	.34**	(.83)	
18. SEAB	4.35	0.57	-.14	-.05	-.10	.00	-.05	-.01	.02	-.06	-.09	-.02	-.40**	.46**	.44**	-.28**	.03	.47**	.42**	(.77)

Note. n = 117. WEC-1= WEC factor 1 Frequent Change and Events; WEC-2= WEC factor 2 Uncertain Job Demands; Unc. = Uncertainty; EUWELL = Leader Eudaimonic Wellbeing; SEAB = Leader Self-Efficacy for Adaptive Behaviour. Range of the response scale: 1-5.
* $p < .05$; ** $p < .01$.

6.3.2 Hypotheses Testing

The results of the predictive effects will be examined first for the outcome of Leader Eudaimonic Wellbeing and secondly for Self-Efficacy for Adaptive Behaviour. In each section, the main effects will be examined first, i.e. the *direct* influence WEC had on the outcomes. Then, the moderation effects will be examined, meaning the extent to which the variables *interacted* with WEC in order to predict the outcomes.

6.3.3 Predicting Leader Eudaimonic Wellbeing

Direct Predictive Effects

Hypothesis 2 posited a curvilinear (inverse U-shaped) effect of WEC on EUWELL. Table 27 depicts the results of Hierarchical Multiple Regression Analyses for both waves and both WEC-factors.

Table 27: Study 4 - Hierarchical Multiple Regression Analyses, EUWELL as criterion variable

Step	*Predictor*	*B*	*SE*	*β*	*p*	*Overall R^2*	ΔR^2
Wave 1							
1	WEC-1	.09	.06	.13	.140	.02	.02
2	WEC-1^2	.05	.07	.50	.494	.02	.00
3	WEC-2	$-.20^{**}$	.06	$-.28^{**}$	.002	.09	$.07^{**}$
4	WEC-2^2	$.17^{**}$	.06	1.37^{**}	.005	.13	$.04^{*}$
Wave 2							
1	WEC-1	.01	.07	.02	.818	.00	.00
2	WEC-1^2	$.15^{+}$	.09	1.55^{+}	.070	.03	$.03^{+}$
3	WEC-2	$-.26^{**}$	.08	$-.33^{**}$	.001	.12	$.09^{**}$
4	WEC-2^2	.07	.10	.52	.405	.13	.01

Notes. n =116 (respective outliers removed). ΔR^2 = Change in R^2.
B, SE and *p* values based on bootstrapping with 5,000 samples, 95% Confidence Interval. Light grey shadows indicate significant effects.
$^{+}p < .10$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

For factor WEC-1, Frequent Change and Events, the linear effect was non-significant in Wave 1 ($\beta = .13$, $p = .140$) and Wave 2 ($\beta = .02$, $p = .818$), and the curvilinear term predicted no additional significant variance in EUDWELL, in Wave 1 ($\beta = .50$, $p = .494$) but in Wave 2 ($\beta = 1.55$, $p < .10$), indicating that there was a significant curvilinear effect of WEC-1 on EUWELL in Wave 2. Figure 34 depicts the relationship, showing that in Wave 2, EUWELL follows a U-shaped trend, with highest levels of EUWELL under conditions of both lowest and highest WEC-1.

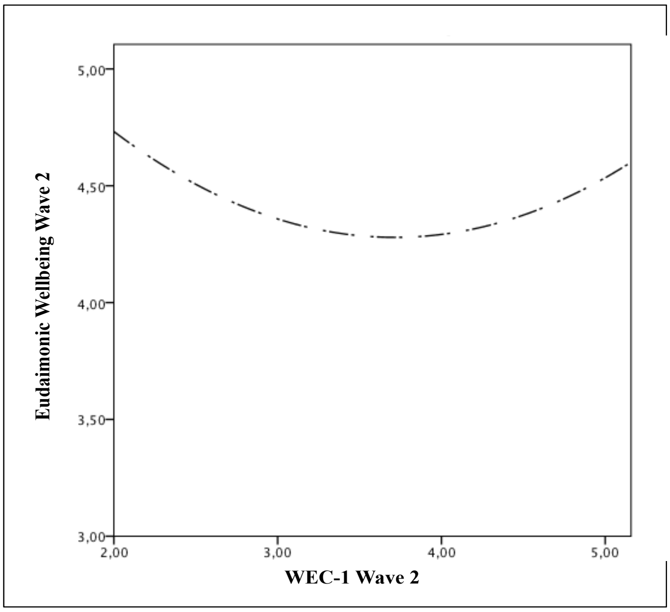

Figure 34. Predictive Effect of WEC-1 on EUWELL, Wave 2.

For factor WEC-2 Uncertain Work Demands, the linear effect was significant and negative in both Wave 1 ($\beta = -.28$, $p < .01$) and Wave 2 ($\beta = -.33$, $p < .01$). Further, the curvilinear term of WEC-2 predicted additional significant variance in EUWELL, in Wave 1 ($\beta = 1.37$, $p < .01$) but not in Wave 2 ($\beta = .52$, $p = .405$). Figure 35 depicts these effects, showing that in both waves, higher levels of WEC-2 led to less reported EUWELL. The curvilinear trend in Wave 1 is again U-shaped, implying that there were peaks in EUWELL, whenever WEC-2 was especially low or especially high. Whilst curvilinear effects were found, they had been hypothesised to be the other way around, as an inverted-U shape. Thus, Hypothesis 2 can be partially supported for factor WEC-1 in Wave 2, and WEC-2 in Wave 1. Above this, results indicated that WEC-2 had a significant negative effect on EUWELL in both waves.

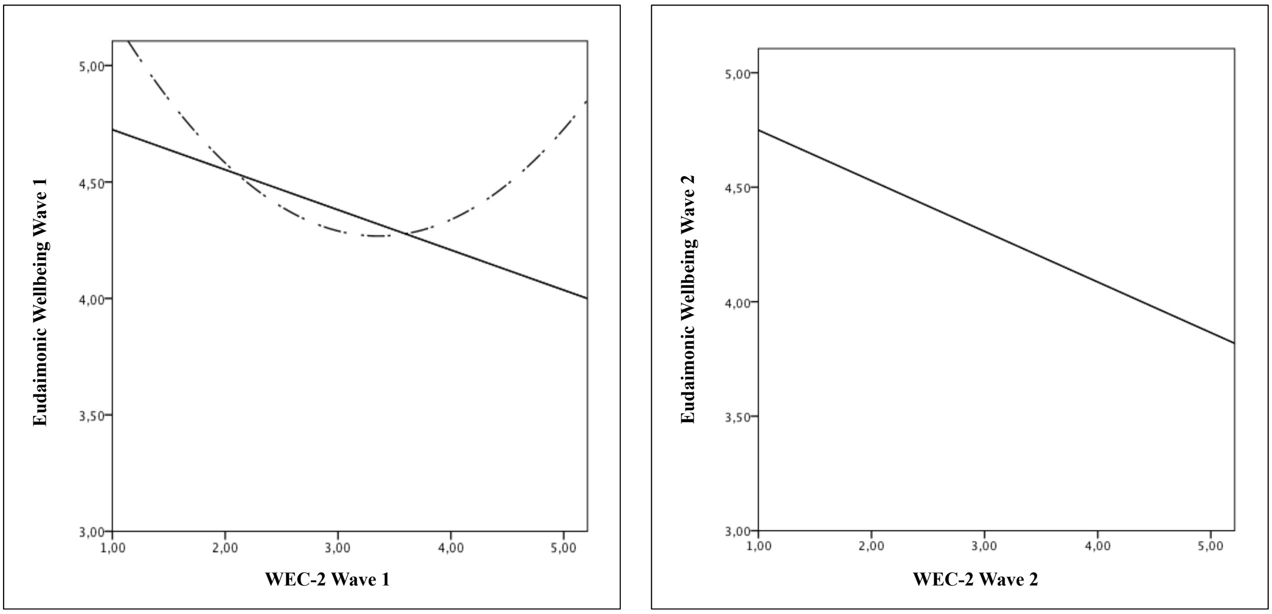

Figure 35. Predictive Effects of WEC-2 on EUWELL.

Moderation Effects

The interaction hypotheses tested the proposition that the relationship between the two WEC-factors and EUWELL would be moderated by five different variables (Uncertainty Tolerance, Approach Motivation, Avoidance Motivation, EL and DL). Five separate models were calculated in order to assess the interaction effects (Villa et al., 2003). Each model tested stepwise for a linear moderation, and a subsequent squared moderation, examining whether the interaction effects explained significant additional amounts of variance (ΔR^2). Chi-square tests were performed to assess, where interactions were significantly above what would have been expected from a Bonferroni probability (5%) alone. Only these effects will be reported in the following, all data can be obtained from the author upon request.

As can be seen in Table 28, moderation effects were significantly more frequent for interactions with factor WEC-2 Uncertain Work Demands as compared to factor WEC-1 Frequent Change and Events. Table 29 provides the detailed results from Hierarchical OLS Regression Analyses for WEC-2.

Table 28: Study 4 - Overview of Moderation Effects, EUWELL as criterion variable

Interaction	Moderator 1 Uncertainty Tolerance		Moderator 2 Approach Motivation		Moderator 3 Avoidance Motivation		Moderator 4 EL		Moderator 5 DL		Chi-Square	*p*
	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2		
WEC-1 × Moderator 1-5	*ns*	*ns*	*ns*	*ns*	*sig****	*ns*	*ns*	*ns*	*ns*	*ns*	.53	.47
WEC-1² × Moderator 1-5	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	n/a	1.0
WEC-2 × Moderator 1-5	*ns*	*ns*	*sig**	*ns*	*sig**	*ns*	*ns*	*ns*	*ns*	*ns*	4.74	<.05*
WEC-2² × Moderator 1-5	*sig**	*ns*	*ns*	*ns*	*sig+*	*sig**	*ns*	*ns*	*sig**	*ns*	13.16	<.000***

Notes. W1 = Wave 1. W2 = Wave 2. *ns* = interaction term not significant. *sig* = interaction term significant.

Light grey shadows indicate instances where the number of interactions was significant above what could have expected from Bonferroni probability (5%).

$^{+}p < .10$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Table 29: Study 4 - Hierarchical OLS Regression Analyses for Moderation, EUWELL as criterion variable

	Model 1 Uncertainty Tolerance				Model 2 Approach Motivation				Model 3 Avoidance Motivation				Model 4 EL				Model 5 DL			
	Linear		Squared		Linear		Squared		Linear		Squared		Linear		Squared		Linear		Squared	
Predictor	*β*	ΔR^2	*β*	ΔR^2	*β*	ΔR^2	*β*	ΔR^2	*β*	ΔR^2	*β*	ΔR^2	*β*	ΔR^2	*β*	ΔR^2	*β*	ΔR^2	*β*	ΔR^2
Wave 1																				
WEC-2 × Moderator 1-5	.78+	.02	7.92*		1.66**	.04*	7.71^{+}		-1.14*	.05*	3.59		.94	.02	.13		.31	.00	8.63*	
WEC-2^2 × Moderator 1-5			-6.12*	.03^{+}			-5.87	.01			-3.84^{+}	.02^{+}			.70	.00			-7.45*	.03*
Wave 2																				
WEC-2 × Moderator 1-5	.72^{+}	.02	.75		1.03	.02^{+}	5.96		.82	.01	-5.03		.91	.01	-6.25		-.07	.00	-1.27	
WEC-2^2 × Moderator 1-5			-.03	.00			-4.02	.01			4.78*	.03^{+}			6.93	.02			1.05	.00

Notes. Wave 1 n =117, n = 116 for Regression of Uncertainty Tolerance (outlier removed). Wave 2 n =116 (outlier removed). ΔR^2 = Change in R^2. Light grey shadows indicate interaction terms with significant change in R^2. Significance levels based on Bootstrapping with 5,000 samples, 95% Confidence Interval.

$^{+}$ $p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$

Leader Disposition. Hypotheses 4, 6, and 8 proposed that Uncertainty Tolerance (positive), Approach Motivation (positive), and Avoidance Motivation (negative) would moderate the relationship between WEC and EUWELL under conditions of high WEC. Five moderation effects for dispositional variables and WEC-2 were significant: *Uncertainty Tolerance* in Wave 1 moderated the squared term of WEC-2 implying a curvilinear interaction, depicted in Figure 36. Whilst leaders with low UT showed higher levels of EUWELL under low WEC-2, the trend seen is that there are significantly higher levels of EUWELL under high WEC-2 for leaders with high UT. EUWELL for leaders with low UT, in contrast, is significantly lower under high WEC. Surprisingly, the lowest level of EUWELL is reached at medium-high WEC for low-UT leaders (as opposed to lowest EUWELL under highest WEC). Generally, these findings support Hypothesis 4.

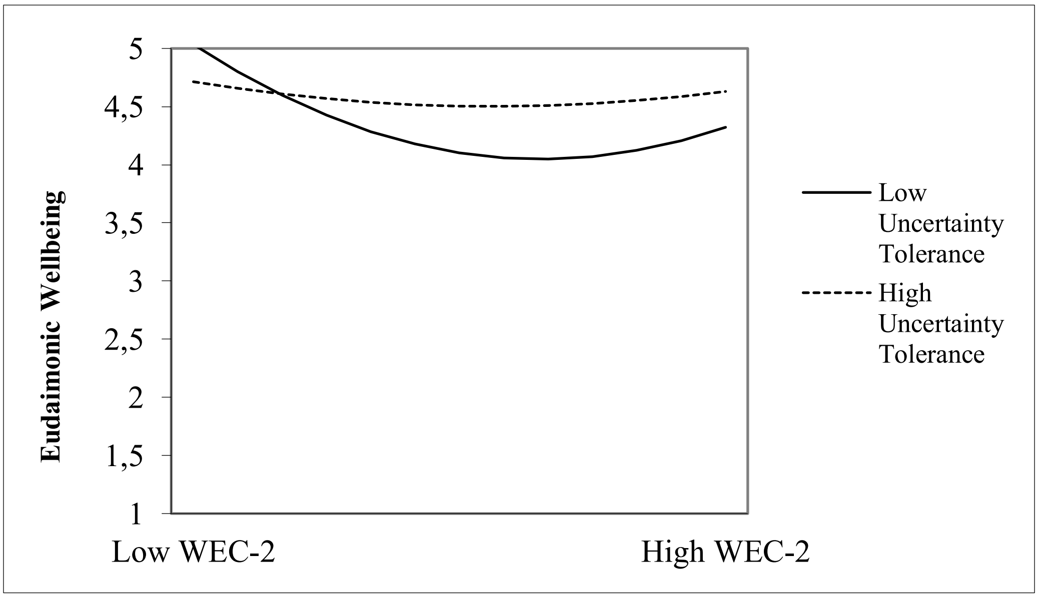

Figure 36. Interaction of Uncertainty Tolerance and WEC-2 predicting EUWELL (Wave 1).

Approach Motivation interacted with WEC-2 in Wave 1, implying that individuals with higher APP reported consistently more EUWELL, especially under conditions of high WEC-2 (Figure 37). This partially supports Hypothesis 6.

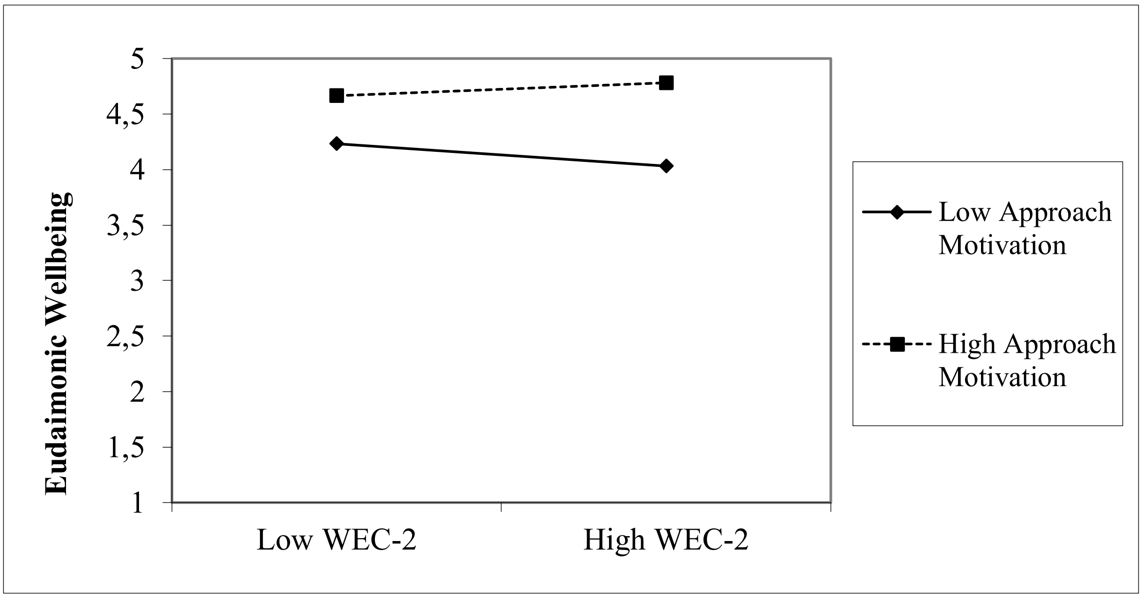

Figure 37. Interaction of Approach Motivation and WEC-2 predicting EUWELL (Wave 1).

Interactions for *Avoidance Motivation* were significant for WEC-2 in both Wave 1 (linear interaction and curvilinear interaction) and Wave 2 (curvilinear interaction), although with differing effects: In Wave 1, EUWELL was significantly higher under high WEC-2 for leaders with *low* AVO (in line with hypothesis 8, Figures 38 and 39), while in Wave 2 this was the case for leaders with *high* AVO (Figure 40). In summary, while not all interactions with dispositional variables were significant, partial evidence could be found for all three Hypotheses 4, 6, and 8. For AVO, however, the direction was not consistent.

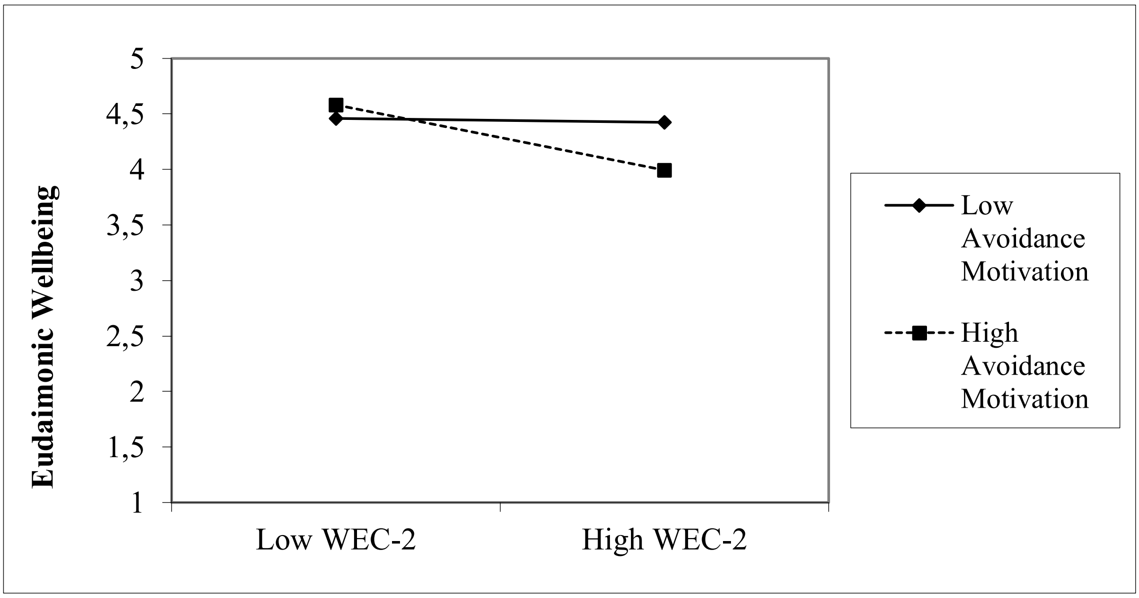

Figure 38. Interaction of Avoidance Motivation and WEC-2 predicting EUWELL (Wave 1).

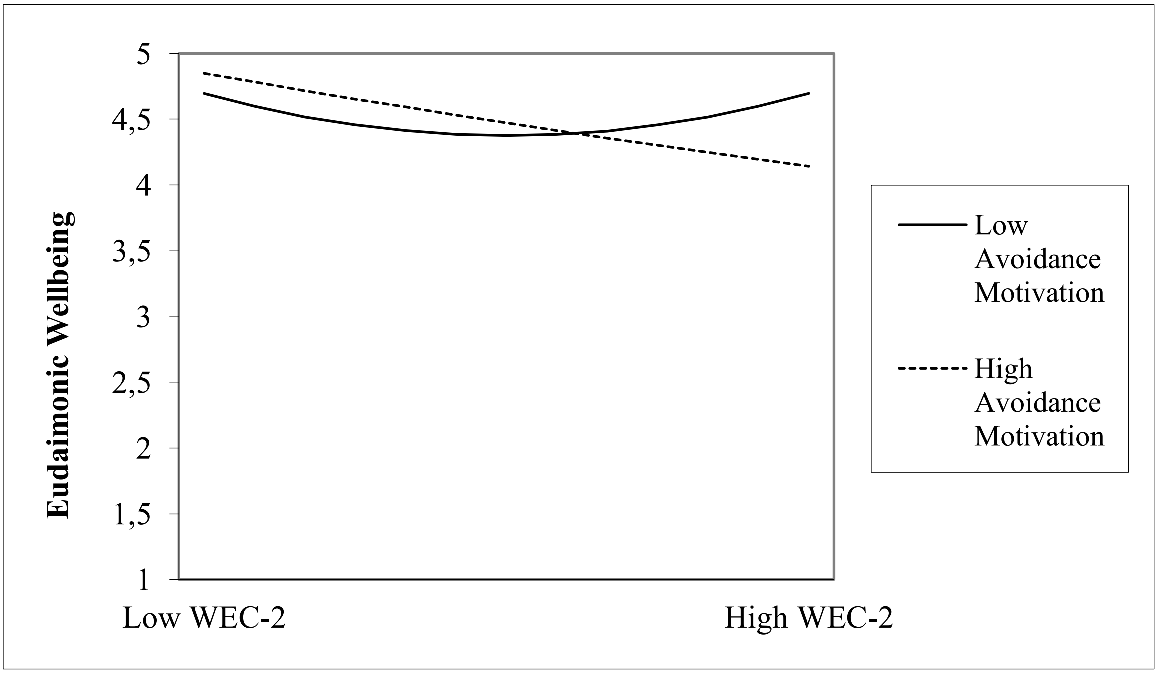

Figure 39. Curvilinear Interaction of Avoidance Motivation and WEC-2^2 Predicting EUWELL (Wave 1).

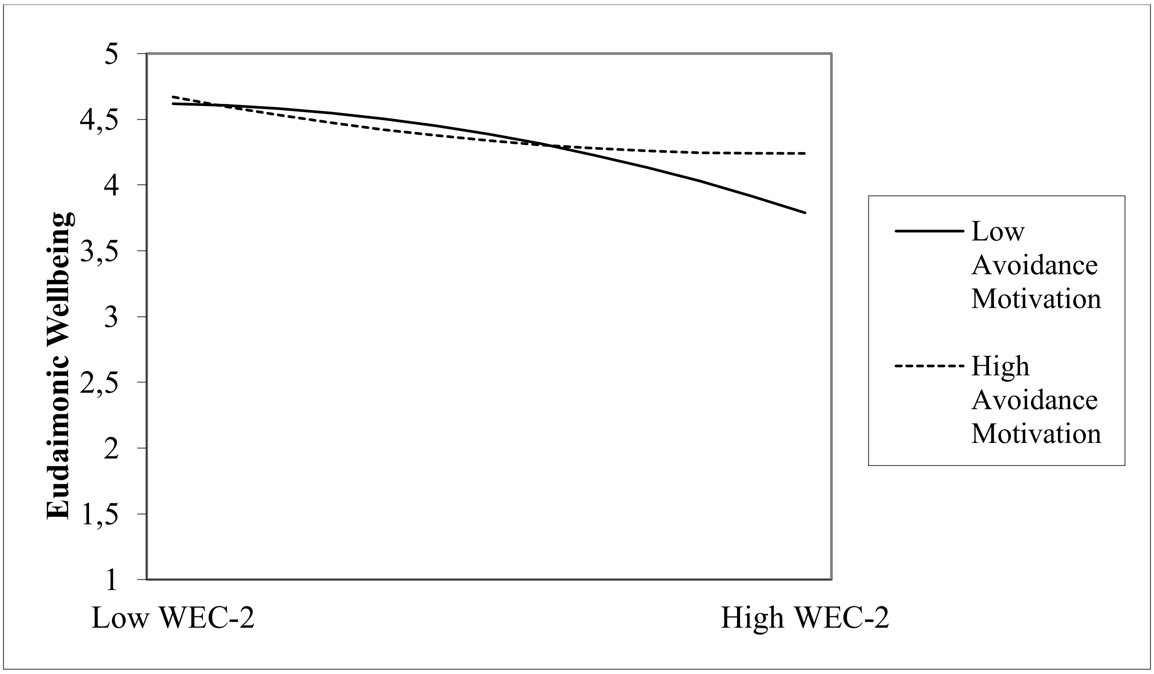

Figure 40. Curvilinear Interaction of Avoidance Motivation and WEC-22 Predicting EUWELL (Wave 2).

Leadership Style. Hypotheses 10 and 12 proposed that EL and DL would positively moderate the relation between WEC-2 and EUWELL under conditions of high WEC. One moderation effect was significant, giving partial support for Hypothesis 12: *directive leadership* interacted with the squared term of WEC-2 in Wave 1. Figure 41 depicts the relation of a U-shaped curve for leaders with low DL. This implies that leaders with low DL reported significantly lower levels of EUWELL especially under medium amounts of WEC-2, while leaders with high DL showed consistently higher levels of EUWELL. In summary, while partial support for the moderating effects of leadership style could be found for Hypothesis 12 (DL), Hypothesis 10 (EL) could not be supported.

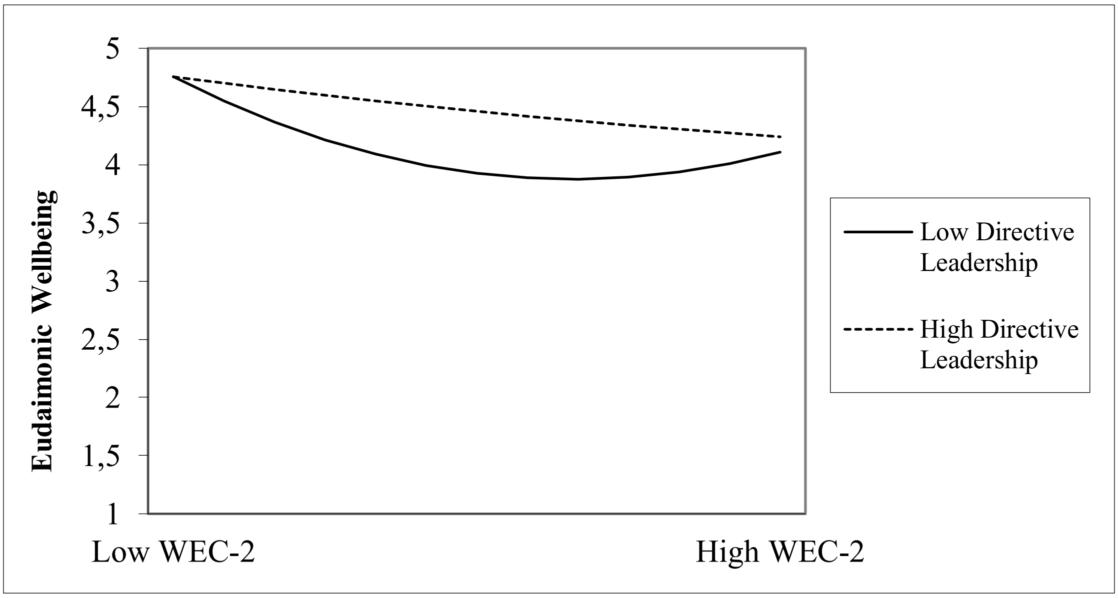

Figure 41. Curvilinear Interaction of DL and WEC-2^2 Predicting EUWELL (Wave 1).

In summary, it is clear that WEC-2 not only exerted a stronger (negative) direct effect on EUWELL, but also more interaction effects became significant compared with WEC-1. For WEC-2, partial support for the moderating influence of *Uncertainty Tolerance*, *Approach Motivation* and *directive leadership* could be found. *Avoidance Motivation* showed the most moderating influence across the two waves; however, the direction was not consistent. Hypotheses for a moderation effect of *empowering leadership* could not be supported.

6.3.4 Predicting Leader Self-Efficacy for Adaptive Behaviour

Direct Predictive Effects

Hypothesis 3 posited a curvilinear (inverse U-shaped) effect of WEC on SEAB. Table 30 shows results of Hierarchical Multiple Regression Analyses for both waves and both WEC-factors.

Table 30: Study 4 - Hierarchical Multiple Regression Analyses, SEAB as Criterion Variable

Step	*Predictor*	*B*	*SE*	*β*	*p*	*Overall R^2*	ΔR^2
Wave 1							
1	WEC-1	.18**	.06	.25**	.001	.06	.06**
2	WEC-1^2	.09	.06	.99	.118	.08	.01
3	WEC-2	-.33***	.06	-.45***	.000	.26	.18***
4	WEC-2^2	.04	.06	.29	.536	.26	.00
Wave 2							
1	WEC-1	-.02	.00	-.02	.811	.00	.00
2	WEC-1^2	.19*	.00	1.74*	.023	.04	.04*
3	WEC-2	-.40***	-.01	-.46***	.000	.21	.18***
4	WEC-2^2	.03	-.03	.19	.750	.22	.00

Notes. n =117. ΔR^2 = Change in R^2.
B, SE and p values based on bootstrapping with 5,000 samples, 95% Confidence Interval. Light grey shadows indicate significant effects.
$^+$ $p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$

For factor WEC-1 Frequent Change and Events, the linear effect was significant in Wave 1 (β = .25, p < .01) but not in Wave 2 (β = -.02, p = .811), and the curvilinear term predicted no additional significant variance in SEAB, in Wave 1 (β = .99, p = .118) but in Wave 2 (β = 1.74, p < .10), indicating that there was a significant linear effect in Wave 1 and a significant curvilinear effect of WEC-1 on SEAB in Wave 2. This indicated different patterns between the to waves. Figure 42 depicts the relations. In Wave 1, higher WEC-1 resulted in higher levels of Adaptive Behaviour. In Wave 2, SEAB follows a U-shaped trend, with highest levels of SEAB under conditions of both lowest and highest WEC-1.

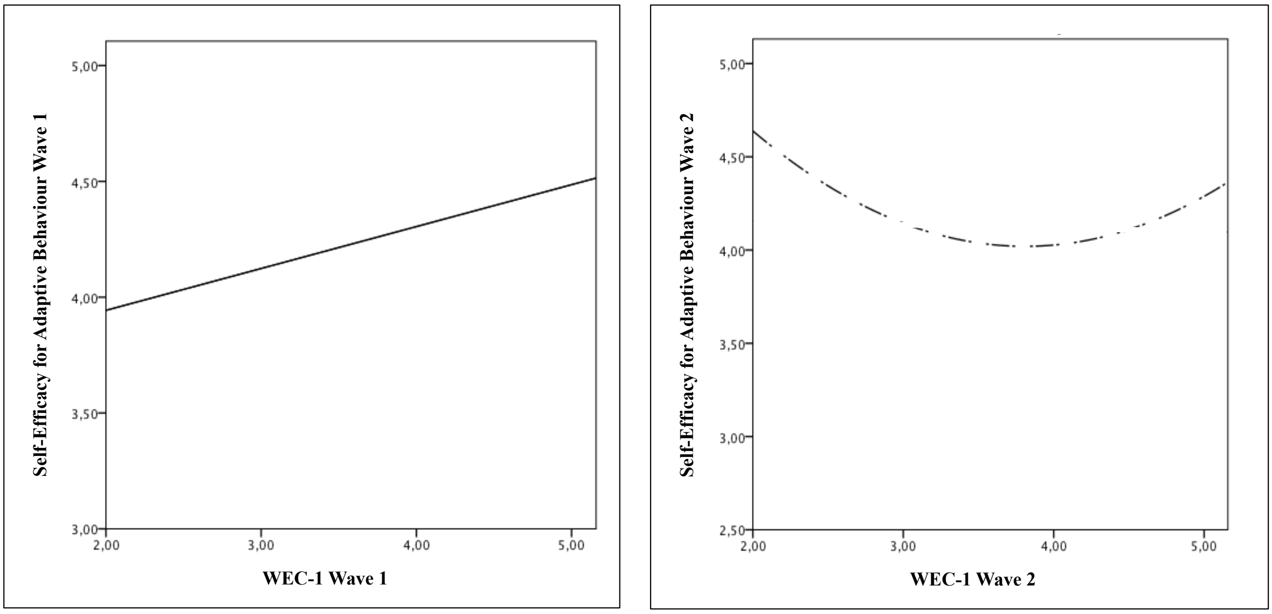

Figure 42. Predictive Effects of WEC-1 on SEAB.

For factor WEC-2 Uncertain Work Demands, the linear effect was significant and negative in both Wave 1 ($\beta = -.45$, $p < .001$) and Wave 2 ($\beta = -.46$, $p < .001$). Both curvilinear terms of WEC-2 did not predict additional significant variance, in Wave 1 ($\beta = .29$, $p = .539$) and in Wave 2 ($\beta = .19$, $p = .750$). Figure 43 illustrates these effects, showing the same trend. In both waves, higher levels of WEC-2 lead to less reported SEAB. In summary, Hypothesis 3 can only be partially supported: While WEC-1 increased SEAB in wave 1, there was no inflection point; and while there was a curvilinear effect in Wave 2, it was not an inverted-U curve. Further, while WEC-2 did not show a significant curvilinear effect; results still indicated that WEC-2 had a significant and strong negative effect on SEAB.

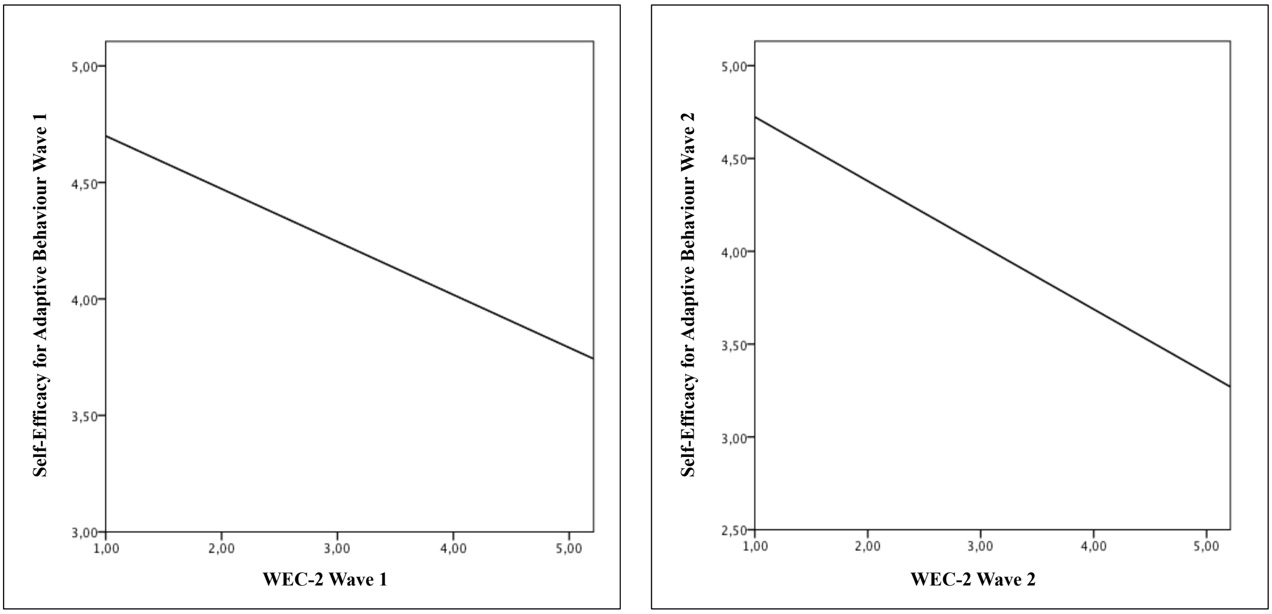

Figure 43. Predictive Effects of WEC-2 on SEAB.

Moderation Effects

Table 31 presents an overview of the five different moderators on the relationship between WEC and SEAB. Again, moderation effects were significantly more frequent for interactions with factor WEC-2 Uncertain Work Demands as compared to factor WEC-1 Frequent Change and Events. Table 32 provides the detailed results from Hierarchical OLS Regression Analyses for WEC-2.

Table 31: Study 4 - Overview of Moderation Effects, SEAB as Criterion Variable

Interaction	Moderator 1 Uncertainty Tolerance		Moderator 2 Approach Motivation		Moderator 3 Avoidance Motivation		Moderator 4 EL		Moderator 5 DL		Chi-Square	*p*
	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2		
WEC-1 × Moderator 1-5	*ns*	*ns*	*ns*	*ns*	*sig****	*ns*	*ns*	*ns*	*ns*	*ns*	.53	.47
WEC-1² × Moderator 1-5	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*sig***	*ns*	*ns*	.53	.47
WEC-2 × Moderator 1-5	*ns*	*sig+*	*sig**	*sig***	*sig**	*ns*	*ns*	*ns*	*ns*	*ns*	25.79	<.000***
WEC-2² × Moderator 1-5	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*sig+*	*sig***	*ns*	4.74	<.05*

Notes. W1 = Wave 1. W2 = Wave 2. *ns* = interaction term not significant. *sig* = interaction term significant. Light grey shadows indicate instances where the number of interactions was significant above what could have expected from Bonferroni probability (5%).

$^{+}$ $p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$

Table 32: Study 4 - Hierarchical OLS Regression Analyses for Moderation, SEAB as criterion variable

	Model 1 Uncertainty Tolerance				Model 2 Approach Motivation				Model 3 Avoidance Motivation				Model 4 EL				Model 5 DL			
	Linear		Squared		Linear		Squared		Linear		Squared		Linear		Squared		Linear		Squared	
Predictor	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2
Wave 1																				
WEC-2 × Moderator 1-5	-.02	.00	4.48		1.24^{*}	$.02^{+}$	1.97		-1.02^{*}	$.04^{*}$	3.24		-.42	.00	-2.73		.81	.02	12.69^{**}	
WEC-2^2 × Moderator 1-5			-3.85	.01			-.71	.00			-3.45^{+}	.02			2.00	.00			-10.65^{**}	$.06^{**}$
Wave 2																				
WEC-2 × Moderator 1-5	$.69^{+}$	$.02^{+}$	2.71		1.88^{**}	$.06^{**}$	2.79		-.11	.00	-4.21		1.29	.02	-7.25		$.67^{+}$	.02	.45	
WEC-2^2 × Moderator 1-5			-1.69	.00			-.87	.00			3.36	.01			8.27^{+}	$.02^{+}$			.19	.00

Notes. n =117. ΔR^2 = Change in R^2. Light grey shadows indicate interaction terms with significant change in R^2. Significance levels based on bootstrapping with 5,000 samples, 95% Confidence Interval.
$^{+}$ $p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$

Leader Disposition. Hypotheses 5, 7, and 9 proposed that Uncertainty Tolerance (positive), Approach Motivation (positive), and Avoidance Motivation (negative) would moderate the relation between WEC and Leader SEAB under conditions of high WEC. Four moderation effects were significant for WEC-2. *Uncertainty Tolerance* in Wave 2 interacted with WEC-2, depicted in Figure 44. Here, leaders with high UT showed consistently higher levels of SEAB as compared to leaders with low UT, and this effect was increased under conditions of high WEC-2. This partially supports Hypothesis 5.

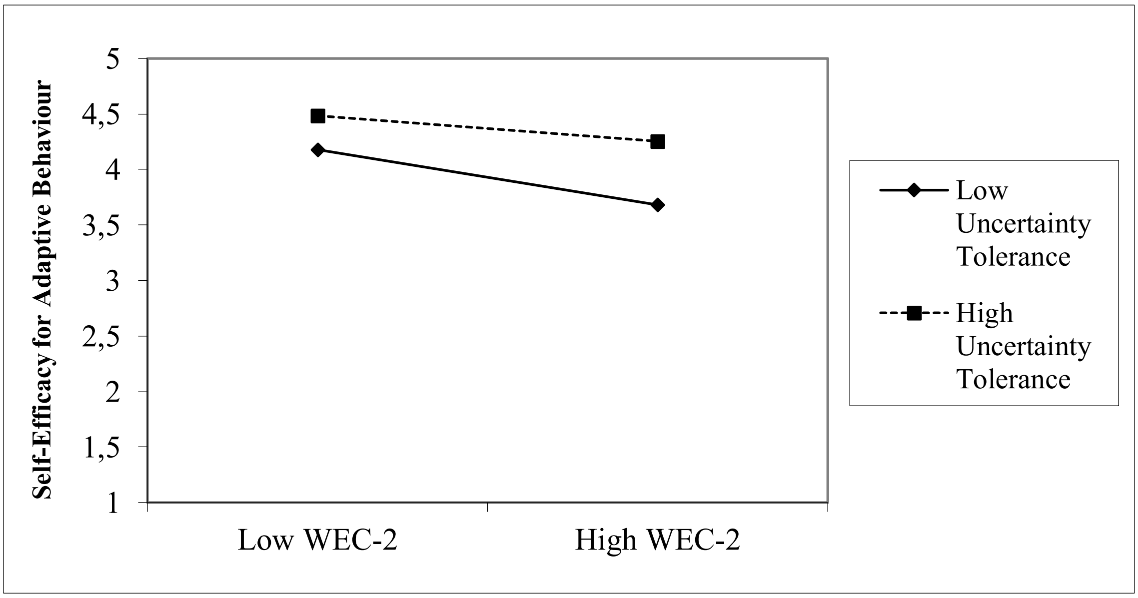

Figure 44. Interaction of Uncertainty Tolerance and WEC-2 Predicting SEAB (Wave 2).

Approach Motivation interacted with WEC-2 in both waves, implying that individuals with higher APP consistently reported more SEAB, especially under conditions of high WEC-2 (Figures 45 and 46). This supports Hypothesis 7.

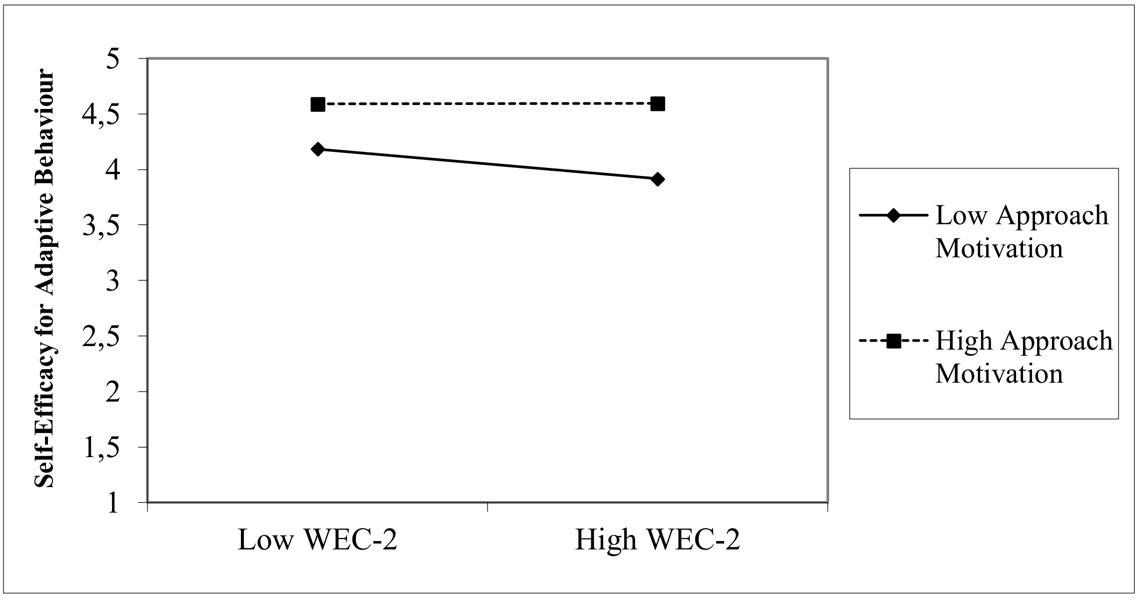

Figure 45. Interaction of Approach Motivation and WEC-2 Predicting SEAB (Wave 1).

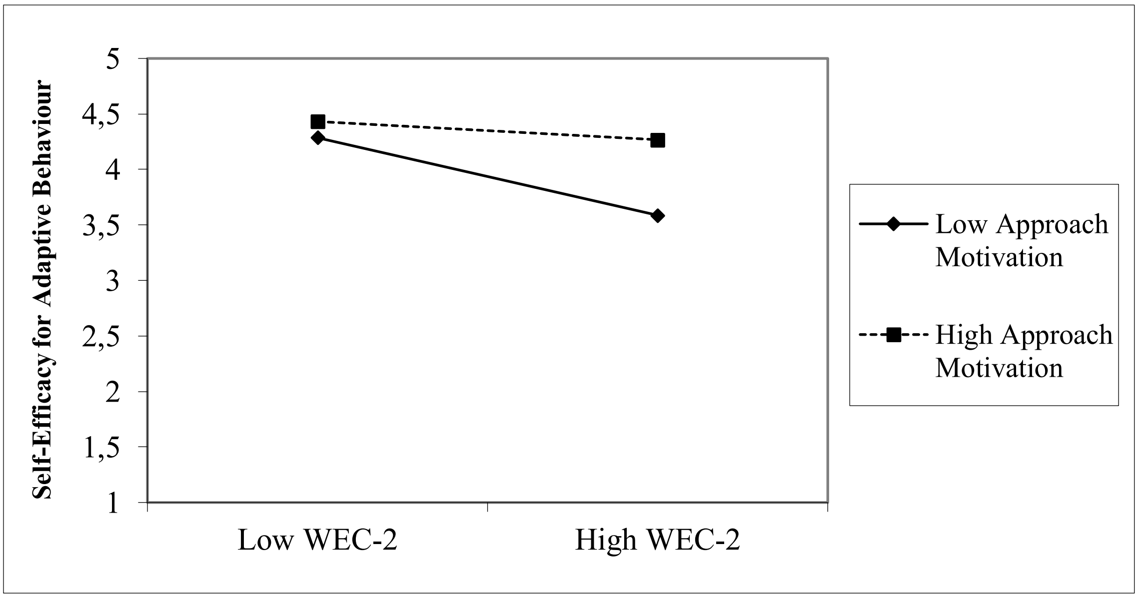

Figure 46. Interaction of Approach Motivation and WEC-2 Predicting SEAB (Wave 2).

One interaction for *Avoidance Motivation* was significant for WEC-2 in Wave 1. In line with Hypothesis 9, leaders with low AVO reported significantly higher levels of SEAB under high WEC-2 (Figure 47). In summary, while not all interactions for dispositional variables were significant, partial evidence could be found for all three Hypotheses 5, 7, and 9. All effects were in the predicted directions.

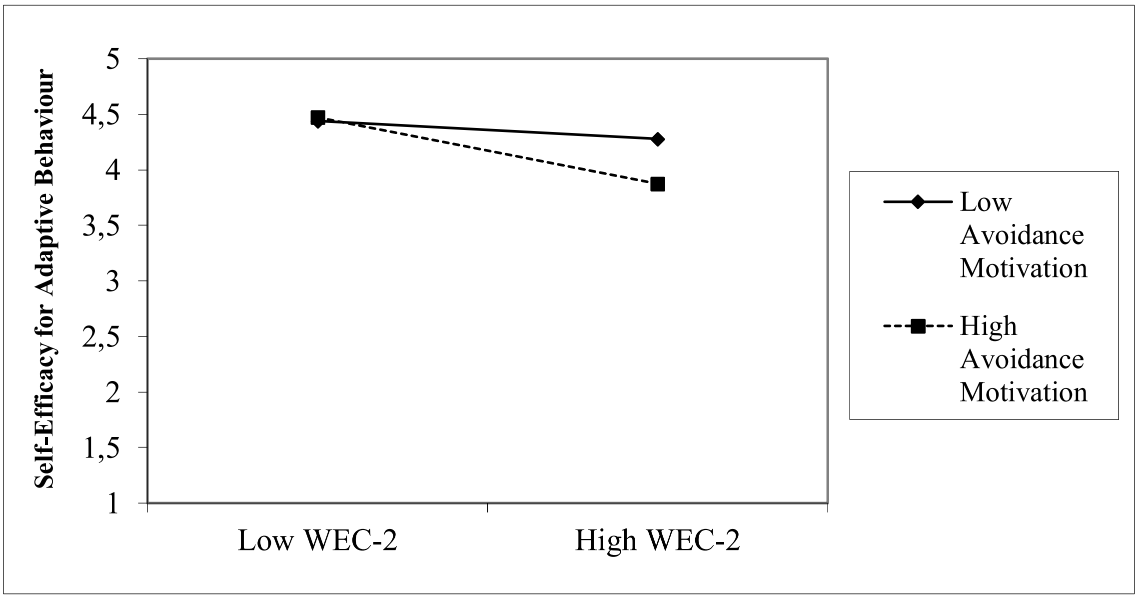

Figure 47. Interaction of Avoidance Motivation and WEC-2 Predicting SEAB (Wave 1).

Leadership Style. Hypotheses 11 and 13 proposed that EL and DL would positively moderate the relation between WEC and SEAB under conditions of high WEC. Two moderation effects were significant for WEC-2. *Empowering leadership* interacted with the square term of WEC-2 (Wave 2): Here, leaders with both high and low EL reported lower levels of SEAB under conditions of high WEC-2. However, for leaders with low EL, the level of SEAB decreased more strongly, indicating a buffering effect of high EL under conditions of high WEC-2 (Figure 48).

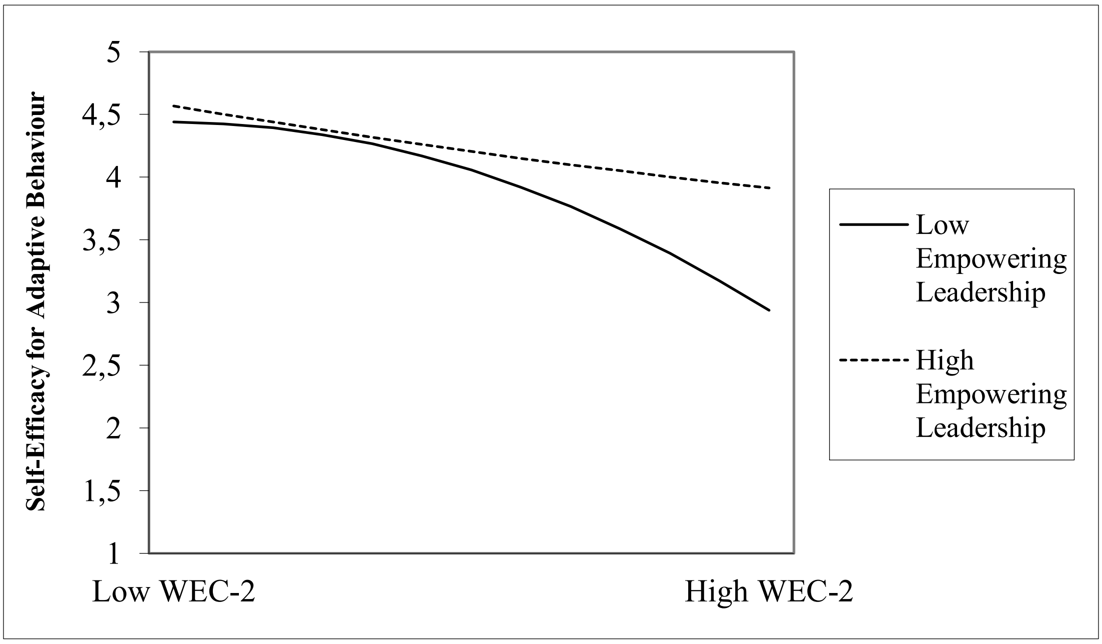

Figure 48. Curvilinear Interaction of EL and the WEC-2^2 Predicting SEAB (Wave 2).

Directive leadership interacted with the squared term of WEC-2 in Wave 1. Figure 49 shows a U-shaped curve for leaders with low DL. While peaking at low levels of WEC-2, the curve indicates that leaders with high DL showed consistently higher levels of SEAB. In summary, while not all interactions with leadership styles were significant, partial support could be found for both Hypothesis 11 (EL) and 13 (DL).

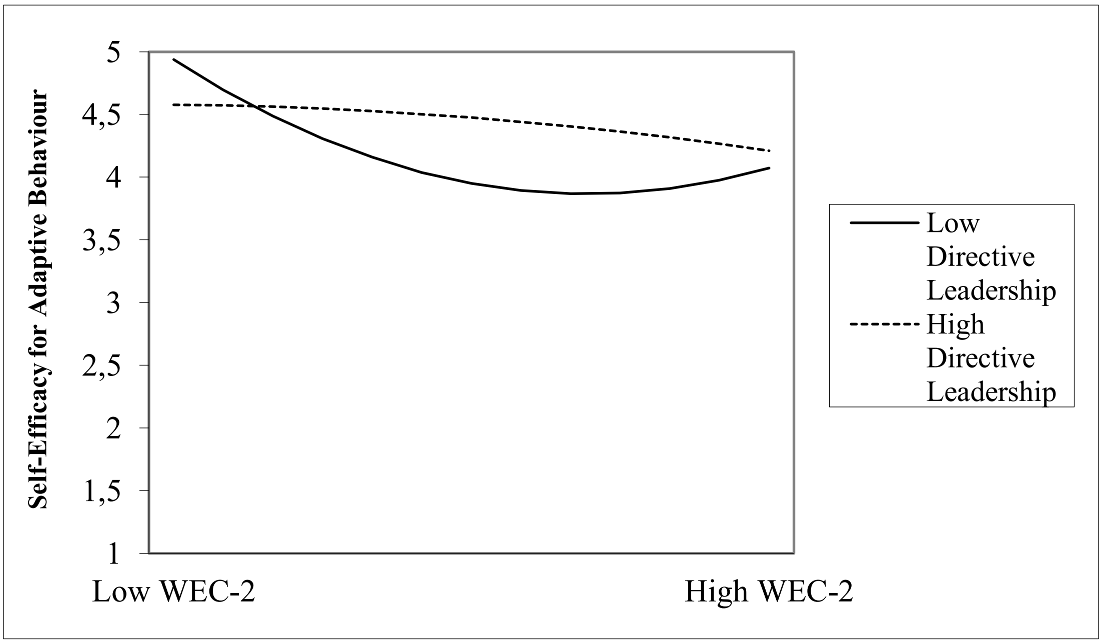

Figure 49. Curvilinear Interaction of DL and WEC-2^2 Predicting SEAB (Wave 1).

In summary, it is clear that WEC-2 not only exerted a stronger (negative) direct effect on SEAB, but also more interaction effects became significant as compared to WEC-1. All proposed moderation effects were significant in at least one Wave for WEC-2. This gives partial support for the moderating influence of *Uncertainty Tolerance*, *Approach Motivation, Avoidance Motivation, EL,* and *DL* on the relationship between WEC-2 and SEAB.

6.4 Study 4 Discussion

The present study is devoted to the question of leadership functionality in Work Environment Complexity. It examined what would make a leader individually capable to act functionally in WEC, and posed the question of whether leaders *could* actually thrive in the face of WEC. While discussions on leadership and WEC have centred on leaders' performance for the productivity of employees and organisations, previous research has largely ignored the leader's wellbeing and own productive functionality (Arnold & Connelly, 2013; Arnold et al., 2017; Judge et al., 1999; Nielsen & Daniels, 2012; Roche et al., 2014). This is in contrast with the finding that leading in WEC confronts managers with considerable challenges, including significant threats to psychological wellbeing in a “potentially toxic” environment (e.g., Roche et al., 2014). Consequently, this study addressed this research gap by examining not only the challenges that a complex work environment could impose upon leaders, but also sought to find out whether managers could lead productively within such contexts and if so, how.

The first contribution of this research was to identify Leader Eudaimonic Wellbeing (EUWELL) and Self-Efficacy for Adaptive Behaviour (SEAB) as indicators of leader functionality in the specific context of WEC. These psychological resources were derived from the particular challenges a complex environment imposes upon leaders. Conceptually, EUWELL was chosen to reflect a more generalised state of engagement (Schaufeli et al., 2006), while SEAB reflects a motivational construct directed at showing a specific behaviour (B. Griffin & Hesketh, 2003). Results of this study revealed that the two variables were related, yet independent. This suggests that they address different aspects of leader functionality. As such, it seems justifiable to propose this set of variables as a basis for assessing leader functionality in WEC in future research. While this study investigated the antecedents of leader functionality, future research could study the relation of EUDWELL and SEAB with other aspects of interest, such as how they relate to leadership performance, employee wellbeing, and organisational economic results in the face of WEC. Moreover, in choosing to study EUWELL, this study kept in line with Seligman and Csikszentmihalyi’s (2014) understanding of wellbeing beyond the absence of illness. Nevertheless, given an apparent lack of research on leader wellbeing and functionality in general, looking into outcomes on mental health/illness for leaders in highly complex positions constitutes another path for future research.

The second contribution of this study lies in identifying a broad set of dispositional, behavioural, and environmental variables that were hypothesised and tested as antecedents of leader functionality in WEC. In brief, the results of this study support the idea that a leader *can* indeed thrive in the face of WEC – however, a leader's Eudaimonic Wellbeing and Self-Efficacy for Adaptive Behaviour seem to be heavily dependent on the dynamics of different influencing factors. Using the model of challenge-skill balance (see e.g., Ceja, 2011; Chung-Yan & Butler, 2011; Csikszentmihalyi & Larson, 1987; Massimini et al., 1987; Moneta, 2017a; Moneta & Csikszentmihalyi, 1996), this study finds that WEC itself, a leader's personal disposition, and the leadership style applied, influence how well a leader will cope and function within WEC.

6.4.1 Predictive Value of WEC

Whilst previous research has studied various effects of the narrower definition of "job complexity" on job-related (employee) outcomes (e.g., Chung-Yan & Butler, 2011), this study was the first to test the effects of a comprehensive WEC measure on leadership samples. The hypotheses of an inverted-U shaped relation between WEC and functionality could not be confirmed. This means that WEC is not necessarily invigorating for all leaders to a certain extent, nor is there necessarily an inflection point that causes wellbeing to decrease with growing levels of WEC. The theoretical framework behind the inverted-U hypothesis had proposed that all individuals would be positively stimulated by WEC characteristics (= upwards slope) up until a certain threshold was reached, at which point the individual began to feel overchallenged or incapable of being successful (= downwards slope).

Instead, this study finds that leader functional wellbeing seems strongly influenced by the characteristics of the two WEC-factors. This finding is important, as it shows that leader EUWELL and SEAB seem to be dependent upon the environmental characteristics of the leader's work, and that complexity is one of them (e.g., Baard et al., 2014). In particular, results indicate that the two WEC-factors play essential, but different roles as direct predictors of leader functionality. Factor WEC-1, Frequent Change and Events, exerted a mildly positive influence on Leader EUWELL and SEAB: being presented with a high frequency of change led executives in Wave 2 to peaks of wellbeing when WEC was especially low or high (U-shaped relation), and seemed to foster a leader's confidence to adapt flexibly in the face of growing WEC across both waves.

In contrast, the influence of WEC-2, Uncertain Work Demands, showed itself to be more detrimental. Results indicated that when leaders faced growing levels of WEC-2, this led to a significant and strong decrease in both EUWELL and SEAB. This pattern was especially strong for levels of SEAB, where ratings dropped over two points on a five-point scale under conditions of high WEC-2. In other words, this facet of WEC by itself had no positive or invigorating effect on individuals – as hypothesised by previous researchers (e.g., Chung-Yan & Butler, 2011; Ilgen & Hollenbeck, 1991). This supports the idea that supposing a continuously linear effect of "the more complexity, the more beneficial", as can be seen, for example, in the foundations of the Job Characteristics Model (JCM; Hackman & Oldham, 1980), is an assumption of the past. Instead, this investigation has found that WEC-2 seems to pose strong threats to the functionality of leaders. This speaks to the qualitatively different nature of WEC from previous conceptualisations of a "complex" job (e.g, Morgeson & Campion, 2003; van Woerkom et al., 2016). With this in mind, the search for other variables that could positively influence or "buffer" such detrimental effects appears even more urgent. Thus, this study further examined a set of dispositional variables and two leadership styles as moderators in the equation of WEC and leader functionality.

6.4.2 Predictive Value of Leader Disposition

Examining moderation effects, this study found evidence for the assumption that a leader's disposition of "embracing the complexity" is especially relevant and beneficial when facing WEC (e.g., Ashmos et al., 2000; Ceja & Navarro, 2012; Fredberg, 2014; Judge et al., 1999; Karp & Helgø, 2008; Lichtenstein & Ashmos, 2009; Mumford et al., 2000). For conditions of high WEC-1, on two occasions it could be shown that leaders who were less reluctant, risk-averse, and cautious (i.e. reported low levels of Avoidance Motivation) were more engaged and reported higher confidence to adapt their behaviour when faced with high levels of Frequent Change and Events as compared to leaders with high AVO.

For WEC-2 Uncertain Work Demands, the interaction effects were stronger: All three dispositional variables (Uncertainty Tolerance, Approach Motivation, and Avoidance Motivation) moderated the relationship between WEC-2 and EUWELL as well as SEAB at least once. In other words, this study has found first indicators for the assumption that the more a leader embraced complexity and the more proactive they were towards it, the higher their levels of EUWELL and SEAB. These findings are especially relevant as they reveal how much a proactive and embracing personality seems to be able to buffer against the detrimental effects of WEC-2 discussed above. Previous research has identified the beneficial value of positive and proactive personality dispositions for employees under conditions of high "job complexity" (e.g., Chung-Yan & Butler, 2011). The present study supports this relationship, and adds insight into the relevance of disposition, firstly for leadership positions and secondly for a more comprehensive notion of WEC. While Chung-Yan and Butler's study reported that levels of wellbeing declined at a certain point of complexity, in this study the moderating influence of dispositional variables was found to stabilise functionality at a constant high. In summary, it can be concluded that an embracing and proactive disposition appears to be a crucial factor for the wellbeing and functionality of leaders in WEC.

These findings have several implications for further research. One pathway could be to investigate the dynamics behind the differences of the studied dispositional variables. For instance, although both are positive dispositions, Uncertainty Tolerance was found to exert comparably weaker positive influence than Approach Motivation, as can be seen by less frequent and weaker significant interaction terms. A possible explanation may be that the (pro-) *active* facet of Approach Motivation – as compared with a more passive state of *tolerating* complexity – may be the most relevant factor for functionality in WEC. Future research could explore this proposition more in detail. Avoidance Motivation gave contradictory results; for most interactions, a *low* level of Avoidance Motivation had the most beneficial outcomes for leaders, but in one case a *high* level of Avoidance resulted in higher engagement for leaders. This notion is in line with Johnson et al. (2013) who found that Approach and Avoidance Motivation are not opposite, but supplementary constructs. Future research could investigate in which WEC-related situations Avoidance Motivation can be most favourable. This study did not test for the combined effects of both motivations simultaneously. Insights on the heightened beneficial effects of *both* motivations combined (Johnson et al., 2013), could be another interesting path for future research. Moreover, the absolute results on EUWELL and SEAB were highest for individuals with high Approach Motivation, while levels of functionality in high WEC faded gradually for individuals with low Avoidance Motivation. This indicates that from all dispositional variables studied, high Approach Motivation might offer most advantages to leaders under conditions of high WEC.

Implications for practical applications are evident when it comes to selecting leaders for positions with high WEC. Given the beneficial effects – uncovered in this research – of proactive and embracing personality on personal wellbeing and functionality, organisations and their recruiting staff should be advised to take into account these personality traits when selecting personnel for leadership functions where high levels of turbulence and uncertainty can be expected. Choosing managers who demonstrate these dispositions is not only advisable for the functionality and productivity of an organisation, but may also be beneficial for the individual leader as a mismatch in disposition appears to negatively affect an individual's wellbeing. On a more personal level, aspiring leaders would also be advised to reflect on their personal character before applying for high-complexity positions – keeping in mind that for more conservative, risk-averse, or passive personalities, such a leadership job could impose undesirable amounts of strain.

While the theory of self-regulatory focus originally states Approach and Avoidance Motivation to be stable, trait-like motivations (Higgins, 1997), recent research has shown that one's promotion or prevention motivation may also be malleable by specific situational factors (Cui & Ye, 2017). For example, a climate in which the adherence to regulations and security is especially pronounced has been found to reduce an individual's Approach Motivation (Wallace & Chen, 2006). This implies, firstly, that organisational settings could be specifically designed to foster and "equip" managers with a more beneficial mindset for mastering the challenges of complexity. Previous research outside of WEC has substantiated that teams benefit from creating an environment of psychological safety (Kahn, 1990), where individuals feel safe to explore innovative behaviour without fearing they may be sanctioned for mistakes. Not only has psychological safety been related to team learning, performance, creative achievement, innovation behaviour, and engagement, (Carmeli et al., 2009; Nembhard & Edmondson, 2006; Ortega et al., 2014; Roussin & Webber, 2012), succeeding to build a psychologically safe environment may also positively increase managers' levels of Approach Motivation. Secondly, leaders in high-complexity functions could also be trained towards more Approach Motivation. Previous studies in this field have substantiated, for example, that individuals will be likely to adopt motivational foci from relevant role models or leaders (Chen, Chen, & Li, 2013). Promoting the visibility of such role models in the organisation may be another promising factor to strengthen a proactive a leadership mindset within an organisation. Such interventions could help to secure the wellbeing and productivity of leaders under high WEC, even if originally they had a less proactive nature.

6.4.3 Predictive Value of Leadership Style

This study contributes to the understanding of the "optimal" leadership style for individual leader functionality in high-WEC contexts. Whilst research has begun to investigate beneficial effects of a participative leadership approach in WEC for organisations and the functionality of employees and teams (e.g., Burnes, 2005; Correia de Sousa & van Dierendonck, 2014; Karp & Helgø, 2008; Lichtenstein et al., 2006; Marion & Uhl-Bien, 2001; Mumford et al., 2000; Uhl-Bien et al., 2007) the effects of applying certain leadership styles in WEC for a leader's wellbeing and adaptivity in WEC had not previously been investigated.

This study suggests that in times of high ambiguity, volatility, and change, a leader's ability to "act despite uncertainty" (Berman & Korsten, 2010, p. 32) caters to an individual's functionality – as opposed to withdrawing and not leading at all. A significant finding of this research is that leaders with higher levels of DL reported to be considerably less affected by the challenging nature of WEC-2 Uncertain Work Demands. In other words, where uncertainty regarding one's job demands increases, it appears advisable for leaders to take direction, give structure, and act as a managerial backbone for the team in order to secure one's own wellbeing and one's capability to adapt flexibly. Interestingly, however, *low* levels of DL were especially detrimental under medium levels of complexity, but rose back to similar levels of functionality under high WEC. An explanation for this pattern may lie in the nature of DL itself; an instrumental leadership approach is about directing, controlling, and closely monitoring the work of one's employees (Ogbonna & Harris, 2000). Where uncertainty and novelty of challenges (WEC-2) are at a peak, the degree of control is limited by the very nature of the situation (Karp & Helgø, 2008). As such, it would be possible to hypothesise that the influence of DL is especially relevant for contexts with medium levels of WEC-2. While this finding can only partly be explained *post hoc*, investigating this phenomenon is an interesting path for future research. Prospective studies could examine how much room there is for directive influence under conditions of high WEC. This could be achieved by studying at what levels of WEC employees perceive a DL approach to be most valuable. Additionally, such an investigation would contribute to the controversial debate on control in WEC discussed in this thesis (e.g. 2.7.2).

The moderating effect of EL in WEC was found to have no influence on a leader's EUWELL. This implies that a participative leadership style in WEC is independent of a leader's own wellbeing. This would fit the very nature of the managerial style, which is concerned strongly with involving and developing other people (Ogbonna & Harris, 2000). Another path worthy of investigation could be the controversial proposition that, depending on situational circumstances, eventually there is only a thin line between EL and the passive laissez-faire-leadership (Wong & Giessner, 2016).

However, EL interacted with both WEC factors to positively influence a leader's SEAB. When complexity (WEC-1 and WEC-2) was especially high, leaders with high EL reported consistently and significantly higher confidence to adapt flexibly. In other words, the more leaders enabled and empowered *others*, the more they *themselves* felt capable of flexibly adjusting to complex demands. This finding supports the rationale of WEC scholars who argue for the advantageous effects of democracy and "power-sharing" in the face of strong complexity (Brodbeck, 2002; Karp & Helgø, 2008; Marion & Uhl-Bien, 2001).

In summary, this study found that high levels of both DL and EL lead to more engagement, wellbeing, and confidence to adapt for leaders in the face of high complexity. Two outcomes are especially remarkable. First, while EL has been highlighted as "the leadership style of choice" for WEC in previous literature (e.g., Karp & Helgø, 2008), this present study found that positive effects were somewhat limited to the outcome variable of SEAB. In line with previous sections of this thesis (e.g. Studies 2 & 3), it can be argued that DL appears to play a relevant role in the equation of "optimal" leadership in WEC. This supports the position developed throughout this thesis, arguing for the balanced coexistence of EL and DL in WEC. To further build on these findings, EL plus DL could be investigated as a distinct leadership *pattern* and compared to the influence of other style patterns, as practised in a recent study by Arnold and colleagues (Arnold et al., 2017). Secondly, *actively* applying a leadership style appears to be more beneficial for a leader's functional wellbeing than passively withdrawing from leadership – the question of *which* active leadership style, however appears to become secondary in this equation (Zopiatis & Constanti, 2010). This is in line with previous studies finding that an active leadership pattern is significantly more beneficial to leader wellbeing than passive styles (Arnold et al., 2017). These findings can thus be understood as a recommendation for leaders to actively engage in situations of high complexity and to take action for the sake of their own functionality and wellbeing. While the underlying mechanisms are yet not fully understood, it is plausible that these effects can be explained by the conservation or increase of positive resources (Arnold et al., 2017; Hobfoll, 1989). This proposition could be investigated in the future. With respect to further implications for research, it would be reasonable to study the effects of the different leadership styles in high WEC on leader- and employee-level outcomes simultaneously, since this study's perspective was limited to the effect on leaders alone. Also research could be expanded to other leadership styles such as Transformational Leadership in WEC.

For practical implications, these findings suggest that strengthening managerial awareness is necessary to lead actively in the face of WEC. In leadership development programmes, executives could be trained to "act despite uncertainty" and practise the application of both EL and DL under conditions of high volatility, novelty, and uncertainty. These ideas could also be integrated into occupational health programmes focused on coping with stress and strain – invigorating awareness of the fact that a proactive leadership approach appears to be a valuable shield against potential harm to one's psychological wellbeing. Such programmes would have to be supported by an organisational climate that encourages proactivity, allows for experimentation or trial and error, and deals constructively with mistakes.

6.5 Study 4 Limitations

To complete the picture, several limitations to this present study shall be highlighted. Firstly, whilst benefitting from two longitudinal samples of leaders and whilst looking at the data from a different angle, the sample had already been used in the previous studies. This is to say, these findings should be replicated with further leadership samples to substantiate the findings and integrate external perspectives so as to overcome the restrictions of self-reports. Secondly, and as mentioned above, the focus of this study was limited to the perspective of leaders. Future research should look at employee, team and organisational perspectives in order to explore the dynamics of functionality, engagement, and wellbeing in high-WEC at all levels of the organisation. Thirdly, a methodological limitation is that moderation effects were tested for separately. While Villa et al. (2003) suggest this approach when working with (comparably) small sample sizes in managerial field studies, future research could examine moderation models in which several interactive effects are tested for simultaneously. Furthermore, with regard to the number of predictive variables, multiplied by the two points of measurement and the two WEC-factors, this study did not take into account the chronological patterns of findings. Examining more closely how individual leader functionality is affected by the different variables *across time* is another interesting path for research, e.g. how do leaders learn from past experience in high WEC or how do motivational focus and leadership style develop across time? Also, whilst there was partial support for the proposed hypotheses, not all effects were consistently significant and one was not in the predicted direction. More research is required to find out exactly when moderators exert maximum influence. Finally, while this study took into account not only linear but curvilinear relations, these models are inherently limited. Researchers in the field of Nonlinear Dynamic Systems (NDS) theory (e.g., Ceja & Navarro, 2009) here lead the way to future research. The so-called “cusp curve”, for instance, allows for modelling more complex patterns of behaviour such as bifurcations, cusps, and sudden ruptures (Ceja, 2011). Hence, there is considerable potential for expanding this research towards more elaborate mathematical models of the challenge-skill-balance in WEC.

6.6 Study 4 Conclusion

This study has found that leaders who are confronted with high WEC *can* thrive and flourish, especially when they are equipped with proactive and embracing personality dispositions as well as the ability to actively engage in leadership behaviour. These factors are likely to act as a buffer and prevent potential threats to wellbeing and functionality even if – and especially when – work conditions are turbulent or uncertain. The present study's findings are in line with the model of challenge-skill balance, which has been shown to be one of the most robust predictors of functionality, engagement and flow in previous research (see e.g., Ceja, 2011; Chung-Yan & Butler, 2011; Csikszentmihalyi & Larson, 1987; Massimini et al., 1987; Moneta, 2017a; Moneta & Csikszentmihalyi, 1996). These findings are particularly relevant for leaders in environments where Uncertain Work Demands (WEC-2) are especially pronounced. If counter-measures are not taken, the challenges of great complexity may take a toll on the wellbeing and functionality of leaders which in turn could have a detrimental trickle-down influence on teams and employees (Roche et al., 2014). In summary, these study findings speak to the qualitatively different nature of WEC from previous conceptualisations of a "complex" job (e.g, Morgeson & Campion, 2003; van Woerkom et al., 2016). Recommendations for action at an individual and organisational level are outlined above. These recommendations will activate "buffering mechanisms" and optimally equip managers for high-WEC positions. This may help leaders to handle high-complexity situations and perceive the complexity not as a stressor, but as a positive challenge (Greenglass & Fiksenbaum, 2009; Judge et al., 1999).

Chapter 7 – General Discussion

This final chapter will summarise the main findings of this thesis with reference to the research questions posed. Furthermore, it will address the overall strengths of this thesis as well as its limitations. Next, theoretical implications and opportunities for future research on Leadership in Work Environment Complexity will be discussed, as well as practical implications of the work carried out in this thesis.

7.1 Summary of Main Findings and Contributions to Research

This PhD thesis is devoted to studying the topic of Leadership in Work Environment Complexity (WEC). In recent years, organisations have been rapidly evolving into evermore-complex workplaces that single actors are hardly able to oversee or control anymore (Osborn & Hunt, 2007). Traditional understandings of organisations as mechanistic, linear systems have moved "to a perspective of the organisations modern leaders act within as nonlinear and organic, characterised by uncertainty, dynamic, and unpredictability" (Marion & Uhl-Bien, 2001). This thesis has therefore introduced and worked with the construct of *Work Environment Complexity* (WEC), which outlines the *(individually perceived) complexity within organisational work contexts*. As WEC presents organisations and leaders with a new and often challenging quality of work, further research is needed to understand complexity as well as the consequences for working and leading in high-complexity work environments (e.g., Burnes, 2005; Uhl-Bien & Marion, 2009).

Not only do employees rely on leaders for guidance in times of transformation, leaders are called upon to successfully navigate this new kind of business environment, which is more and more unstable, fluid, and challenging (e.g., Ashmos et al., 2002;

Intezari & Pauleen, 2014). In organisational psychology, Complexity Leadership has thus been created as one of the top emerging leadership theories of the modern age (e.g., Dinh et al., 2014). Over recent decades, complexity has been approached by a wide-ranging variety of complexity paradigms and schools. Input from complexity sciences has progressed our understanding of complex organisations. However, the characterisation of WEC and the approach to its measurement have remained contested areas. In particular, with many and competing views in complexity science, there has not yet been any common agreement about what characterises a "complex" work environment for an individual, and how, based on such a common foundation, these insights can be substantially and empirically related to research in leadership and organisational psychology (Black, 2000; Burnes, 2005; Maguire & McKelvey, 1999; Schneider & Somers, 2006). Consequently, this thesis has aimed to expand knowledge and research, both on the construct of Work Environment Complexity itself and on leadership within complex working environments. In particular, several research questions were posited and explored in the course of this project:

Overarching Research Question 1: What is Work Environment Complexity (WEC) and How Can It Be Measured?

Chapter 2 set out the theoretical foundations for studying the construct of Work Environment Complexity. Acknowledging the given disparity of views on complexity sciences and critically reviewing the state of research, this section evaluated the diverse perspectives and paradigms on complexity thinking and through this developed the epistemological and methodological position of this thesis. The most prominent Complexity Theories (Deterministic complexity theories: Chaos Theory, Catastrophe Theory, Nonlinear Dynamic Systems Theory; Aggregate complexity theories: Theory of Complex Adaptive Systems; and the Complex Responsive Processes view) as well as upcoming measurement approaches (e.g. NDS methods, post-positivistic approaches) were evaluated with respect to their transferability to work organisations and characterisations of complex systems, as well as their perspectives on the measurement of complexity. Central insights are that most complexity approaches have in common the motivation to advance complexity thinking towards the study of organisations and leadership, that there are common characteristics of WEC that the major complexity theories share, and that – by means of various methods – the context of WEC can be studied or empirically measured. However, it became apparent that the empirical study of complex contexts is still in its infancy, and the knowledge that was applicable to the solution of problems at work was limited (Black, 2000; Burnes, 2005; Maguire & McKelvey, 1999; Schneider & Somers, 2006). Limitations were evident in several areas. Firstly, different schools of thought were competing in their views and definitions of "complexity". Secondly, there was no agreement on the topic of causality and influence in complexity: whether individuals could influence processes in complex organisations and with this, how best to measure "complexity". One of the strongest debates was around methodology, claiming an especially complex methodology would be needed to measure or study complex systems (Uhl-Bien & Arena, 2017); yet, this methodology had not been applied and most research in complexity theory had remained purely theoretical (Burnes, 2005). Thirdly, this led to a state where the different schools were using unique and idiosyncratic vocabulary to discriminate the different concepts in complexity science, rather than integrating similar ideas into a joint framework (Schneider & Somers, 2006). Despite several decades of discourse, the fundamental flaw in this research area was that there had been no agreed-upon definition across the complexity schools of what makes a working context "complex" – and what it is exactly that one is studying (Ashmos et al., 2000; Black, 2000; Burnes, 2005). Furthermore, there had been no construct or scale that could measure the complexity of a (leader's) work environment.

It has been the motivation of this thesis to overcome this lack of a conceptual and empirical foundation for the construct of WEC in organisational psychology. Given that there seemed to be a general agreement on the common elements in complex working environments (Lissack, 1999; Stacey, 2011), this thesis has adopted a post-positivistic perspective to integrate these into a substantiated construct that enables empirical measurement of WEC. By pursuing a quantitative, empirical, and application-oriented measurement approach, the perspective of this thesis provides a counter-argument to the prominent theme in complexity research that "it takes complexity to beat complexity" (Uhl-Bien & Arena, 2017, p. 10). This thesis overcomes this mantra, which has hindered empirical research for several decades. It aimed to do this by providing a substantiated and validated, yet easy-to apply WEC construct to organisational psychology research. It proposes that studying WEC through a post-positivistic lens enriches complexity research by integrating existing standpoints, developing a measurement instrument for WEC, establishing linkages to leadership research, and accelerating application in organisational psychology. A central contribution of this work thus lies in providing a scale for researchers and practitioners that enables the measurement of the amount of complexity an individual faces in their work environment. This overcomes research gaps between WEC and leadership research, and provides an empirical baseline from which to facilitate empirical study of work and leadership in WEC.

The work undertaken in Chapter 2 thus provided an oversight on existing conceptualisations of WEC and developed a conceptual framework for empirically establishing an integrated WEC Scale. Building on previous conceptualisations and measurement approaches, a preliminary operationalisation was established: Work Environment Complexity was characterised as *(the perception of) a frequently* *changing, unpredictable, and demanding work environment.* An important contribution from post-positivistic research was to understand WEC as an individual perceives it (e.g., Amabile et al., 1996; Babalola et al., 2016). Furthermore, this chapter highlighted the necessity to incorporate time into empirical research to adequately reflect the dynamics of WEC (e.g., Dinh et al., 2014; Uhl-Bien & Marion, 2009).

Research question Study 1: *Which factors form the integrated construct of Work Environment Complexity?*

Research question Study 1: *Can the same construct of Work Environment Complexity be applied to both employees and leaders?*

Carrying on the argumentation of Chapter 2, Study 1 of this thesis developed and empirically tested the first measurement instrument for Work Environment Complexity (WEC). By outlining the content of WEC as a comprehensive construct, previously fragmented approaches were integrated to understand what makes an environment complex for individuals in leadership positions. A central limitation that Study 1 overcame was that researchers had, to date, discussed and measured singular factors of WEC, rather than proposing an integrated measurement of WEC. The most prominent ones were identified as Frequent Change, Unpredictability, Ambiguity, Uncertainty, Interdependence/Interaction, and Challenging Work Demands (cf. section 2.2 and Table 3). However, where research had been fragmented (Black, 2000), overlaps were likely. This study consequently aimed to clarify the core content of an integrated WEC construct, addressing relevant overlaps or limitations and identifying facets that were conceptually sound, measurable yet distinct enough from one another. Following the operationalisation identified in Chapter 2, and a standard for construct validation for similar scales (e.g., Morgeson & Humphrey, 2006), it was proposed that the elements of Frequent Change, Unpredictability, and Challenging Work Demands formed the core of the WEC construct.

In response to the growing interest in WEC in organisational research, this research presented three studies aimed at developing and validating a self-report measure of WEC for leaders. In a thorough process of construct validation, through a pre-test, a set of Exploratory Factor Analyses (EFA) on cross-sectional employee (n = 305) and leader (n = 53) samples, and three subsequent Confirmatory Factor Analyses (CFA) with a new, longitudinal sample of leaders (n = 77), the 7-item WEC Scales' factor structure and psychometric properties were explored and validated. This multi-study approach was chosen as, firstly, it assessed the WEC scale's factorial invariance cross-sectionally across the two distinct groups of employee and leaders, understanding whether the construct is valid for different categories of workers. Secondly, this design tested the scales' factorial invariance longitudinally, including response styles, to assess whether the WEC scale could be applied for longitudinal testing.

For the leadership samples, a clear two-factor structure of WEC emerged, and two factors of the WEC-construct could be confirmed, namely WEC-1 Frequent Change and Events and WEC-2 Uncertain Work Demands. Finally, a test for factorial invariance stated that metric invariance can be assumed, indicating that with the 7-item solution, WEC for leaders is measured as stable over time. This enables the testing of causal relationships with the WEC Scale longitudinally (Byrne et al., 1989). Results support the characterisation of WEC as a state or perception, as repeated measures of WEC were uncorrelated. This study provides researchers with a WEC scale for leaders that is consistent with the original definitions of WEC, has good psychometric properties, and is so short that it can be administered in longitudinal studies of change that include other scales and require a compact survey format. Figure 50 displays the

WEC Scale components and identified factor structure.

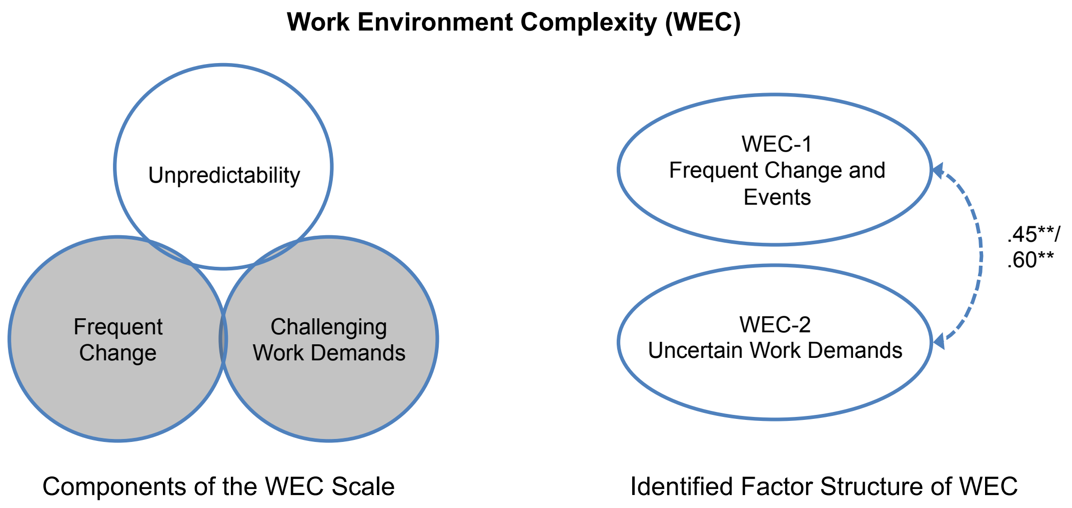

Figure 50. WEC Scale components and identified factor structure. Simplified visualisation.
Figures indicate correlation between factors in Wave 1 (top) and Wave 2 (bottom). ** = p < .01.

In summary, findings of this study suggest that leaders in modern organisations face a specific state of WEC characterised by frequent transformation, the occurrence of unpredictable events, and demanding yet uncertain work requirements. This conceptualisation expands the notion of WEC for leaders from a previously narrow understanding of "job complexity" as completing challenging tasks (e.g., Chung-Yan & Butler, 2011) to a more comprehensive understanding of WEC that also incorporates external influences for leaders in a workplace. It also falls in line with recent research examining the *combined* influence of more than one job demand together (van Woerkom et al., 2016).

Whilst claiming it to be a predominant leadership concern, previous scholars had intertwined employee and leader perspectives on WEC (see e.g., Morgeson & Humphrey, 2006). The cross-sectional testing results of Study 1 indicate that WEC perceptions of employees and leaders are divergent, which may be explained by models of individual judgement (Bernieri et al., 1996; Morgeson & Humphrey, 2006). This suggests that the WEC Scale can be considered only as a measurement tool for studying a leader's WEC. Exploring the nature of an employee's WEC is therefore considered an interesting path for future research.

An important contribution of this study's findings is the possibility of quantifying the amount of complexity a leader confronts and the extent to which this changes over time. It provides a comprehensive scale for researchers and practitioners that allows the level of WEC to be monitored. It could also be used to measure an organisational change process and for leadership selection and training. For organisational psychology, being able to evaluate the nature and level of WEC allows us to address a wide range of empirical questions concerning the effects that WEC has for working and leading, for example studying leader behaviour and wellbeing with the aim of identifying optimal ways for leaders to cope with and manage Work Environment Complexity. Consequently, the following empirical studies addressed central questions of Leadership in WEC.

Research Question: ***Which leadership approaches are suited to match the novel challenges of WEC?***

Chapter 2 developed a conceptual framework for Leadership in Work Environment Complexity. Where increasing WEC challenges leaders and their skills to a new extent (e.g., Karp & Helgø, 2008; Lichtenstein et al., 2006), there is agreement in current leadership research that classic leadership models and guidelines are out-dated and deficient (Burnes, 2005; Marion & Uhl-Bien, 2001; Schneider & Somers, 2006; Uhl-Bien & Marion, 2009). Consequently, practice and research have called for new leadership models in the face of complexity (Uhl-Bien & Marion, 2009; Uhl-Bien et al., 2007; Zaccaro & DeChurch, 2012) and have sought answers on "how to lead" in the face of WEC for complex organisations to survive and succeed (Correia de Sousa & van Dierendonck, 2014; Lane & Down, 2010; Martin & Ernst, 2005; Schneider &

Somers, 2006).

Chapter 2 of this thesis evaluated the current state of research and the most prominent ideas on Leadership in WEC, finding strong support for a paradigm shift towards more *participative* or *empowering* leadership styles (e.g., Ashmos et al., 2002; Burnes, 2005; Correia de Sousa & van Dierendonck, 2014; Lee et al., 2018; Osborn & Hunt, 2007; Uhl-Bien et al., 2007), *adaptive leadership* (e.g., Uhl-Bien & Arena, 2017; Yukl & Mahsud, 2010), as well as the need to investigate *individual leader disposition and wellbeing* for contexts of WEC (e.g., Ashmos et al., 2000; Judge et al., 1999; Roche et al., 2014). This evaluation revealed that without an empirical approach to measure WEC (Maguire & McKelvey, 1999), today's research on leadership in complex work environments is inherently limited (Schneider & Somers, 2006) and has evolved up to now by overlooking the question of measuring WEC. This led to a situation where the conceptual models behind the relation of certain leadership approaches and characteristics of WEC were not well substantiated (Schneider & Somers, 2006; Uhl-Bien et al., 2007). Although current research has offered valuable foundations for exploring leadership in WEC and has contributed with both conceptual and singular empirical insights, many approaches have remained purely theoretical (Burnes, 2005), fragmented, or disconnected from complexity research (Black, 2000). A fundamental flaw of previous research was thus that without a substantiated measure for WEC, "complexity" was assumed without measuring it, or "complexity" was equated with narrower constructs such as measuring the degree of change or challenging tasks. Hence, all studies on leadership behaviour could not be related back to measurable "complex" characteristics of a work environment.

Establishing a foundation upon which to measure WEC was an important step towards addressing these limitations. Firstly, the operationalisation of WEC could now be applied to form more substantial models behind the mechanisms of certain leadership approaches and the characteristics of WEC. For instance, building on the definition of WEC as a frequently changing, demanding, and unpredictable work environment, Chapter 2 provided conceptual rationales as to why it would be reasonable to assume benefits from EL for complex working contexts (e.g., Ashmos et al., 2002; Lee et al., 2018; Styhre, 2002). Also, Chapter 2 discussed how the skill to flexibly adapt to dynamically changing and unexpected situations becomes especially relevant in contexts of WEC (Burke et al., 2006; Griffin et al., 2010; Ilgen & Hollenbeck, 1991; Ilgen & Pulakos, 1999; Zhang et al., 2015). Secondly, with the validation of the WEC scale in Study 1, the propositions of "optimal" leadership in WEC could now be empirically addressed. Thus, the following empirical studies set out to examine the relationships between a complex working environment and leadership style, leader's adaptability, and leader functional wellbeing with the aim of identifying optimal ways for leaders to cope with and manage WEC.

Research question Study 2: ***Is the level of Work Environment Complexity causal for leaders to adopt higher levels of empowering leadership?***

Research question Study 2: ***Is the level of Work Environment Complexity causal for leaders to adopt lower levels of directive leadership?***

Research Question Study 2: ***Are empowering leadership and directive leadership in WEC shown independently of one another?***

Having developed and validated a measurement instrument for WEC, Study 2 was the first to successfully apply the WEC Scale and empirically relate it to the choice of leadership style. A line of strong theoretical arguments underpins the benefits of leading by participation in WEC, presenting EL as the "leadership of choice" (Ashmos et al., 2002; Burnes, 2005; Correia de Sousa & van Dierendonck, 2014; Marion & Uhl-Bien, 2001). In summary, the seemingly uncontrollable and evolving nature of WEC calls leaders to pass responsibility to others as it is unlikely that a single manager will be capable of single-handedly fulfilling complex work demands (e.g., Burnes, 2005; Schneider & Somers, 2006; Uhl-Bien & Arena, 2017; Uhl-Bien & Marion, 2009). Consequently, one can find strong arguments that due to the characterisation of WEC as frequently changing, unpredictable and demanding context, leadership in WEC has to be about enabling, empowering, and involving others to achieve high quality, shared, and agile decisions (e.g., Ashmos et al., 2002; Brodbeck, 2002; Karp & Helgø, 2008; Lee et al., 2018; Marion & Uhl-Bien, 2001). A central theme is sharing control or power, which is likely to encourage employees' responsibility-taking, proactivity, engagement with creative and learning processes, adaptability, and the development of employee skills (e.g., Carmeli et al., 2013). In contrast, the seemingly opposing leadership behaviour of Directive Leadership has been labelled as "outdated" and has largely been discussed as less suitable for managing the challenges of WEC (e.g., Ashmos et al., 2002; Brodbeck, 2002; Karp & Helgø, 2008). This is because instrumental leadership is highly related to exerting control by oneself, and not sharing it. This builds the rationale to propose empowering behaviour as the leadership of choice and reject a DL style. The review of literature, however, uncovered an apparent lack of conceptual models as well as empirical support for these assumptions.

Study 2 was able to address the limitations to previous research in several areas. First, there had been no comprehensive definition of WEC (see section 2.2). Thus, studies had only investigated a participative or directive leadership style and its relationship with singular factors of "complexity" (B. Griffin & Hesketh, 2003). A fundamental flaw of research so far was thus to equalise a singular concept such as "change" or "unpredictability" with complexity; not least because the impact of one work factor is significantly different from the dynamic that several work factors exert in combination (van Woerkom et al., 2016). A second limitation was that conceptually, there was no model that explained why an EL style would be more adequate to meet WEC-characteristics. This thesis has provided a rationale behind the relation between the WEC factors (Frequent Change, Unpredictability, and Uncertain Work Demands) and the benefits of an EL style, whilst – for the first time – also understanding the potential downsides or benefits of *directive* leadership in comparison. Thirdly, there needed to be empirical testing of the subject. This is the first study that demonstrates the link between WEC and the display of EL and DL. Previously, there had been no empirical studies into whether leaders would *actually* find it appropriate to engage in more empowering, and consequently less directive, leadership in WEC. Further, the fact that the two leadership behaviours (empowering vs. directive) had been strongly contrasted in the discussions of leading in WEC suggested that both should be studied simultaneously. This had not previously been attempted in the context of WEC. Consequently, the relationships between WEC and the two leadership styles were examined with a longitudinal design and structural equation modelling, studying a field sample of 117 leaders. Comparing the fit of different longitudinal SEM models, this design made it possible to test for the assumption that the characteristics if WEC did indeed influence the adoption of leadership styles, ruling out other directions of this relation (reverse causality).

Core finding of this study is that the level of WEC appears to influence the amount of EL a leader shows, and seems to less strongly affect a leader's choice of DL. Also, and in line with the argument for EL as the "leadership style of choice" for WEC, results indicated that on an absolute level, more empowering than directive leadership was shown. Above this, this study revealed that the two WEC factors play different roles in the prediction of leadership style; i.e. it seems the nature of the work environment influences the display of leadership behaviour: in contexts of frequent change and unexpected events (WEC-1), leaders were more likely to choose more empowering and more directive leadership behaviour. In contrast, factor WEC-2, Uncertain Work Demands, predicted *less* EL, and appeared not to affect the choice of DL. This finding stands in contrast to the predominant call for EL on WEC. Figure 51 depicts the findings of Study 2.

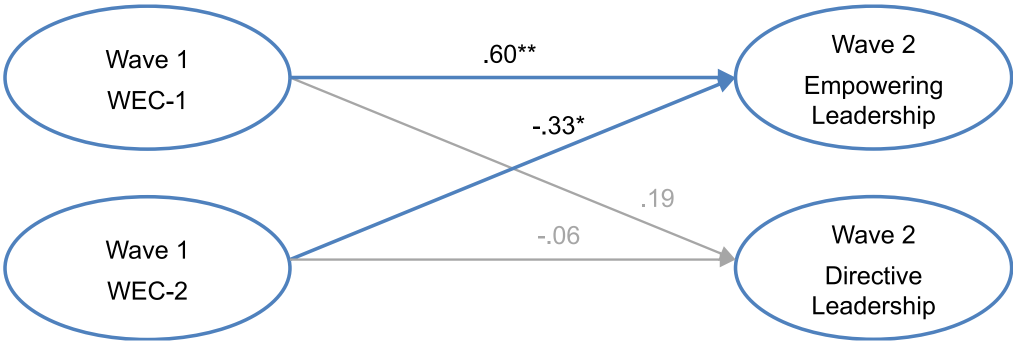

Figure 51. Causal relation between WEC and Leadership Styles across time. Simplified visualisation.
Figures indicate standardised path coefficients. * $p < .05$; ** $p < .01$.

Although the literature suggests it, not all leaders are showing consistently more empowering leadership. Why is it that leaders seem to be regulating the amount of EL they show depending on the facets of WEC? Several thoughts are possible. One, it may have to do with the outcome that they are expected to achieve. As we know from creativity research, creativity needs empowerment; and it will not succeed when individuals are forced or pressured to be creative (Amabile, Hadley, & Kramer, 2002). Yet, the greatest creative achievements require a mixture of empowering and directive approaches from leadership (Amabile et al., 2002; Carmeli et al., 2013). It might, thus, be that leaders, especially in WEC-2 situations where problems are ill-defined and demanding, “tune back” their empowerment to balance what a worker needs to engage into creative flow.

Explanation two, it might be a question of experience with similar situations.

Leaders of this century have frequently been trained in the concept of change management, learning that it is essential to empower their teams to be successful in moments of change. This experience might make them react with more EL for WEC-1 frequent change and events. When facing uncertain work demands (WEC-2), it might be less clear for leaders which behaviour to adopt, resulting in a decrease of EL, but no consequent increase in the alternative investigated behaviour of DL. Thus, further research is needed as to which leadership style could be most appropriate for WEC-2. This finding could mean that leaders instead turn to another leadership behaviour not covered in this research design: for example, a more content-related leadership style based on functional expertise or technical know-how. Lastly, it might be that leaders are overwhelmed by the challenge; an idea that gave rise to the assumption that the challenging nature of WEC-2 could possibly evoke a leadership vacuum. As leadership withdrawal or passivity have been found to put the wellbeing of leaders and their teams at risk (Zopiatis & Constanti, 2010); this phenomenon was subject to further examination in Study 3. While some potential explanations have been offered, clearly, the uncovered associations between EL, DL and WEC are open to more research into the motivations for this behaviour.

More interesting insights come from studying both EL and DL in parallel. Previous literature had presented the two leadership styles as an opposing, *either-or* choice, implying that a leader in WEC could – simply put – *either* lead by participation (which would be beneficial) *or* by direction (which would be detrimental) (e.g., Ashmos et al., 2002; Karp & Helgø, 2008). This study has contributed empirically, finding the two styles to be independent constructs, which implies that both can be practised simultaneously. While a number of theoretical arguments (outlined in Chapter 2) argue for applying less DL in the face of WEC, and this study finds that the absolute level of DL was significantly lower than EL, this study has broadened the debate on DL as an independent leadership style. Future research should thus acknowledge DL not as an opposing behaviour, but as a supplementary behaviour to EL in WEC. Finding different patterns between EL and DL in face of the WEC-factors adds to the assumption that both styles are used to influence different outcomes or effects. Had the patterns been the same, one could assume that they are interchangeable. For the first time, the integrative WEC Scale provided an empirical baseline for studying which form of leadership leaders choose in the face of WEC. As touched on above, this will allow investigating which leadership approach proves to be most effective for optimally managing complex circumstances; and to investigate which style is applied to achieve which outcomes. This also opens the discussion and the opportunity for further research around how the two styles can be effectively applied in coexistence. For leadership research, this might mean exploring the effect of so called “cluster” or “pattern approaches” (Arnold et al., 2017). This means that behaviours from both DL and EL would be merged into a new cluster in order to study them in combination (see also the following section 7.2). Relevant practical implications of Study 2 include a call for leadership development programmes to promote balanced management skills, more participative organisational structures when facing WEC, and an application of the WEC Scale for organisational diagnostics.

Small test-retest reliabilities of the styles further indicated that leaders might be adjusting their behaviour to the given situation. Consequently, Study 3 investigated the adaptive response of leadership behaviour in WEC.

Research question Study 3: ***Are empowering and directive leadership adapted across time as a response to changing WEC; and if yes, how are they adapted?***

Research question Study3: ***Do the two WEC-factors evoke different patterns of***

adaptation across time in empowering and directive leadership?

Building on this finding of Study 2, the subsequent Study 3 set out to investigate whether and how managers would adapt their levels of DL and EL depending on the changing nature of Work Environment Complexity. So far, little research has investigated the occurrence of leadership behaviour adaptation as a result of facing the specific circumstances of WEC (Baard et al., 2014). Despite this, it is agreed that in changing or complex organisational settings, leaders will be successful if they flexibly adapt their behaviour (e.g., Yukl & Mahsud, 2010). This study addressed several limitations to the conceptual model as well as the empiric evidence behind adaptive leadership and WEC. First, in general, considerably less was known about leaders' adaptivity than that of employees. Second, as long as the characteristics of WEC had not been clearly outlined, the explanatory models behind *if* and *why* individuals would adapt to them, were significantly limited; the "complexity" of a context was often simply assumed, not measured. Lastly, as long as there had been no longitudinal research around complexity and adaptivity, reverse causality could not yet be ruled out. A work environment could have been complex *because* a leader was adapting. Study 3 thus aimed to substantiate a conceptual rationale, the link to the integrated characteristics of WEC, and empirical testing. Consequently, it was hypothesised that changes in WEC would elicit an adaptive response, and the stronger the change in WEC from Wave 1 to Wave 2, the more adaptive behaviour a leader would show. With the use of a longitudinal design, Multiple Hierarchical Regression Analysis, and a sample of 117 leaders, findings indeed indicated that there was significant adaptation of leadership behaviour as a result of changes in WEC.

While EL was shown on a high level more or less independent of the changes in complexity, DL in particular was significantly dependent on the level of change in WEC. This implies that the increase was partly as a response to turbulent changes, especially in the face of WEC-2, Uncertain Work Demands. Hence, when the levels of uncertainty and novelty regarding one's work and job demands are strongly turbulent, this study finds that leaders are likely to respond and intervene by exercising more instrumental control over their environment. Again, this opens the discussion for future research on the leader's motivation behind applying a particular leadership style in WEC, and the outcome that the leader expects to achieve (also touched upon in section 7.4). A positive interpretation of this "directive intervention" could be that a leader will find this a working situation where it is helpful to give direction and structure to their employees. Positive examples of heightening direction include findings in creativity research (Carmeli et al., 2013); for instance, leaders can help their employees to focus, and thus to achieve creative flow even under time pressure (Amabile et al., 2002). Instructing about rules and expectations can help with team learning and innovation (Sarin & McDermott, 2003). An alternative and more negative interpretation could be in line with the assumption that when turbulence within WEC-2 is too strong, leaders may feel so insecure and overwhelmed by the challenge that they revert to exerting controlling behaviour to reduce their own feelings of uncertainty (Karp & Helgø, 2008). These explanations remain to be empirically tested. While the underlying rationales of this phenomenon cannot fully be explained by the present study, this finding implies that DL should not be understood as an opposing style to EL, but supplementary; this supports the initial discussion in Chapter 2. It further supports the idea that both EL and DL in WEC are used to influence different outcomes or effects. Had they been equally adapted, one could assume that they are interchangeable. Moreover, having identified this adaptive response, the risk of a "leadership vacuum" in the most turbulent moments of WEC-2 can be seen as partly reduced, somewhat curtailing the concerns brought up in Study 2. Figure 52 summarises the results of Study 3.

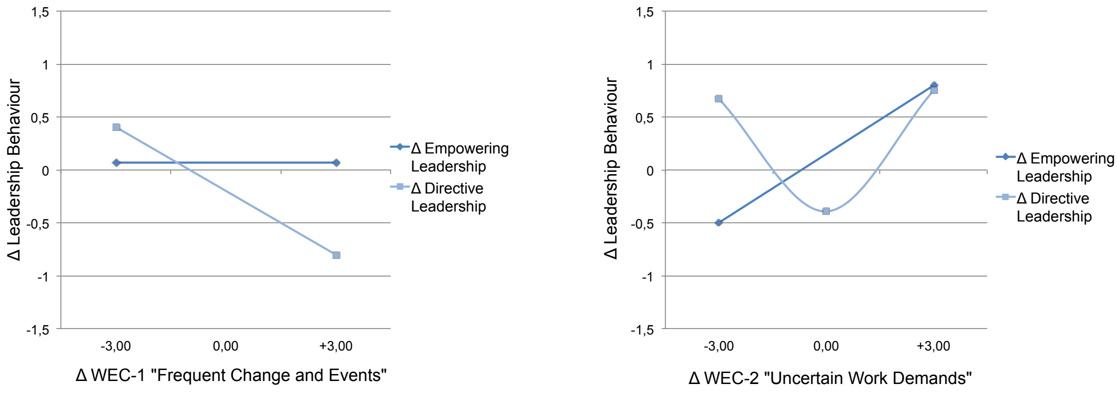

Figure 52. Adaptation of leadership styles in response to changes in WEC. Simplified visualisation.
Δ = Change in construct across Waves 1 and 2.

This study therefore adds empirical evidence to the assumption that, as a result of facing changes in WEC, a leader will indeed modify their leadership behaviour. In other words, this study is the first to indicate that change in the characteristics of a complex work environment may trigger a significant change in leadership behaviour. These findings contribute to understanding which environmental factors are associated with adaptive leadership; until now it had not been clear if complexity was one of them (e.g., Baard et al., 2014). It was further shown that, in general, EL was employed strongly when facing turbulent contexts of WEC, supporting the work carried out in Study 2. In summary, Studies 2 and 3 have found that leaders will show a combination of strong EL and an adaptive response of DL when facing (changes in) Work Environment Complexity.

Research question Study 4: *Which challenges of Work Environment Complexity may affect the functional, psychological wellbeing of leaders?* And research question Study 4: *Which constructs are suited to measure the functional, psychological wellbeing of leaders in the face of Work Environment Complexity?*

While discussions on leadership and Work Environment Complexity have to date largely centred on the importance of leadership and specific leadership styles for "performing" with regard to the productivity of employees and organisations, previous research has left the leader's own wellbeing and productive functionality largely out of the picture (Arnold & Connelly, 2013; Judge et al., 1999; Nielsen & Daniels, 2012; Roche et al., 2014). This is seen as a fundamental limitation in the previous research. If we want to understand how leadership in WEC can sustainably and functionally be achieved, this thesis has argued that it will require greater knowledge of what makes leaders psychologically capable of thriving and coping with complex and challenging working environments. With the exception of a few studies (Judge et al., 1999; Nielsen & Daniels, 2012; Roche et al., 2014), this field was very much under-researched. Limitations were apparent in several areas. Firstly, there was no measure for WEC. Therefore, there had been no empirical evidence to demonstrate that this presented a substantially new quality of work and challenge to individuals, let alone leaders. The need to address this limitation was further driven by recent research finding that the *combined* influence of more than one job demand on the psychological and physiological wellbeing of individuals could be exponentially detrimental if left unmanaged (van Woerkom et al., 2016). Secondly, it was yet not clear which challenges of WEC were likely to affect leaders in particular, as this group's wellbeing had been largely left out of scope in previous research. Thirdly, it was clear how – given these challenges – a functional leader response would look like and how it could be conceptualised to measure functional leader coping in WEC.

Hence, Chapter 2 set out to examine which challenges of Work Environment Complexity might affect the functional, psychological wellbeing of leaders and to explore which constructs would in turn serve as a valid basis upon which to measure a leader's functional wellbeing or coping ability in response to these challenges. Drawing on research into WEC, role ambiguity, and (chaotic) change, the detrimental feelings of uncertainty and ambiguity which go hand-in-hand with a perceived lack of control were identified as threats to a leader's functional wellbeing. Self-Efficacy for Adaptive Behaviour was presented as a promising variable to measure a productive response to this challenge, as it may serve as a coping mechanism for leaders to exert an alternative form of "control", in an environment where control in its traditional sense is no longer applicable (Karp & Helgø, 2008; Stacey, 2011; Uhl-Bien & Arena, 2017). Secondly, stress, mental strain, and diminished (psychological) wellbeing were found to be additional threats to the personal functionality of leaders when facing WEC. Comparing different approaches to the term of "wellbeing", this study argued for examining the construct of Eudaimonic Wellbeing (e.g., Ryan & Deci, 2001; Waterman, 1993) for the context of WEC, as it describes a productive, functional, and engaged nature of wellbeing, beyond the mere absence of illness (Seligman & Csikszentmihalyi, 2014). Hence, the two constructs of Self-Efficacy for Adaptive Behaviour (SEAB) and Eudaimonic Wellbeing (EUWELL) were proposed as a basis to measure the functional, psychological wellbeing of leaders, tailored to the specific challenges of managing a context of Work Environment Complexity.

Research question Study 4: *Which factors will predict a Leader's Self-Efficacy for Adaptive Behaviour in the Face of Work Environment Complexity?* And research question Study 4: *Which factors will predict a Leader's Eudaimonic Wellbeing in the Face of Work Environment Complexity?*

Having established the two constructs of SEAB and EUWELL as outcome variables to be examined, Study 4 investigated the antecedents, i.e. the predictors of the leader's functional, psychological wellbeing. Given the scarce research in this area so far, this study set out to explore the influences of WEC itself, dispositional factors, and leadership behaviour on a leader's functional wellbeing in WEC.

In investigating the relation between WEC and leader wellbeing/functionality this study addressed several limitations in previous research: Firstly, while many studies explore a leader's influence on employee wellbeing, little has been discovered in general about a leader's individual functional wellbeing (e.g., Roche et al., 2014). Second, with the lack of a measure for WEC, there had been no previous investigation of SEAB and/or EUWELL in contexts of WEC. Third, existing studies had either assumed "complexity" rather than measuring it, or had operationalised "complexity" more narrowly, e.g. as the fulfilment of challenging tasks (Morgeson & Campion, 2003). Hence, Study 4 was able to revisit an assumption of organisational psychology that had prevailed across the last decades. In the narrower operationalisation of "complexity", a number of researchers followed the rationale that more complex work has more motivational potential for the working individual, and have found supporting evidence for this relation (Chung-Yan, 2010; Chung-Yan & Butler, 2011; Ilgen & Hollenbeck, 1991; Morgeson & Campion, 2003). In contrast, this thesis proposes that WEC, as conceptualised in this thesis, describes a new quality of work and that this makes it necessary to revisit the assumption that more complexity (linearly) equals more positive outcomes. As WEC combines several work characteristics (Unpredictability, Frequent Change, and Challenge), such a *combination* of different demands is likely to exacerbate negative impact (van Woerkom et al., 2016). Also, it was proposed that the work characteristics of WEC might intensify a motivational conflict between an individual's desire to be challenged and stimulated by work, as well as their desire not to be overchallenged and overstrained. Therefore, this study suggested describing the effects of complexity on leaders' wellbeing in terms of a curvilinear, *inverted U-* shape, indicating that both too much and on the other side too little complexity in the workplace may have detrimental effects (e.g., Champoux, 1980; Chung-Yan, 2010; Chung-Yan & Butler, 2011; Shaw & Gupta, 2004). In summary, the first part of this study set out to understand the relation between WEC, EUWELL and SEAB; especially how leaders respond to high levels of complexity.

Second, this study explored the idea of the challenge-skill match in WEC; i.e. the assumption that certain dispositional factors and/or behaviours can positively influence leader coping, especially in high-complexity contexts. The constructs of Uncertainty Tolerance, Approach Motivation and Avoidance Motivation were identified as promising dispositional variables to investigate, for two reasons. Firstly because they reflect discussions on a beneficial mind-set of embracing or accepting complexity as something positive (e.g., Ashmos et al., 2000; Lichtenstein & Ashmos, 2009; White & Shullman, 2010), as well as the proposed benefits of proactively approaching (rather than avoiding) complex environments (e.g., Judge et al., 1999; Mumford et al., 2000). Secondly, previous empirical research applying the more narrow construct of a "complex job" had indicated positive associations between wellbeing and adaptability for individuals with proactive and embracing dispositional variables (e.g., Bartone et al., 2013; Chung-Yan & Butler, 2011; B. Griffin & Hesketh, 2003; Pulakos et al., 2002; Shaw & Gupta, 2004). However, the previous research had been limited by the lack of a comprehensive WEC measure. Study 4 also addressed gaps in understanding leader wellbeing (EUWELL) and adaptability (SEAB) in general, while considerably more research has been devoted to the influence of leader behaviour on employees' wellbeing and adaptability. Furthermore, also outside the context of WEC, no study had yet empirically examined a leader's Approach/Avoidance Motivation with respect to leader processes (Cui & Ye, 2017; Kark & Van Dijk, 2007). Insights on the third group of predictors, *leadership styles,* were similarly scarce. Also outside the context of WEC, authors state a "dearth of research" (Zopiatis & Constanti, 2010) when describing effects of leadership styles on leader psychological or functional wellbeing, although many authors have acknowledged it as an interesting topic to be studied (Arnold & Connelly, 2013; Ilies et al., 2005). Also here, the research focus had been largely on understanding leadership styles and their impact on employee outcomes (Arnold & Connelly, 2013; Nielsen & Daniels, 2012; Roche et al., 2014). Study 4 was thus able to overcome several areas of limitations around the association between leadership style, WEC, and functional wellbeing: previous studies on leader wellbeing had not linked to complex contexts, had not worked with the leadership styles empowering or directive leadership, and had not examined EUWELL nor SEAB.

Some indicators could, however, been drawn from research on the relationship between leadership styles and leader mental health and stress (Corrigan et al., 2002; Zopiatis & Constanti, 2010). Here, a theme to further investigate was the differentiation between more active vs. more passive leadership behaviour, indicating that an *active* display of leadership action (independent of which style) could be more beneficial to leaders' coping than passivity or withdrawal (Arnold et al., 2017; Zopiatis & Constanti, 2010). In order to test these assumptions, Study 4 worked with the skill-demands rationale of flow theory (e.g., Moneta & Csikszentmihalyi, 1996), assuming that this would also apply to the application of leadership style (Arnold & Connelly, 2013): it proposed that when leaders feel challenged (by a complex work environment) yet capable of handling such challenge (by actively applying *leadership behaviour*), the occurrence of leader wellbeing (EUWELL) and adaptability (SEAB) should naturally follow (Ceja, 2011; Hektner et al., 2007; Moneta, 2017a).

Applying regression analyses both for direct and interaction effects, this study finds that a leader *can* thrive in the face of Work Environment Complexity. However, building on the model of challenge-skill balance (see e.g., Ceja, 2011; Chung-Yan & Butler, 2011; Csikszentmihalyi & Larson, 1987; Massimini et al., 1987; Moneta, 2017a; Moneta & Csikszentmihalyi, 1996), a leader's functional wellbeing is, indeed, significantly dependent on the nature of Work Environment Complexity itself, a leader's personal disposition, and the leadership style applied. More specifically, results suggested that being presented with high levels of WEC Factor 1 Frequent Change and Events exerted a mildly positive influence on a leader's functionality. Factor 2 Uncertain Work Demands was found, however, by itself to have strongly detrimental effects on a leader's Self-Efficacy for Adaptive Behaviour and Eudaimonic Wellbeing. WEC-2, by itself, had no positive or invigorating effect on individuals. This supports the idea that supposing a continuously linear effect of "the more complexity, the more beneficial", as can be seen, for example in the Job Characteristics Model (JCM; Hackman & Oldham, 1980), is an assumption of the past. Instead, this investigation has found that WEC-2 in particular seems to pose strong threats to the functionality of leaders. This speaks to the qualitatively different nature of WEC from previous conceptualisations of a "complex" job (e.g, Morgeson & Campion, 2003; van Woerkom et al., 2016). Possible explanations for this negative leader reaction have been offered throughout this thesis – one prominent theme is the managerial loss of control that might leave leaders feeling overwhelmed, insecure and helpless (Karp & Helgø, 2008; Roche et al., 2014). Another stream worthy of investigation is explaining the detrimental impact of WEC-2 through the Conservation of Resources (COR) theory, as described by Hobfoll (1989): if several job demands collide, an individual's resources might be lessened by coping with one demand, and thus insufficient to cope with another one. This turns into a loss spiral when more than one demand occurs at the same time, and is likely to exacerbate the negative effect (van Woerkom et al., 2016). In summary, this finding underlines even more strongly the need to find variables that would buffer or reduce the potential detrimental effects of complex work.

One of the most significant findings of this thesis is that it has identified several factors that seem to mitigate the negative effects of "too much" complexity in one's work environment. Firstly, proactive and embracing personality dispositions (high Uncertainty Tolerance, high Approach Motivation, and low Avoidance Motivation) and likewise, actively applying leadership behaviour (both EL and DL) were found to act as buffering mechanisms to secure high functional wellbeing even under conditions of high WEC. Especially, a leader's high level of Approach Motivation showed strong and beneficial effects on leader functionality under high-complexity contexts. Hence, this study highlights the importance of taking into account a leader's disposition when choosing suitable personnel for highly complex positions. Furthermore, it is the *active* facets of disposition and leadership style that appear to play a major role for optimal wellbeing. This became apparent when finding the beneficial effects of actively exerting a leadership style, more or less independent of which one of the two tested (EL and DL). While the mechanisms are yet not fully understood, it is plausible that these results can be explained by the conservation or depletion of resources as stated, for example, by the Conservation of Resources theory (COR, Hobfoll 1989; see e.g. Arnold et al., 2017). (Pro-)active leaders may be more able to create positive interactions or mitigate negative ones and are likely to receive positive resources back (Arnold et al., 2017). In contrast, passive leaders who refrain from exerting influence are more likely to face situations of negativity which deplete their resources without gaining back positive ones, which would yield lower levels of leader functionality (Arnold et al., 2017; Zopiatis & Constanti, 2010).

Figures 53 to 56 summarise the moderation effects for dispositional variables and leadership styles on the relation between WEC and EUWELL / SEAB.

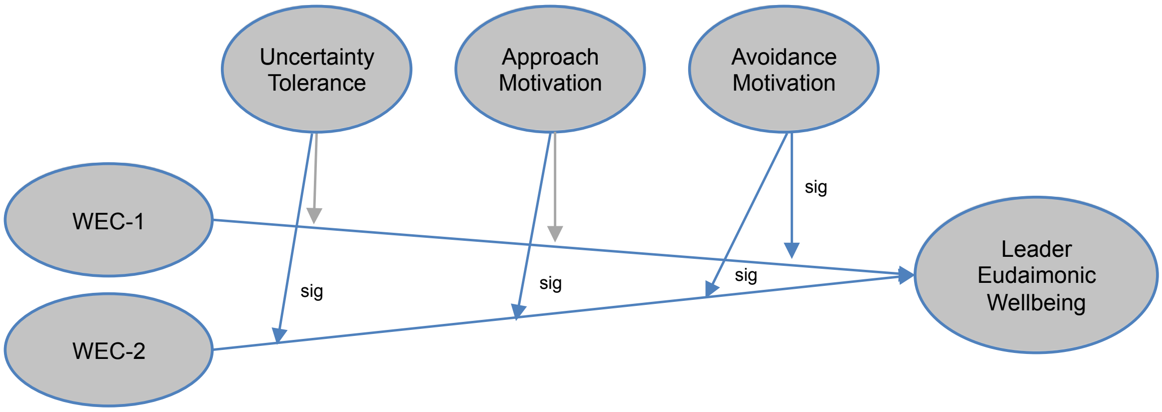

Figure 53. Moderation effects of dispositional variables on the relation between WEC and EUWELL. Simplified visualisation.
"sig" indicates significant moderation at min. one point of testing.

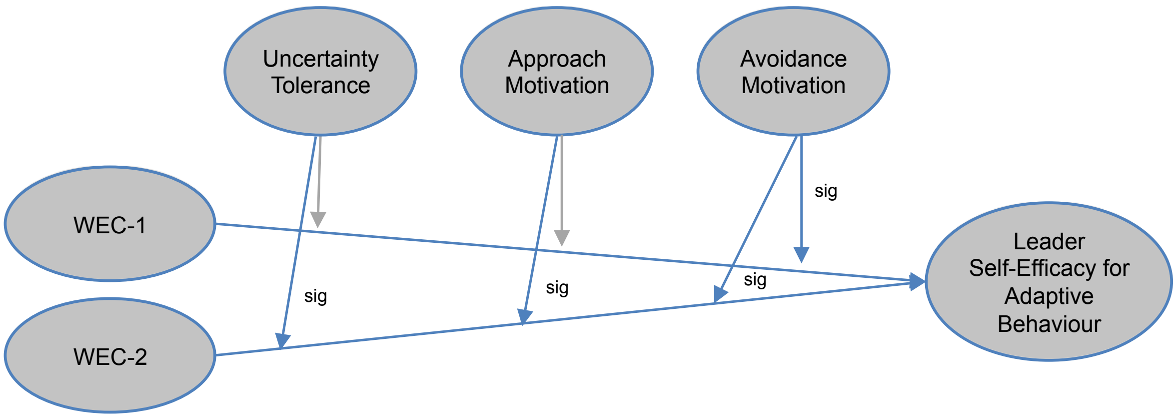

Figure 54. Moderation effects of dispositional variables on the relation between WEC and SEAB.
"sig" indicates significant moderation at min. one point of testing.

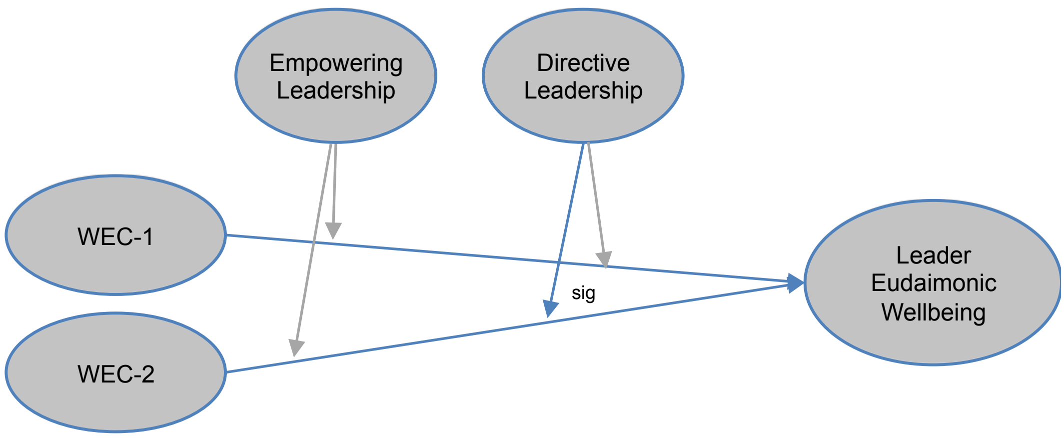

Figure 55. Moderation effects of leadership styles on the relation between WEC and EUWELL.
"sig" indicates significant moderation at min. one point of testing.

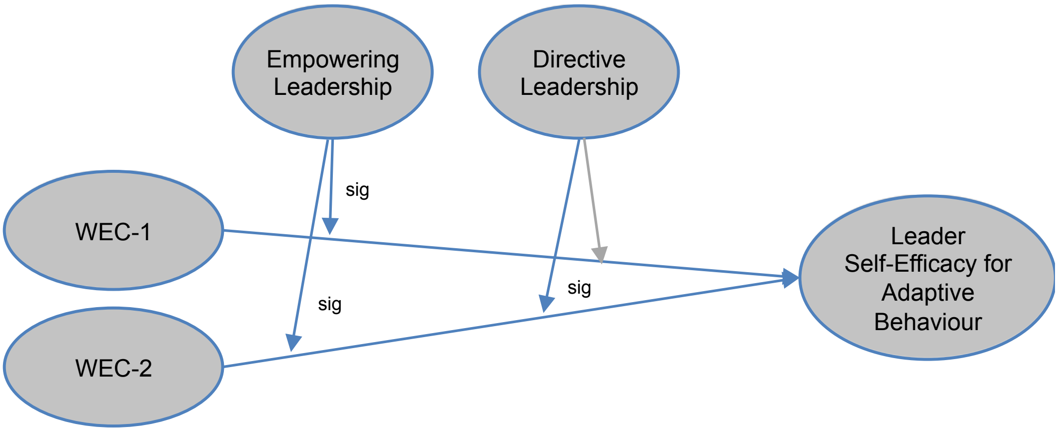

Figure 56. Moderation effects of leadership styles on the relation between WEC and SEAB.
"sig" indicates significant moderation at min. one point of testing.

In summary, a proactive, approach-oriented motivation and the active performance of leadership behaviour are linked to the most favourable effects on a leader's functionality under high Work Environment Complexity. By placing a focus on the individual leader when managing the challenges of highly complex positions, this last empirical chapter has contributed to and rounded off the investigation of Leadership in Work Environment Complexity on an individual level. These findings provide concrete recommendations for the training and selection of leaders in WEC as well as for the design of organisational structures, HR processes, and culture.

7.2 Specific Strengths and Assets of this Thesis

This thesis has aimed to both consolidate and expand the understanding of Leadership in Work Environment Complexity. As such, it provides a reflective summary of the current state of research in the area, and has contributed with original knowledge, conceptual models, and empirical measurements to the topic. In particular, five strengths of this thesis can be emphasised.

***Measuring Work Environment Complexity*.**

One of the strongest assets of this thesis is that it was the first to develop and validate a measurement scale for WEC that can be used for leaders. While the measurement of complexity has been a controversial debate, operationalising and validating WEC as a leader's individual perception of a frequently changing, unpredictable, and challenging work environment integrated common thoughts from previous complexity research. Moreover, having substantiated this measurement scale provides both researchers and practitioners with a way to measure the level of WEC that an individual leader is facing. This provides a link between complexity theory and its application in today's work organisations. In this respect, the adoption of a post-positivistic position is considered an asset of this research. The statistical methodology and multi-study approach used to validate the WEC scale is sophisticated and aligns with the state-of the-art standards used to validate similar scales (e.g., Breevaart et al., 2012; Moneta, 2017b). Being able to empirically measure the WEC construct opens broad possibilities for the empirical research and practical understanding of issues in organisational psychology far beyond the question of leadership. Furthermore, and in line with recent research examining the concept of *accumulating* job demands (van Woerkom et al., 2016), the findings in Study 4 around the strong effect of WEC on leader functional wellbeing speak to the fact that WEC – as conceptualised in this thesis – indeed describes a distinct, new quality of work that needs further research.

***Establishing models of leadership in WEC*.**

The validation of the WEC construct allowed more substantial models to be established. Previous complexity leadership models were limited in their tangibility, as they had not been tied to concrete characteristics of a complex environment, but used the term "complex" more as a metaphor or analogy (Burnes, 2005; Schneider & Somers, 2006). A strength of this research project is therefore that for the first time, empirically tested models have been established of the relationship between the concrete WEC characteristics (Unpredictability, Frequent Change, Challenging Work Content) and their interplay with leadership styles (EL and DL), adaptive leadership over time, as well as leader wellbeing and functionality.

***Longitudinal field samples*.**

This study strongly profited from samples of real-life leaders in field contexts, and especially from a longitudinal design. WEC for leadership populations is still strongly under-researched. For instance, there is a broad range of literature on employee adaptability and functional wellbeing in “complex” contexts, but much less has been developed for leaders in these fields. Secondly, previous leadership studies have been partly conducted with non-managerial populations (e.g. students acting as leaders) or as laboratory studies. While this might aid understanding, it cannot be a substitute for real-life leader samples. Thirdly, the longitudinal data in this study addressed the criticism of the use of quantitative cross-sectional methods for complexity research. Thus, the longitudinal studies in this thesis advanced what had been previously realised in post-positivistic complexity research. For instance, incorporating the element of time made it possible to assess the factorial invariance of the WEC scale longitudinally (Widaman et al., 2010) (Study 1), and allowed for capturing the dynamics of WEC (Study 3) as well as testing for causal – rather than bidirectional – relationships (Study 2). These studies suggested that not only can the nature of WEC be measured validly over time, but also WEC substantially influences the behaviour of leaders, ruling out reverse causality.

***Comparative discussion of empowering and directive leadership*.**

The critical discussion of the role of DL in WEC is seen as an additional strength. Voices in current complexity leadership theory had built up DL as the antagonist of EL, calling it out-dated or deficient to match the novel challenges of WEC (Ashmos et al., 2002; Karp & Helgø, 2008). This thought was further strengthened by a belief that has been prevailing in psychology literature: that direction and participation contradict each other (Blanchard et al., 1993; Sagie, 1997). This thesis has contributed with a more differentiated perspective on the role that both leaderships may play when navigating the leadership challenges in WEC. By guiding the discussion along the concrete characteristics of WEC, situations were identified in which a DL style could, in fact, be seen as beneficial or appropriate and where EL may reach its limits. Consequently, all leadership studies (Study 2, 3, and 4) worked with both leadership styles in parallel, thus not only comparing them conceptually but empirically. For instance, the Structural Equation Models in Study 2 tested both leadership styles simultaneously, rather than investigating a single style in isolation, a criticism that is often raised in leadership research (e.g., Yukl, 2013). Furthermore, previous empirical research had revealed that the two leadership styles were unlikely to be opposites. Findings from Studies 2 and 3 empirically support this claim, implying that EL and DL may, in fact, be most effective in managing WEC when complementing each other. For further research, this could mean to explore the *combination* of both styles in so-called “pattern-oriented” or “cluster” approaches, as recently pursued by Arnold and colleagues (2017). This trend in leadership research works more towards deconstructing leadership styles and in contrast, rearranges individual leadership behaviours tailored to the needs of the situation. Based on the findings of this thesis, WEC might be an interesting ground for studying a new, combined pattern of EL and DL.

For leadership training, this finding means that developmental interventions need to train leaders in the ability to discriminate between situations in which a more empowering or a directive leadership action will be most effective. Also, it can mean that a leader might use both styles in combination. For instance, they could be directive in setting a certain goal, direction, or requirement (= DL), yet leaving the process/how to achieve the goal to the individuals themselves (= EL). This combination has been proven successful in creativity and innovation research (Carmeli et al., 2013; Sarin & McDermott, 2003)

***Investigating leadership functionality and wellbeing in work environment complexity*.**

The study of employee wellbeing is growing in the area of changing or "complex" contexts. In contrast, understanding the psychological consequences of working and leading in WEC for leaders had been surprisingly under-researched. This thesis addressed this gap by investigating leadership functionality and wellbeing in WEC both conceptually and empirically. A strength in this undertaking is that it identified Eudaimonic Wellbeing and Self-Efficacy for Adaptive Behaviour as variables that would operationalise a leader's functional wellbeing specifically curated to the challenges of an unpredictable, frequently changing, and demanding work environment. Empirical evidence in Study 4 supports the relevance of these two variables for understanding a leader's functional coping in WEC. Through empirically examining their relation, Study 4 found that the two variables are related yet distinct concepts (Shaffer et al., 2016). Furthermore, Study 4 indicated by empirical testing for the first time that a set of variables (i.e. the WEC-factors, personality dispositions, and leadership style) significantly influenced the functional wellbeing of leaders in WEC.

7.3 Limitations of this Thesis

While this research was designed and conducted carefully, it is vital to discuss its limitations. There are five overarching limitations:

Sample size and usage

In general, this thesis profited from its sample quality, which consisted of an employee field sample (n = 305) as well as two longitudinal field samples of leaders (combined: *n* = 117). A limitation of this thesis is, however, that these same leadership samples were used (in part) in all four studies of this project. While Study 1 compared employees' perceptions and leaders' perceptions of WEC in the validation process and used only parts of the leadership samples (finding that the WEC Scale is only valid for leaders, not for employees), Studies 2-4 were focused on leadership issues and thus made use of the two longitudinal leader samples again. Yet, in each study different issues and perspectives on leadership in WEC were investigated. For instance, Study 2 focused on whether WEC influenced leadership style. Here, results over time unveiled that leaders might adapt their behaviour to changing WEC. Consequently, Study 3 was conducted to further investigate this finding and to understand the dynamics behind *changing* WEC. In contrast, Study 4 focussed on the individual level-view.

Secondly, all study participants were employed in the health care industry in Germany. This limits the generalisability of findings to leaders in other organisational and national contexts. Therefore, further research should assess the WEC scale in a range of industries, testing factorial invariance between groups of leaders.

Another limitation is that the two leader samples (*n* = 43) and (*n* = 74) were combined and examined as one (except in Study 1). This was necessary to have a large enough sample size for statistical analyses like the Structural Equation Modelling (SEM) and even with 117 leaders, this sample was relatively small. Given that both samples were collected in the same branch (healthcare) with similar leaderships roles, in a similar context (change process) and with the same 5-month gap between Wave 1 and Wave 2, it appears justified to say that these samples were reasonably similar. Secondly, they were combined in order to ease interpretation; the studies' design already included a matrix of variables to begin with (two WEC-factors, two points of time and two leadership styles / two variables of leader functionality / several predictors of leader functionality). Adding an additional discrimination between the samples would have confused more than clarified. In summary, while there was reasoning behind the sample usage and combination, future studies expanding on the results of this thesis should use other and larger samples.

Reliability of WEC factor 2

In the validation of WEC, the model's second factor WEC-2 (Uncertain Work Demands) showed lower and not fully satisfying internal consistency. In Study 1, with use of one leadership sample (n =77) Cronbach's alphas were satisfactory for WEC-1 at time 1 (0.73) and time 2 (0.73), but reliability fell under the cut-off point of .7 for WEC-2 at time 1 (.61) and time 2 (.63). The alternative model-based estimate of composite scale reliability (Raykov, 1997) was good for WEC-1 at time 1 (0.83) and time 2 (0.84), but similarly indicated lower levels for WEC-2 at time 1 (.60) and time 2 (.60). In Study 2, both leadership samples were combined (n = 117). This sample yielded more promising reliabilities. Here, WEC-2 reached a reliability (Cronbach's alpha/ Raykov's composite scale reliability) of .64/.64 in Wave 1, and .65/.67 in Wave 2. While the construct validation process demonstrated the factorial validity of the 7-item WEC Scale, in this study, future research should examine WEC-2 and its reliability in more depth.

Focus on leadership self-reports

Leadership can only occur in the interplay between leaders and followers. It is seen as a limitation that this thesis focused on leadership samples only. Leaving aside the limited scope of a thesis, it is not uncommon for leadership studies only to use leaders as samples (Yukl, 2013). Moreover, given that many of the models and research in complexity leadership are still at an early stage, focusing first on leaders' views seemed reasonable for this project. Undoubtedly, adding the perspectives on leadership in WEC from a team or employee view in future research will greatly enrich the findings of this thesis. For instance, it would be interesting to compare a leader's self-reported empowering behaviour with the interpretation of the behaviour by employees. Congruence of this perception has been shown to be vital for employees to feel empowered (Wong & Giessner, 2016).

The fact that leaders in this research evaluated their own leadership behaviour in WEC through self-reports is seen as a related limitation. It lies in the nature of self-report measures, that they may be subjectively biased (Podsakoff et al., 2003). Thus, ratings of one's own leadership behaviour are likely to happen under the influence of motivations such as consistency seeking, impression management, and self-enhancement (Paulhus & Vazire, 2007). Leaders could, for example, answer the questions with the belief that an empowering leadership style is expected from them rather than a directive one (social desirability bias; see e.g. Podsakoff et al., 2003). This thesis aimed to mitigate some of these risks. For instance, existing validated scales were chosen (Paulhus & Vazire, 2007), respondents' anonymity was secured (Podsakoff et al., 2003), and the measurement points were rather far apart to minimise consistency bias (Podsakoff et al., 2003). Also, the scales for leadership styles in Study 2 were embedded into a questionnaire of the companies' on-going change process and leaders were asked to rate which leadership behaviour they found *most appropriate for the current situation.* This might mitigate some response biases by asking about concrete situations rather than a general evaluation of one's style (Podsakoff et al., 2003). Confirmation that certain behaviour is actually shown will require additional external ratings such ratings by employees, peers, and higher-order supervisors, or through observation of behaviour.

WEC as an individual's perception

Another topic that deserves discussion is the fact that this project conceptualised WEC as an individual's *perception* of it. Work environment questionnaires that capture an individual's evaluation of a work environment comprise the standard approach in organisational psychology; comparable approaches include the work design questionnaire (Morgeson & Humphrey, 2006), the scale for creative working environments (Amabile et al., 1996), and the "total-work-environment level of analysis" approach (Pierce et al., 1989). Thus, such research is not an attempt to quantify actual objectifiable aspects of a work environment, but rather to capture a psychological evaluation of them that is relevant to the respective individual (Amabile et al., 1996). In this line of thinking, all the following investigations in this thesis, like the studies of leadership behaviour (Study 2 and 3) or leader wellbeing (Study 4), are based on the individual's interpretation of WEC: an individual responds to their perception of WEC.

A limitation to this approach is that this thesis did not take into account how individual dispositional factors, skills, experiences, or other variables might influence the perception of WEC in the first place. In line with Lazarus and Folkman's (1984) transactional model of stress and coping, certain individual resources that individuals draw upon in order to handle a given situation might directly influence their cognitive appraisal of this situation. Future research could therefore examine what individual factors influence the rating of WEC. For instance, mentally tough persons may "underrate" the amount of complexity in their work environment, because they feel capable of handling it; while individuals with little experience in similar contexts might rate the amount of WEC higher than leaders with a lot of experience. Similarly, as touched upon in section 6.1.5, some individuals might enjoy the nature of complex work more than others, which might change their evaluation of it (Crooke et al., 2015; Marion, 2012; Webster & Kruglanski, 1994). In contrast, some dispositional factors like neuroticism could trigger an "overrating" of WEC, as high-neuroticism individuals tend to focus on distress that they might associate with certain situational factors such as change (Terry, 1994). In a multi-method study with students, Weinstein and colleagues (Weinstein, Brown, & Ryan, 2009) found that more mindful individuals rated the same threatening events as less stressful. This might be explained by the fact that mindfulness might enable individuals to filter out negative emotionality from their appraisal of a situation. Rafferty and Griffin (2006) found that an individual's seniority influenced their perception of organisational change processes. Age, neuroticism, or conscientiousness, in contrast, did not affect the appraisal.

In summary, future studies could investigate how the perception of WEC might be affected by factors in the individual; and why that is. Independent of this, as WEC is based on an individual's perception, direct comparisons of WEC-figures across individuals and samples must be treated with caution. For instance, a work environment in Company A with an average score of 4 is not "twice as complex" as a work environment in Company B with an average WEC score of 2.

Effectiveness of leadership behaviour

It is important to mention that the studies reported here are limited in the extent to which they can demonstrate how effective the respective leadership behaviour was. While Studies 2 and 3 gave first-time insights into which leadership style would be chosen in WEC (Study 2) and how leadership behaviour would be adapted to changing WEC (Study 3), no variables measured *how successful* this behaviour was. While previous research has established that EL, for instance, is likely to be related to positive employee outcomes such as engagement, wellbeing and adaptability, these relationships have not yet been secured in the context of WEC. Thus, including measures of effectiveness in future research would undoubtedly be valuable. Such measures could, for instance, include variables at the employee level such as quality of work, feeling of empowerment, engagement, or absenteeism (Silverthorne & Wang, 2001). It could include variables at the team level such as team performance, team climate, and innovation behaviours, (Somech, 2006) and it could also include variables at the organisational level such as productivity, financial performance, and organisational agility (Ashmos et al., 2000). Not including these measures was a decision of economy, given the limited scope of this thesis and its focus on studying some foundational models of leadership in WEC. Despite this, Study 4 did, in fact, add some insights on individual-leader effectiveness by identifying variables that would predict a leader's functionality and wellbeing in WEC. Given that leaders are the touchpoint to their employees and looked to for guidance in challenging times, securing a leader's functionality is vital for the subsequent functionality of team members (Roche et al., 2014). Thus, if a leader is psychologically well, this will not only be beneficial for the leader, but it is likely to positively affect employees and organisations in turn (e.g., Quick et al., 2013; Roche et al., 2014).

7.4 Directions for Further Research

The work conducted in this thesis has theoretical and methodological implications that point to new opportunities for future research in complexity and complexity leadership research. If they have been mentioned above, they will not be repeated. The issues discussed below incorporate themes that – due to the limited scope of the thesis – could not be investigated but seem promising for future work.

Leader vs. employee perceptions of WEC

While claiming the "management" of WEC to be a primary leadership concern, which in turn influences employees (Lichtenstein et al., 2006; Marion & Uhl-Bien, 2001; Nienaber & Svensson, 2013), previous scholars have intertwined employee and leader perspectives on WEC (e.g., Griffin et al., 2007). Therefore, there had been no research on the question of whether the concept of WEC is equally meaningful for leaders and employees. The construct validation in Study 1 addressed this gap and provided more conceptual clarity by looking at these two populations separately (e.g., Morgeson & Humphrey, 2006). Findings revealed that the 7-item WEC Scale was only valid for leaders, not for employees. This had been hypothesised, as leadership positions differ considerably from employees' roles in an organisation, as can their perception of workplaces (Morgeson & Humphrey, 2006; Pulakos et al., 2000). Finding leaders' judgments of WEC to be distinct is seen as a theoretical contribution of this thesis. This finding invites further research on *employees'* perceptions of WEC. Future studies could investigate a WEC construct that is valid for employees and see how it differs from the results of this thesis. It could be possible, for instance, that given an employee's working role is often less broad (Morgeson & Humphrey, 2006), the conceptualisation of an employees' WEC will have to reflect this. If this holds, the dissociation of employee WEC from the existing construct of "Job Complexity" (e.g., Frese et al., 1996; Morgeson & Humphrey, 2006) would have to be carefully examined.

Overcoming the challenges of WEC-2 and the role of leader disposition

The second factor of WEC, Uncertain Work Demands, asserted itself throughout the course of this thesis as the element of WEC that seemed to pose most challenge to leaders. For instance, while it appeared that leadership reactions to WEC-1 Frequent Change and Events followed similar patterns of showing high EL (Studies 2 and 3), the reactions to WEC-2 were not as clearly decipherable. In particular, Study 2 showed that leaders who faced WEC-2 overall seemed to draw back from leading, indicated by a decrease in both DL and EL. Study 3 showed an interfering instrumental response to strongly changing WEC-2. An uncertain yet demanding work environment may therefore represent a challenge that leaders seem less familiar with, or a context where the leadership styles at hand seemed inappropriate. Such leadership uncertainty of how to act or resulting passivity puts the success and wellbeing of teams at risk (Zopiatis & Constanti, 2010). Study 4 uncovered the potential detrimental influence of

WEC-2, showing that growing levels of WEC-2 lead to a significant and strong decrease in both leaders' EUWELL and SEAB. This pattern was especially strong for levels of SEAB, where ratings dropped over two points on a five-point scale under conditions of high WEC-2. Thus, WEC-2 seems to pose strong threats to the functionality of leaders. In light of these findings, firstly, more research is needed to understand, *why* this work environment factor appears to be especially challenging for leaders. Secondly, the search for variables that may help leaders to functionally cope with WEC-2 or "buffer" its detrimental effect, is even more in need of further research.

One path for future direction would be to expand on the model of challenge-skill balance in high-complexity contexts (see e.g., Ceja, 2011; Chung-Yan & Butler, 2011; Csikszentmihalyi & Larson, 1987; Massimini et al., 1987; Moneta, 2017a; Moneta & Csikszentmihalyi, 1996). Study 4 provides evidence towards the models' validity in contexts of WEC and therefore has added to growing research also approached in the field of Nonlinear Dynamic Systems (Ceja, 2011). In support of the model, several personality dispositions (Uncertainty Tolerance, Approach Motivation, Avoidance Motivation) and two leadership styles (EL and DL), were found to be relevant factors that influence how well a leader functionally copes with WEC, and in particular with WEC-2. However, other variables may play a role and should be explored in future research. On a dispositional level, for instance, the construct of personal hardiness or resilience may be interesting to investigate (e.g., Nguyen, Kuntz, Näswall, & Malinen, 2016). Resilience is a constellation of dispositions that makes it more likely for individuals to perceive stressful conditions as (1) overall interesting and valuable, (2) controllable, and (3) a positive opportunity to grow. This relates to several concepts discussed in the course of this thesis, e.g. the topic of control. Previous research has found resilience to be a resource for individuals who maintain their performance and health under stressful conditions, and it has been found to predict adaptive behaviour in military leaders (Bartone et al., 2013).

Next, there is growing research into concepts such as mindfulness or psychological capital (PsyCap) with respect to leader wellbeing and coping (Gebauer, 2013; Judge et al., 1999; Roche et al., 2014). PsyCap is a positive psychological state characterised by efficacy, optimism, hope/perseverance, and resilience (Luthans, Youssef, & Avolio, 2007). Whilst, to the author's knowledge, PsyCap has not yet been investigated in (measurably) complex work environments, high PsyCap has been related to performance, wellbeing and other desirable behaviours of leaders, including a positive trickle-down effect to employees (Roche et al., 2014). Given that it is a higher-order construct that combines several established components, it may add insights beyond those of this thesis. Mindfulness, a psychological resource characterised by heightened awareness, is a construct that is only now getting attention in leadership research, but has been found to be related to positive outcomes of coping in clinical settings (Gebauer, 2013; Roche et al., 2014). In WEC, mindfulness might function in line with the mechanisms of "embracing complexity" and adaptability discussed in this thesis. More mindful leaders might, for instance, be more aware of and attentive to the current situation they act within which might enable them to make better choices regarding the appropriate behaviour for the current (complex) situation (Baard et al., 2014; Yukl & Mahsud, 2010). In summary, investigating the relationship between leader wellbeing in WEC (especially WEC-2) and the relationship to various dispositional factors seems a promising direction for future research.

Nonlinear Dynamic System models

While this study has investigated the concept of challenge-skill-balance for the first time in high-complexity contexts, and has tested not only linear but curvilinear relations, there are opportunities to apply more elaborate mathematical models. We know, for instance, from Nonlinear Dynamic Systems research on flow (e.g., Ceja &

Navarro, 2009), that not only are chaotic patterns in worker's engagement common, but that especially in high-challenge environments, sudden, radical changes in engagement are likely to occur (Arrieta et al., 2008; Ceja, 2011; Ceja & Navarro, 2009, 2012). In order to truly understand a leader's functionality in highly dynamic contexts of WEC, it might thus be vital to apply these mathematically more elaborate models to the findings of this thesis. The cusp flow model, for instance, allows for modelling more complex patterns of behaviour such as bifurcations and sudden ruptures (Ceja, 2011). It could be applied to test the novel conceptualisation of WEC and to expand NDS insights into realities of leadership behaviour.

The active facet of coping with WEC

Several findings in Study 4 agreed with the hypothesis that more *active* dispositions or behaviour would be more beneficial to a leader's coping in WEC. For instance, high Uncertainty Tolerance (a more passive state of *tolerating* complexity) as well as low Avoidance Motivation (a passive-avoidant state) were found to exert a relatively weaker positive influence than Approach Motivation (a variable that is considered to be *pro-active*). Similarly, insights from Study 4 lead to the assumption that *actively* applying a leadership style appears to be more beneficial for a leader's functional wellbeing than passively withdrawing from leadership. The question of *which* active leadership style, however, appears to become secondary in this equation, as – by and large – both empowering and directive leadership were found to exert a positive influence when actively applied (Zopiatis & Constanti, 2010). Wong and Giessner (2016) only recently corroborated that there was only a "thin line" between empowering and laissez-faire leadership, strengthening the assumption that the degree of action might be more impactful than the leadership style or intent itself. Possible explanations for these findings of "active leadership" may lie in the dynamics of the paradox of control in complex work settings, a topic touched upon in several parts of this thesis. Where control in its traditional sense cannot be exerted anymore (Hooijberg et al., 1997; Karp & Helgø, 2008; Stacey, 2011), pro-active dispositions and behaviour may be a valuable substitute for retaining the feeling of control, influence, or self-efficacy in WEC. Future research could look into this hypothesis for coping in WEC and the mechanisms behind it. For instance, it would be interesting to study whether the comparative benefits of (pro)-active, self-initiated constructs on outcomes such as feelings of empowerment, influence, self-efficacy, mastery and, eventually, organisational performance, also prevail in other study settings when compared to more passive approaches. In line with this, understanding more about the cognitive rationales and processes behind the choice of active behaviour in WEC would be interesting to explore.

***Motivations, rationales behind behavioural choice*.**

This thesis has examined the leadership styles of empowering and directive leadership and has argued for future research to treat DL as a supplementary behaviour to EL. It might be that the characteristics of WEC did influence the respective choice of leadership behaviour, however there are few answers as to *why* leaders behaved this way. Future research could explore which cognitive rationales drive leaders to use one, the other, or both leadership styles in WEC.

A significant finding of Study 3 suggested that DL showed the greatest increase whenever large *changes* in WEC-2 were experienced – irrespective of whether WEC-2 increased or decreased. In other words, when the level of uncertainty regarding one's work, the novelty of problems, and the ambiguity of job demands were strongly turbulent, leaders responded by exercising more control over their environment. Several explanations for this pattern have been offered. One positive interpretation of this "directive intervention" could be that in the case of severe turbulence within WEC-2, leaders will find it appropriate to show DL in order to give structure, order, and clear direction to their team. In the words of Uhl-Bien and Arena (2017), a leader will find this a situation where it is necessary to be "highly visible to catalyse others" (p.18). An alternative and more negative interpretation could be in line with the assumption that when turbulence within WEC-2 is too strong, leaders may no longer be able to "keep at bay the anxiety caused by not being in managerial control" (Karp & Helgø, 2008, p. 85), and will therefore increase instrumental behaviour to reduce their own feelings of uncertainty. These explanations remain to be empirically tested. Although it became clear in the course of this thesis that leaders relied on showing high levels of EL in WEC, much less is known about the outcomes that leaders expect from this behaviour. Exploring the motivations and reasons behind the decision-making process for specific leadership behaviour in specific WEC-situations is therefore considered an interesting path for future research and would also add depth to the discussions on adaptive leadership in WEC (e.g., Baard et al., 2014).

The role of shared leadership, change leadership, and transformational leadership in WEC.

The leadership styles of EL, DL, and flexible/adaptive leadership were chosen for the focus of this thesis, as they are prominently represented in the current discourse on leadership in WEC. Yet, other leadership styles may play relevant roles and should be investigated in future research. Firstly, exploring the roles of change leadership (CL) and transformational leadership (TL) appears promising. The conceptualisation of WEC developed in this thesis incorporates Frequent Change as a core factor. Thus, the connection to CL and TL appears logical, as both styles concern themselves with the leading or management of change in organisations. However, the conceptualisation of WEC goes beyond the concept of change in at least two ways. Firstly, the construct of Frequent Change has only recently caught the attention of researchers. It is fuelled by the notion that change can no longer be conceptualised as a one-off incident with clear beginning and end, but should be understood as a more continuous and cumulative factor of work environments (Babalola et al., 2016; Rafferty & Griffin, 2006; Wee & Taylor, 2018). Secondly, WEC is a combined construct that also incorporates elements of Unpredictability and Challenging Work Demands. Recent research has explored the influence that such cumulative demands may have on the productivity of individuals in organisations (van Woerkom et al., 2016). The investigation of change-oriented leadership styles has so far received comparably less attention in this respect. An interesting question for further research is whether these leadership styles conceptualised for *changing* contexts equip leaders enough to also manage *complex* contexts. Several studies have uncovered limitations that change-focused leadership styles may face when it comes to managing “complex” jobs or tasks. For instance, Dóci and Hofmans (2015) found in their study that the fulfilment of complex tasks decreased a leader’s level of TL, presumably because the cognitive challenge of a complex task may temporarily deplete the manager’s psychological resources to act in a transformational way. Similarly critical of TL, van der Voet et al. (2015) build on several case studies to propose that transformational leadership is a necessary, yet not sufficient variable for the management of complex environments. Their study highlights the necessity for networking and externally focused behaviours across organisational boundaries to successfully lead in WEC-contexts. In contrast, Wang and colleagues (2014) find that TL influences employees’ creative performance more positively in jobs that are more “complex” (i.e. characterised by less routine tasks). However, none of the above studies have applied a coherent measure for WEC. With the WEC Scale now available, future studies could investigate the interplay between WEC and change-oriented leadership behaviour – exploring their value and potential boundaries when it comes to leading in WEC.

A second promising line of research lies in the field of shared leadership. In contrast to vertical leadership, i.e. leadership by a formally appointed leader, shared leadership is “a group process in which leadership is distributed among, and stems from, team members” (Pearce & Sims Jr, 2002, p. 172). Shared leadership is a construct closely related to team empowerment, as decision-making authority is shared or distributed across the team in a participative way (Carson et al., 2007). Several rationales make shared leadership a promising concept for complex context. Firstly, WEC is often described by complexity research as a context of emergence; in complexity, rich dynamics of frequent transformation, interdependence, and influence between manifold agents are at play. As discussed in this thesis, such high levels of complexity and ambiguity make it more unlikely for single team leaders to successfully perform all required leadership actions (Marion, 2012). Secondly, the fulfilment of complex work relies on the expertise and advanced skillsets of employees, applied in a more autonomous way (Carson et al., 2007). Thirdly, the trend towards flatter organisational hierarchies and power sharing in WEC emphasises the need for self-organisation or leadership to originate from members within the team. As such, researchers are increasingly interested in studying the roles of informal or non-hierarchical leadership concepts and highlight their role in the fulfilment of complex team tasks (Dinh et al., 2014). Pearce and Sims (2002), for instance, found that shared leadership in change management teams was an equally important predictor for team effectiveness as vertical leadership. A meta-analysis by Wang, Waldman & Zhang (2014) further demonstrated that not only was shared leadership a better predictor for team effectiveness in general (as compared with initiating structure and transformational leadership), but the effects of shared leadership were generally stronger for teams with more “complex” (i.e. skill-demanding, cognitively challenging) work. Having established a more comprehensive measure for WEC, this thesis invites further research on shared leadership in complex contexts, as it still has enormous potential (Dinh et al., 2014; Pearce & Sims Jr, 2002).

Psychological safety and an organisational culture of managing mistakes

Several parts of this thesis discussed the need for more empowerment and participation when leading and working in complex contexts (cf. Section 2.4.2; Studies 2 & 3). Teams in WEC are increasingly looked to for their potential to innovate, solve complex problems, and find novel and creative solutions (Nembhard & Edmondson, 2006). Such problem-solving and innovative processes are, however, rarely straightforward, but incorporate the risk of failing and making mistakes along the way (Ortega et al., 2014). Thus, empowerment of individuals and teams requires an organisational climate that allows for this sharing of power and the consequences such (leadership) behaviour brings with it. A promising construct to explore in this relation is the concept of psychological safety. Psychological safety is defined as a work environment where individuals “feel able to show and employ one’s self without fear of negative consequences to self-image, status or career” (Kahn, 1990, p. 708). Previous research has associated psychological safety in teams and organisations with higher team learning, performance, creative achievement, innovation behaviour, engagement, and has demonstrated that the influence of leadership behaviour in this relationship is high (Carmeli et al., 2009; Nembhard & Edmondson, 2006; Ortega et al., 2014; Roussin & Webber, 2012). Recent research finds, for instance, that leaders may be able to foster creativity merely by listening to their employees; and that psychological safety mediates this relation (Castro et al., 2018). Nembhardt and Edmondson (2006) find that leaders who are inclusive and appreciative of others are more likely to establish psychological safety in their teams. If leaders manage to create a psychologically safe environment, individuals will be more likely to speak up, voice ideas or concerns, and engage in creative, autonomous problem-solving with team members, feeling less afraid of being punished for ideas or mistakes in the creative process (e.g., Ortega et al., 2014). Such an openness to exploratory behaviour and a culture that appreciates mistakes as a platform for learning rather than punishment, may be the key for fast adaptation and innovation in today's complex organisations (Carmeli & Paulus, 2015). However, existing studies in this direction (e.g., Carmeli et al., 2009; Carmeli & Paulus, 2015; Ortega et al., 2014) have not actively incorporated measures for WEC. Further investigating the interplay of leadership behaviour, team/organisational psychological safety, and performance in WEC-contexts is thus seen as a promising pathway for future research.

7.5 Practical Implications

The findings of this thesis translate into practical implications for work and leadership in organisations in at least four areas.

Leadership Training

Insights from this research project may equip managers with guidelines for leadership in complex work situations and may be useful when training them to respond optimally. Firstly, and following the predominant theoretical opinion (Ashmos et al., 2002; Burnes, 2005; Correia de Sousa & van Dierendonck, 2014; Karp & Helgø, 2008; Styhre, 2002), several patterns uncovered in this study underline that, generally speaking, a leader seems well advised to apply a strong empowering approach when facing complex challenges. As Study 3 has shown, this holds particularly true when turbulences within WEC are especially high. Consequently, leadership training should advise managers to maintain stable high levels of empowering behaviour across time, even if – or especially when – turbulence occurs. This includes enhancing leaders' awareness of WEC and the strengthening of leadership skills such as delegation, involving others, passing on responsibility and perspective-sharing. Even though not all mechanisms of EL and WEC have been established, it is likely that this will benefit the team and employees by enhancing creativity, self-organisation, wellbeing and a sense of purpose, and by developing the skillset of team members (Amabile et al., 2004; Correia de Sousa & van Dierendonck, 2014; Lee et al., 2018; Yukl, 2013; Zhang & Bartol, 2010). In turn, a strong DL style *alone* does not seem to be the appropriate way to lead in WEC. This could be especially relevant for coaching managers who have in the past exerted largely directive or controlling behaviours, for example in traditionally hierarchical organisations.

Management training for WEC will, however, need to create particular awareness that the two styles can – and should – be applied simultaneously. As this thesis has argued, DL should be seen as and taught as a supplement of EL in WEC. Therefore, leaders should be educated in how they can show both leadership styles in parallel or "fine-tune" them flexibly, depending on their goals and the respective situation (see also Judge et al., 2004). It is likely that DL can give a team orientation, direction, and structure in turbulent work contexts (Uhl-Bien & Arena, 2017). Complex situations may, for instance, require moments of directive leadership where leaders take a clear stand on decisions and in supervising employees where they are not capable of fulfilling demands themselves. Here, training scenarios that simulate the changing and challenging demands in WEC could be effective (Pulakos et al., 2000).

As touched on above, it is critical to strengthen managerial awareness of the need to lead actively in the face of WEC. Hence, leadership development programmes could train managers to act despite uncertainty; practicing the pro-active application of both empowering and directive leadership under conditions of high volatility, novelty, and uncertainty. Also, recent research suggests that Approach Motivation is trainable (Cui & Ye, 2017). Thus, leaders in high-complexity functions could be trained towards more Approach Motivation, even if they have less of a pro-active nature. Such interventions could help to secure the wellbeing and productivity of leaders under high

WEC.

Leadership assessment and selection

Study 4 uncovered the positive impact of personality factors such as Uncertainty Tolerance and Approach Motivation on a leader's functionality and wellbeing in WEC. Given these findings, organisations and their recruiting staff can be advised to take into account a leader's proactive and embracing personality when selecting personnel for leadership functions where high levels of turbulence and unpredictability can be expected. Even though some effects from training can be expected, explicitly assessing and choosing managers with pronounced levels of these dispositions seems to be advisable for the functionality and productivity of an organisation. Furthermore, it may also be best for the individual leader, as a mismatch in disposition might take a toll on an individual's wellbeing. On a more personal level, aspiring leaders would also be advised to reflect on their own character before applying for high-complexity positions, keeping in mind that for more conservative, risk-averse, or passive personalities, such a leadership job could impose undesirable amounts of strain.

Change monitoring and organisational diagnostics.

Thirdly, implications lie in the field of change monitoring and organisational diagnostics. Studies 1-3 have suggested the WEC Scale as a tool for evaluating the perceived level of complexity within an organisation and have found that changes in WEC across time appear as relevant factors for deciding which leadership approach to apply. It is thus suggested to use the WEC Scale regularly in organisational diagnostics, e.g. in staff surveys, together with determining the levels of relevant leadership styles. Regularly monitoring the *changes* in WEC, for example by repeating the monitoring every couple of months, would allow an organisation to assess whether the leadership styles shown presently by managers are well-suited for the level of

WEC. In the case that relevant changes occur, management could initiate organisational interventions such as leadership awareness programmes, change management, or training measures.

Organisational design and climate

Another practical implication addresses organisational design. When arguing that empowerment equips leaders to manage WEC, organisational practices will have to allow for and foster participative behaviour. This can, for example, be achieved by implementing non-hierarchical mechanisms of decision-making, such as democratic polls on organisational resolutions or heterogeneous cross-unit circles of problem-solving, as well as creative spaces and "laboratories". Where responsibility is passed down to many others, and where novel, creative solutions are to be found, errors and missteps are likely to happen. Thus, an organisation's culture will have to allow for trial and error and demonstrate openness for handling – and learning from – mistakes. In this context, a particular focus should be placed on communicating top management expectations when it comes to managing the challenges of WEC, particularly WEC-2 Uncertain Work Demands. This involves clarifying questions such as: How to treat ambiguous situations that we have never encountered before? How much freedom has a manager got when trying to find new solutions to unclear problems, where do boundaries lie? How to handle mistakes made? Such guidelines and messaging, along with role models of leaders who share stories of failure and learning, can help to shape an innovation-friendly climate. Similarly, individuals are likely to adopt motivational foci from relevant role models or leaders (Chen et al., 2013). Promoting the visibility of highly-proactive and empowering role models in the organisation may be another promising factor to strengthen a specific mindset within an organisation. Further, rewarding the "new" desired behaviours on several levels of the organisation appears important. Performance management tools could thus be adjusted, for instance, towards rewarding leaders for empowering behaviour. Leaders would thus be rewarded most when they develop team members' skills and confidence to take personal responsibility and by creating team climates of psychological safety, where individuals feel confident and safe from organisational punishment to explore novel or unconventional ideas. Also, teams and individuals who achieve high-quality results while relying less on leadership guidance could be rewarded for their joint and self-reliant behaviours.

Shaping an organisational culture that allows for experimentation and for trial and error, and deals constructively with mistakes, could further have a positive impact on the psychological health and coping mechanisms of leaders. The above research has strongly suggested that a proactive leadership approach appears to be a valuable shield against potential harm to one's psychological wellbeing. Enhancing awareness of the psychological benefits of a proactive mindset could be integrated into occupational health programmes that are focused on coping with stress and strain. In summary, the design and climate of an organisation will strongly shape how well leaders are equipped to lead and thrive in conditions of Work Environment Complexity.

References

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, London: Sage.

Alison, L., Power, N., van den Heuvel, C., & Waring, S. (2015). A taxonomy of endogenous and exogenous uncertainty in high-risk, high-impact contexts. *Journal of Applied Psychology, 100*(4), 1309–1318.

Amabile, T. M. (1988). A model of creativity and innovation in organizations. *Research in Organizational Behavior, 10*(1), 123-167.

Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the Work Environment for Creativity. *Academy of Management Journal, 39*(5), 1154-1184.

Amabile, T. M., Hadley, C. N., & Kramer, S. J. (2002). Creativity under the gun. *Harvard Business Review, 80*, 52-63.

Amabile, T. M., Schatzel, E. A., Moneta, G. B., & Kramer, S. J. (2004). Leader behaviors and the work environment for creativity: Perceived leader support. *The Leadership Quarterly, 15*(1), 5-32.

American Psychological Association (APA). (2017). Statement of the Society of Industrial and Organizational Psychology, retrieved from http://www.apa.org/ed/graduate/specialize/industrial.

Anderson, P. (1999). Perspective: Complexity theory and organization science. *Organization Science, 10*(3), 216-232.

Andrea, H., Bültmann, U., van Amelsvoort, L. G., & Kant, Y. (2009). The incidence of anxiety and depression among employees—the role of psychosocial work characteristics. *Depression and Anxiety, 26*(11), 1040-1048.

Antonakis, J., House, R. J., & Simonton, D. K. (2017). Can super smart leaders suffer from too much of a good thing? The curvilinear effect of intelligence on perceived leadership behavior. *Journal of Applied Psychology, 102*(7), 1003-1021.

Arnold, K. A., & Connelly, C. E. (2013). Transformational leadership and psychological well-being: Effects on followers and leaders. In H. S. Leonard, R. Lewis, A. M. Freedman, & J. Passmore (Eds.), *The Wiley-Blackwell handbook of the psychology of leadership, change and organizational development* (pp. 175-195). Chichester: John Wiley & Sons.

Arnold, K. A., Connelly, C. E., Gellatly, I. R., Walsh, M. M., & Withey, M. J. (2017). Using a pattern-oriented approach to study leaders: Implications for burnout and perceived role demand. *Journal of Organizational Behavior, 38*(7), 1038-1056.

Arnold, K. A., Turner, N., Barling, J., Kelloway, E. K., & McKee, M. C. (2007). Transformational leadership and psychological well-being: The mediating role of meaningful work. *Journal of Occupational Health Psychology, 12*(3), 193-203.

Arrieta, C., Navarro, J., & Vicente, S. (2008). Factores asociados a la emergencia de patrones diferenciales de la motivación en el trabajo [Variables related to the emergence of differential patterns in work motivation]. *Psicothema, 20*, 745-752.

Ashmos, D. P., Duchon, D., & McDaniel, R. R. (2000). Organizational responses to complexity: The effect on organizational performance. *Journal of Organizational Change Management, 13*(6), 577-595.

Ashmos, D. P., Duchon, D., McDaniel, R. R., & Huonker, J. W. (2002). What a mess! Participation as a simple managerial rule to 'complexity' organizations. *Journal of Management Studies, 39*(2), 189-206.

Avolio, B. (1999). *Full leadership development: Building the vital forces in organizations*. Thousand Oaks: SAGE Publications.

Baard, S. K., Rench, T. A., & Kozlowski, S. W. J. (2014). Performance adaptation - A theoretical integration and review. *Journal of Management, 40*(1), 48-99.

Babalola, M. T., Stouten, J., & Euwema, M. (2016). Frequent change and turnover intention: The moderating role of ethical leadership. *Journal of Business Ethics, 134*(2), 311-322.

Bakker, A. B. (2008). The work-related flow inventory: Construction and initial validation of the WOLF. *Journal of Vocational Behavior, 72*(3), 400–414.

Bandura, A. (1977). *Social learning theory* (Vol. 1). Englewood Cliffs, N.J.: Prentice-Hall.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*, 122-147.

Bartlett, M. S. (1954). A note on multiplying factors for various chi-squared approximations. *Journal of the Royal Statistical Society, 16*, 296–298.

Bartone, P. T., Kelly, D. R., & Matthews, M. D. (2013). Psychological hardiness predicts adaptability in military leaders: A prospective study. *International Journal of Selection and Assessment, 21*(2), 200-210.

Bechtold, B. L. (1997). Chaos theory as a model for strategy development. *Empowerment in Organizations, 5*(4), 193-201.

Beeson, I., & Davis, C. (2000). Emergence and accomplishment in organizational change. *Journal of Organizational Change Management, 13*(2), 178-189.

Berman, S., & Korsten, P. (2010). *Capitalising on complexity: insights from the global chief executive officer (CEO) study. IBM Global Business Services.* IBM Institute for Business Value (ed.), Portsmouth, USA.

Bernieri, F. J., Gillis, J. S., Davis, J. M., & Grahe, J. E. (1996). Dyad rapport and the accuracy of its judgment across situations: A lens model analysis. *Journal of Personality and Social Psychology, 71*(1), 110-129.

Black, J. A. (2000). Fermenting change - Capitalizing on the inherent change found in dynamic non-linear (or complex) systems. *Journal of Organizational Change Management, 13*(6), 520-525.

Blanchard, K. H., Zigarmi, D., & Nelson, R. B. (1993). Situational Leadership after 25 years: A retrospective. *Journal of Leadership Studies, 1*(1), 21-36.

Boal, K. B., & Schultz, P. L. (2007). Storytelling, time, and evolution: The role of strategic leadership in complex adaptive systems. *The Leadership Quarterly, 18*(4), 411-428.

Bollen, K. A. (1989). *Structural equations with latent variables*. New York, NY: Wiley.

Bordia, P., Hobman, E., Jones, E., Gallois, C., & Callan, V. J. (2004). Uncertainty during organizational change: Types, consequences, and management strategies. *Journal of Business and Psychology, 18*(4), 507-532.

Boyatzis, R., & McKee, A. (2013). *Resonant leadership: Renewing yourself and connecting with others through mindfulness, hope and compassion*. Boston, MA: Harvard Business Press.

Breevaart, K., Bakker, A. B., Demerouti, E., & Hetland, J. (2012). The measurement of state work engagement: A multilevel factor analytic study. *European Journal of Psychological Assessment, 28*(4), 305-312.

Brien, M., Forest, J., Mageau, G. A., Boudrias, J. S., Desrumaux, P., Brunet, L., & Morin, E. M. (2012). The basic psychological needs at work scale: Measurement invariance between Canada and France. *Applied Psychology: Health and Well-Being, 4*(2), 167-187.

Brodbeck, P. W. (2002). Implications for organization design: Teams as pockets of excellence. *Team Performance Management: An International Journal, 8*(1/2), 21-38.

Burke, C. S., Pierce, L. G., & Salas, E. E. (2006). *Understanding adaptability: A prerequisite for effective performance within complex environments*. Oxford: Emerald Group Publishing.

Burnes, B. (2005). Complexity theories and organizational change. *International Journal of Management Reviews, 7*(2), 73-90.

Burrell, G., & Morgan, G. (2017). *Sociological paradigms and organisational analysis: Elements of the sociology of corporate life*. Milton Park: Routledge.

Bycio, P., Hackett, R. D., & Allen, J. S. (1995). Further assessments of Bass's (1985) conceptualization of transactional and transformational leadership. *Journal of Applied Psychology, 80*(4), 468-478.

Byrne, B. M., Shavelson, R. J., & Muthén, B. O. (1989). Testing for equivalence of factor covariance and mean structures: The issue of partial measurement invariance. *Psychological Bulletin, 105*(3), 456-466.

Campbell, M., Baltes, J. I., Martin, A., & Meddings, K. (2007). The stress of leadership. *Center for Creative Leadership, 12*.

Carleton, R. N., Norton, P. J., & Asmundson, G. J. (2007). Fearing the unknown: A short version of the Intolerance of Uncertainty Scale. *Journal of Anxiety Disorders, 21*(1), 105–117.

Carmeli, A., Brueller, D., & Dutton, J. E. (2009). Learning behaviours in the workplace: The role of high-quality interpersonal relationships and psychological safety. *Systems Research and Behavioral Science, 26*(1), 81-98.

Carmeli, A., Gelbard, R., & Reiter-Palmon, R. (2013). Leadership, creative problem-solving capacity, and creative performance: The importance of knowledge sharing. *Human Resource Management, 52*(1), 95-121.

Carmeli, A., & Paulus, P. B. (2015). CEO ideational facilitation leadership and team creativity: The mediating role of knowledge sharing. *The Journal of Creative Behavior, 49*(1), 53-75.

Carson, J. B., Tesluk, P. E., & Marrone, J. A. (2007). Shared leadership in teams: An investigation of antecedent conditions and performance. *Academy of Management Journal, 50*(5), 1217-1234.

Castro, D. R., Anseel, F., Kluger, A. N., Lloyd, K. J., & Turjeman-Levi, Y. (2018). Mere listening effect on creativity and the mediating role of psychological safety. *Psychology of Aesthetics, Creativity, and the Arts, 12*(8), 489-502.

Ceja, L. (2011). *Flow experiences at work: an approach from the complexity theory.* (PhD Thesis), University of Barcelona, Barcelona, Spain.

Ceja, L., & Navarro, J. (2009). Dynamics of flow: A nonlinear perspective. *Journal of Happiness Studies, 10*, 665-684.

Ceja, L., & Navarro, J. (2012). ‘Suddenly I get into the zone’: Examining discontinuities and nonlinear changes in flow experiences at work. *Human Relations, 65*(9), 1101-1127.

Champoux, J. E. (1980). A three sample test of some extensions to the job characteristics model of work motivation. *Academy of Management Journal, 23*(3), 466-478.

Chen, C. Y., Chen, C. H. V., & Li, C. I. (2013). The influence of leader’s spiritual values of servant leadership on employee motivational autonomy and eudaemonic well-being. *Journal of Religion and Health, 52*(2), 418-438.

Chung-Yan, G. A. (2010). The nonlinear effects of job complexity and autonomy on job satisfaction, turnover, and psychological well-being. *Journal of Occupational Health Psychology, 15*(3), 237-251.

Chung-Yan, G. A., & Butler, A. M. (2011). Proactive personality in the context of job complexity. *Canadian Journal of Behavioural Science, 43*(4), 279-286.

Cilliers, P. (1998). *Complexity and postmodernism: Understanding complex systems*. London: Routledge.

Clegg, C., & Wall, T. (1990). The relationship between simplified jobs and mental health: A replication study. *Journal of Occupational Psychology, 63*(289–295).

Cohen, J. (1988). *Statistical Power Analysis for the Behavioural Sciences*. Mahwah, New York: Lawrence Earlbaum.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2013). *Applied multiple regression/correlation analysis for the behavioral sciences*. London: Routledge.

Colvin, G. (2006). How one CEO learned to fly. *Fortune Magazine*.

Colwell, S. R. (2016). The composite reliability calculator. Technical Report. doi: 10.13140/RG.2.1.4298.088.

Corrigan, P. W., Diwan, S., Campion, J., & Rashid, F. (2002). Transformational leadership and the mental health team. *Administration and Policy in Mental Health and Mental Health Services Research, 30*(2), 97-108.

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology, 78*(1), *98-104*.

Craig, J., & Lopez, P. D. (2016). Can leaders enhance follower innovation by requiring it? *Journal of Leadership Studies, 10*(1), 46-47.

Cramer, D. (2003). *Advanced quantitative data analysis*. London, UK: McGraw-Hill Education.

Crooke, M., Csikszentmihalyi, M., & Bikel, R. (2015). Leadership in a complex world. *Organizational Dynamics, 2*(44), 146-155.

Csikszentmihalyi, M. (1975/2000). *Beyond boredom and anxiety: Experiencing flow in work and play*. San Francisco: Jossey Bass.

Csikszentmihalyi, M., & Larson, R. (1987). Validity and reliability of the experience-sampling method. *The Journal of Nervous and Mental Disease, 175*, 526-536.

Cui, W., & Ye, M. (2017). An introduction of regulatory focus theory and its recently related researches. *Psychology, 8*, *837-847*.

Dawson, J. F. (2014). Moderation in management research: What, why, when, and how. *Journal of Business and Psychology, 29*(1), 1-19.

DeChurch, L. A., & Marks, M. A. (2006). Leadership in multiteam systems. *Journal of Applied Psychology, 91*, 311-329.

Denison, D. R., Hooijberg, R., & Quinn, R. E. (1995). Paradox and performance: toward a theory of behavioral complexity in managerial leadership. *Organization Science, 6*(5), 524-540.

Dinh, J. E., Lord, R. G., Gardner, W. L., Meuser, J. D., Liden, R. C., & Hu, J. (2014). Leadership theory and research in the new millennium: Current theoretical trends and changing perspectives. *The Leadership Quarterly, 25*(1), 36–62.

Donaldson-Felder, E., Munir, F., & Lewis, R. (2013). Leadership and employee well-being. In H. S. Leonard, R. Lewis, A. M. Freedman, & J. Passmore (Eds.), *The Wiley-Blackwell handbook of the psychology of leadership, change and organizational development* (pp. 155-175). Chichester: John Wiley & Sons.

Dong, Y., Liao, H., Chuang, A., Zhou, J., & Campbell, E. M. (2015). Fostering employee service creativity: Joint effects of customer empowering behaviors and supervisory empowering leadership. *Journal of Applied Psychology, 100*, 5.

Doucet, O., Fredette, M., Simard, G., & Tremblay, M. (2015). Leader profiles and their effectiveness on employees' outcomes. *Human Performance, 28*(3), 244-264.

Dóci, E., & Hofmans, J. (2015). Task complexity and transformational leadership: The mediating role of leaders' state core self-evaluations. *The Leadership Quarterly, 26*(3), 436-447.

Einhorn, H. J., & Hogarth, R. M. (1981). Behavioral decision theory: Processes of judgement and choice. *Annual Review of Psychology, 32*(1), 53-88.

Elkington, R., & Booysen, L. (2015). Innovative leadership as enabling function within organizations: a complex adaptive system approach. *Journal of Leadership Studies, 9*(3), 78-80.

Fay, D., & Frese, M. (2001). The concept of personal initiative: An overview of validity studies. *Human Performance, 14*(1), 97-124.

Fenwick, T. (2010). Response to Jeffrey McClellan. Complexity theory, leadership, and the traps of utopia. *Complicity: An International Journal of Complexity and Education, 7*(2).

Ferris, D. L., Johnson, R. E., Rosen, C. C., Djurdjevic, E., Chang, C.-H. D., & Tan, J. A. (2013). When is success not satisfying? Integrating regulatory focus and approach/avoidance motivation theories to explain the relation between core self-evaluation and job satisfaction. *Journal of Applied Psychology, 98*(2), 342.

Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. London: Sage.

Fredberg, T. (2014). If I say it's complex, it bloody well will be: CEO strategies for managing paradox. *The Journal of Applied Behavioral Science, 50*(2), 171-188.

Fredrickson, B. L., & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition & Emotion, 19*(3), 313-332.

Frese, M., Kring, W., Soose, A., & Zempel, J. (1996). Personal initiative at work: differences between East and West Germany. *The Academy of Management Journal, 39*(1), 37-63.

Gebauer, A. (2013). Mindful organizing as a paradigm to develop managers. *Journal of Management Education, 37*(2), 203-228.

Gleick, J. (1988). *Chaos: The making of a new science*. London: William Heinemann Limited.

Grant, A. M., Christianson, M. K., & Price, R. H. (2007). Happiness, health, or relationships? Managerial practices and employee well-being tradeoffs. *The Academy of Management Perspectives, 21*(3), 51-63.

Grant, A. M., & Schwartz, B. (2011). Too much of a good thing: The challenge and opportunity of the inverted U. *Perspectives on Psychological Science, 6*(1), *6 1-76*.

Gray, D. E. (2014). *Doing research in the real world*. London: Sage.

Grebner, S., Semmer, N., Faso, L. L., Gut, S., Kälin, W., & Elfering, A. (2003). Working conditions, well-being, and job-related attitudes among call centre agents. *European Journal of Work and Organizational Psychology, 12*(4), 341-365.

Greenglass, E. R., & Fiksenbaum, L. (2009). Proactive coping, positive affect, and well-being: Testing for mediation using path analysis. *European Psychologist, 14*(1), 29-39.

Griffin, B., & Hesketh, B. (2003). Adaptable behaviours for successful work and career adjustment. *Australian Journal of Psychology, 55*(2), 65–73.

Griffin, M. A., Neal, A., & Parker, S. K. (2007). A new model of work role performance: Positive behavior in uncertain and interdependent contexts. *Academy of Management Journal, 50*(2), 327-347.

Griffin, M. A., Parker, S. K., & Mason, C. M. (2010). Leader vision and the development of adaptive and proactive performance: A longitudinal study. *Journal of Applied Psychology, 95*(1), 174-182.

Grødal, K., Innstrand, S. T., Bauer, G. F., Haugan, G., Rannestad, T., & André, B. (2017). Validation of the Norwegian version of the work-related sense of coherence scale. *Scandinavian Journal of Public Health, 46*(7), 711-717.

Guastello, S. J., Koopmans, M., & Pincus, D. E. (2009). *Chaos and complexity in psychology. The theory of nonlinear dynamical systems*. New York, NY: Cambridge University Press.

Hackman, J. R., & Oldham, G. R. (1975). Development of the Job Diagnostic Survey. *Journal of Applied Psychology, 60*, 159–170.

Hackman, J. R., & Oldham, G. R. (1980). *Work redesign*. Reading, MA: Addison Wesley.

Haigh, C. (2002). Using chaos theory: the implications for nursing. *Journal of Advanced Nursing, 37*, 462–469.

Hannah, S. T., Avolio, B. J., Luthans, F., & Harms, P. D. (2008). Leadership efficacy: Review and future directions. *The Leadership Quarterly, 19*(6), 669-692.

Hannah, S. T., Balthazard, P. A., Waldman, D. A., Jennings, P. L., & Thatcher, R. W. (2013). The psychological and neurological bases of leader self-complexity and effects on adaptive decision-making. *Journal of Applied Psychology, 98*(3), 393-411.

Hannah, S. T., Woolfolk, R. L., & Lord, R. G. (2009). Leader self-structure: a framework for positive leadership. *Journal of Organizational Behavior, 30*(2), 269-290.

Hartman, N. S., & Conklin, T. A. (2014). Ethics and leadership: The role of prevention and promotion. In R. Selladurai & S. Carragher (Eds.), *Servant Leadership: Research and Practice* (pp. 182-200). Hershey, PA: IGI Global.

Hayes, A. F. (2012). PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling. http://www.afhayes.com/public/process2012.pdf.

Heifetz, R. A. (1994). *Leadership without easy answers*. Cambridge, MA: Harvard

University Press.

Hektner, J. M., Schmidt, J. A., & Csikszentmihalyi, M. (2007). *Experience sampling method: Measuring the quality of everyday life*. London: Sage.

Hemphill, J. F. (2003). Interpreting the magnitudes of correlation coefficients. *American Psychologist, 58*(1), 78-79.

Henker, N., Sonnentag, S., & Unger, D. (2015). Transformational leadership and employee creativity: the mediating role of promotion focus and creative process engagement. *Journal of Business and Psychology, 30*(2), 235-247.

Henson, R. K., & Roberts, J. K. (2006). Use of exploratory factor analysis in published research - Common errors and some comment on improved practice. *Educational and Psychological Measurement, 66*(3), 393-416.

Higgins, E. T. (1997). Beyond pleasure and pain. *American Psychologist, 52*(12), 1280-1300.

Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress. . *The American Psychologist, 44*(3), 513–524.

Hochwarter, W. A., Ferris, G. R., Zinko, R., Arnell, B., & James, M. (2007). Reputation as a moderator of political behavior-work outcomes relationships: A two-study investigation with convergent results. *Journal of Applied Psychology, 92*(2), 567-576.

Hooijberg, R., Hunt, J. G., & Dodge, G. E. (1997). Leadership complexity and development of the leaderplex model. *Journal of Management, 23*(3), 375-408.

Horner, M. (1997). Leadership theory: past, present and future. *Team Performance Management: An International Journal, 3*(4), 270-287.

Hoyle, R. H., & Smith, G. T. (1994). Formulating clinical research hypotheses as structural equation models: A conceptual overview. *Journal of Consulting and Clinical Psychology, 62*, 429-440.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1–55.

Hunter, J., & Chaskalson, M. (2013). Making the mindful leader: Cultivating skills for facing adaptive challenges. In H. S. Leonard, R. Lewis, A. M. Freedman, & J. Passmore (Eds.), *The Wiley-Blackwell handbook of the psychology of leadership, change and organizational development* (pp. 195-219). Chichester: John Wiley & Sons.

Ilgen, D. R., & Hollenbeck, J. R. (1991). The structure of work: Job design and roles. In M. D. Dunnette & L. M. Hough (Eds.), *Handbook of industrial and organizational psychology* (Vol. 2nd ed., Vol. 2, pp. 165–207). Palo Alto, CA: Consulting Psychologists Press.

Ilgen, D. R., & Pulakos, E. D. (1999). *The changing nature of performance: Implications for staffing, motivation, and development. Frontiers of industrial and organizational psychology*. San Francisco, CA: Jossey-Bass Inc.

Ilies, R., Morgeson, F. P., & Nahrgang, J. D. (2005). Authentic leadership and eudaemonic well-being: Understanding leader–follower outcomes. *The Leadership Quarterly, 16*(3), 373-394.

Intezari, A., & Pauleen, D. J. (2014). Management wisdom in perspective: Are you virtuous enough to succeed in volatile times? *Journal of Business Ethics, 120*(3), 393-404.

Jackson, S. E., & Schuler, R. S. (1985). A meta-analysis and conceptual critique of research on role ambiguity and role conflict in work settings. *Organizational Behavior and Human Decision Processes, 36*(1), 16-78.

Janssen, O. (2001). Fairness perceptions as a moderator in the curvilinear relationships between job demands, and job performance and job satisfaction. *Academy of*

Management Journal, 44(5), 1039-1050.

Johnson, R. E., Chang, C. H., Meyer, T., Lanaj, K., & Way, J. (2013). Approaching success or avoiding failure? Approach and avoidance motives in the work domain. *European Journal of Personality, 27*(5), 424-441.

Correia de Sousa, M. J., & van Dierendonck, D. (2014). Servant leadership and engagement in a merge process under high uncertainty. *Journal of Organizational Change Management, 27*(6), 877-899.

Judge, T. A., Piccolo, R. F., & Ilies, R. (2004). The forgotten ones? The validity of consideration and initiating structure in leadership research. *Journal of Applied Psychology, 89*(1), 36-51.

Judge, T. A., Thoresen, C. J., Pucik, V., & Welbourne, T. M. (1999). Managerial coping with organizational change: A dispositional perspective. *Journal of Applied Psychology, 84*(1), 107-122.

Jöreskog, K. G. (1999). *How large can a standardized coefficient be. Unpublished Technical Report, available at:* http://www.ssicentral.com/lisrel/techdocs. Retrieved from

Jöreskog, K. G., & Sörbom, D. (1996). LISREL 8: User's reference guide.

Jöreskog, K. G., & Sörbom, D. (2006). LISREL 8.8 for Windows. Skokie, IL: Scientific Software International, Inc.

Kahn, W. A. (1990). Psychological conditions of personal engagement and disengagement at work. *Academy of Management Journal, 33*(4), 692-724.

Kahneman, D., Diener, E., & Schwarz, N. (1999). *Well-being: The foundations of hedonic psychology*. New York: Russel Sage Found.

Kaiser, R. B. (2010). Introduction to the special issue on developing flexible and adaptable leaders for an age of uncertainty. *Consulting Psychology Journal: Practice and Research, 62*(2), 77-80.

Kaiser, R. B., Lindberg, J. T., & Craig, S. B. (2007). Assessing the flexibility of managers: A comparison of methods. *International Journal of Selection and Assessment, 15*(1), 40-55.

Kaiser, R. B., & Overfield, D. V. (2010). Assessing flexible leadership as a mastery of opposites. *Consulting Psychology Journal: Practice and Research, 62*(2), 105-118.

Karanika-Murray, M., Antoniou, A. S., Michaelides, G., & Cox, T. (2009). Expanding the risk assessment methodology for work-related health: A technique for incorporating multivariate curvilinear effects. *Work & Stress, 23*(2), 99-119.

Karanika-Murray, M., & Cox, T. (2010). The use of artificial neural networks and multiple linear regression in modelling work–health relationships: Translating theory into analytical practice. *European Journal of Work and Organizational Psychology, 19*(4), 461-486.

Karelaia, N., & Hogarth, R. M. (2008). Determinants of linear judgment: A meta-analysis of lens model studies. *Psychological Bulletin, 134*(3), 404-426.

Kark, R., & Van Dijk, D. (2007). Motivation to lead, motivation to follow: The role of the self-regulatory focus in leadership processes. *Academy of Management Review, 32*(2), 500-528.

Karp, T., & Helgø, T. I. (2008). From change management to change leadership: embracing chaotic change in public service organizations. *Journal of Change Management, 8*(1), 85-96.

Keyes, C. L., Shmotkin, D., & Ryff, C. D. (2002). Optimizing well-being: The empirical encounter of two traditions. *Journal of Personality and Social Psychology, 82*(6), 1007-1022.

Kozlowski, S. W., Gully, S. M., Brown, K. G., Salas, E., Smith, E. M., & Nason, E. R. (2001). Effects of training goals and goal orientation traits on multidimensional training outcomes and performance adaptability. *Organizational Behavior and Human Decision Processes, 85*(1), 1-31.

Kunze, F., Raes, A. M., & Bruch, H. (2015). It matters how old you feel: Antecedents and performance consequences of average relative subjective age in organizations. *Journal of Applied Psychology, 100*(5), 1511-1526.

Lane, D. A., & Down, M. (2010). The art of managing for the future: Leadership of turbulence. *Management Decision, 48*(4), 512-527.

Lavine, M. (2014). Paradoxical leadership and the competing values framework. *The Journal of Applied Behavioral Science, 50*(2), 189-205.

Lawrence, K. A., Lenk, P., & Quinn, R. E. (2009). Behavioral complexity in leadership: The psychometric properties of a new instrument to measure behavioral repertoire. *The Leadership Quarterly, 20*(2), 87–102.

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York: Springer.

Ledford, G. E. (1999). Comment: Happiness and productivity revisited. *Journal of Organizational Behavior, 20*, *2*5-30.

Lee, A., Willis, S., & Tian, A. W. (2018). Empowering leadership: A meta-analytic examination of incremental contribution, mediation, and moderation. *Journal of Organizational Behavior, 39*(3), 306-325.

LePine, J. A., Colquitt, J. A., & Erez, A. (2000). Adaptability to changing task contexts: Effects of general cognitive ability, conscientiousness, and openness to experience. *Personnel Psychology, 53*(3), 563-593.

Lewin, K., Heider, F., & Heider, G. M. (1936). *Principles of topological psychology*.

Lewis, R. (1994). From chaos to complexity: Implications for organizations. *Executive Development, 7*(4), 16-17.

Li, L., Li, G., Shang, Y., & Xi, Y. (2015). When does perceived leader regulatory-focused modeling lead to subordinate creativity? The moderating role of job complexity. *The International Journal of Human Resource Management, 26*(22), 2872-2887.

Lichtenstein, B. B., & Ashmos, D. P. (2009). The leadership of emergence: A complex systems leadership theory of emergence at successive organizational levels. *The Leadership Quarterly, 20*(4), 617–630.

Lichtenstein, B. B., Uhl-Bien, M., Marion, R., Seers, A., Orion, J. D., & Schreiber, C. (2006). *Complexity leadership theory: An interactive perspective on leading in complex adaptive systems. Management Department Faculty Publications*.

Lissack, M. R. (1999). Complexity: the science, its vocabulary, and its relation to organizations. *Emergence, 1*(1), 110-126.

Lissack, M. R., & Richardson, K. A. (2001). When modeling social systems, models ≠ the modeled: Reacting to Wolfram's A New Kind of Science. *Emergence, 3*(4), 95-111.

Lorenz, E. (1993). *The Essence of Chaos*. London: UCL Press.

Luthans, F., Youssef, C. M., & Avolio, B. J. (2007). *Psychological capital*. New York, NY: Oxford University Press.

MacCallum, R. C., & Austin, J. T. (2000). Applications of structural equation modeling in psychological research. *Annual Review of Psychology, 51*(1), 201-226.

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods, 1*(2), 130-149.

Maguire, S., & McKelvey, B. (1999). Complexity and management: Moving from fad to firm foundations. *Emergence, 1*(2), 19-61.

Malmo, R. B. (1959). Activation: A neuropsychological dimension. *Psychological*

Review, 66(6), 367-386.

Manson, S. M. (2001). Simplifying complexity: A review of complexity theory. *Geoforum, 32*(3), 405-414.

Marion, R. (2012). Organizational leadership and complexity mechanisms. In M. G. Rumsey (Ed.), *The Oxford handbook of leadership* (pp. 184-202). New York: Oxford University Press.

Marion, R., & Uhl-Bien, M. (2001). Leadership in complex organizations. *The Leadership Quarterly, 12*(4), 389–418.

Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. (2001). A temporally based framework and taxonomy of team processes. *The Academy of Management Review, 26*(3), 356-376.

Martin, A., & Ernst, C. (2005). Exploring leadership in times of paradox and complexity. *Corporate Governance: The International Journal of Business in Society, 5*(3), 82-94.

Massimini, F., Csikszentmihalyi, M., & Carli, M. (1987). The monitoring of optimal experience: A tool for psychiatric rehabilitation. *The Journal of Nervous and Mental Diseases, 175*, 545-549.

McGonagle, A. K., Fisher, G. G., Barnes-Farrell, J. L., & Grosch, J. W. (2015). Individual and work factors related to perceived work ability and labor force outcomes. *Journal of Applied Psychology, 100*(2), *376-398*.

Meade, A. W., & Craig, S. B. (2012). Identifying careless responses in survey data. *Psychological Methods, 17*(3), 437-456.

Melchior, M., Caspi, A., Milne, B. J., Danese, A., Poulton, R., & Moffitt, T. E. (2007). Work stress precipitates depression and anxiety in young, working women and men. *Psychological Medicine, 37* (08), 1119-1129.

Moneta, G. B. (2012). Opportunity for creativity in the job as a moderator of the relation between trait intrinsic motivation and flow in work. *Motivation and Emotion, 36*(4), 491-503.

Moneta, G. B. (2017a). *Applications of flow to work*. London: Routledge.

Moneta, G. B. (2017b). Validation of the short flow in work scale (SFWS). *Personality and Individual Differences*(109), 83–88.

Moneta, G. B., & Csikszentmihalyi, M. (1996). The effect of perceived challenges and skills on the quality of subjective experience. *Journal of Personality, 64*, 275-310.

Morgeson, F. P., & Campion, M. A. (2003). Work design. In W. C. Borman, D. R. Algen, & R. J. Klimoski (Eds.), *Handbook of psychology: Industrial and organizational psychology* (Vol. 12, pp. 423–452). Hoboken, NJ: Wiley.

Morgeson, F. P., & Humphrey, S. E. (2006). The Work Design Questionnaire (WDQ): Developing and validating a comprehensive measure for assessing job design and the nature of work. *Journal of Applied Psychology, 91*(6), 1321-1339.

Mumford, M. D., Baughman, W. A., Threlfall, K. V., Uhlman, C. E., & Costanza, D. P. (1993). Personality, adaptability, and performance: Performance on well-defined problem solving tasks. *Human Performance, 6*(3), 241-285.

Mumford, M. D., Zaccaro, S. J., Harding, F. D., Jacobs, T. O., & Fleishman, E. A. (2000). Leadership skills for a changing world: Solving complex social problems. *The Leadership Quarterly, 11*(1), 11–35.

Munné, F. (2005). Qué es la complejidad? [What's complexity?]. *Encuentros de Psicología Social, 3*, 6-17.

Navarro, J., Arrieta, C., & Ballén, C. (2007). An approach to the study of dynamics of work motivation using the diary method. *Nonlinear Dynamics Psychology and Life Sciences, 11*, 473–498.

Nave, C. S., Sherman, R. A., & Funder, D. C. (2008). Beyond self-report in the study of hedonic and eudaimonic well-being: Correlations with acquaintance reports, clinician judgments and directly observed social behavior. *Journal of Research in Personality, 42*(3), 643-659.

Nelson, D. L., & Simmons, B. L. (2003). Health psychology and work stress: A more positive approach. In J. C. E. Quick & L. E. Tetrick (Eds.), *Handbook of occupational health psychology* (Vol. 2, pp. 97-119). Washington, DC, US: American Psychological Association.

Nembhard, I. M., & Edmondson, A. C. (2006). Making it safe: The effects of leader inclusiveness and professional status on psychological safety and improvement efforts in health care teams. *Journal of Organizational Behavior, 27*(7), 941-966.

Nguyen, Q., Kuntz, J. R., Näswall, K., & Malinen, S. (2016). Employee resilience and leadership styles: The moderating role of proactive personality and optimism. *New Zealand Journal of Psychology, 45*(2), 13-21.

Nielsen, K., & Daniels, K. (2012). Enhancing team leaders' well-being states and challenge experiences during organizational change: A randomized, controlled study. *Human Relations, 65*(9), 1207-1231.

Nienaber, H., & Svensson, G. (2013). An analysis of the contribution of leadership to organisational performance using complexity science. *Journal of Management Development, 32*(8), 836-851.

Norton, L. W. (2010). Flexible leadership: An integrative perspective. *Consulting Psychology Journal: Practice and Research, 62*(2), 143-150.

Ogbonna, E., & Harris, L. C. (2000). Leadership style, organizational culture and performance: Empirical evidence from UK companies. *International Journal of Human Resource Management, 11*(4), 766-788.

Oldham, G. R., & Cummings, A. (1996). Employee creativity: Personal and contextual factors at work. *Academy of Management Journal, 39*(3), 607-634.

Oreg, S. (2003). Resistance to change: Developing an individual differences measure. *Journal of Applied Psychology, 88*(4), *680-693*.

Ortega, A., Van den Bossche, P., Sánchez-Manzanares, M., Rico, R., & Gil, F. (2014). The influence of change-oriented leadership and psychological safety on team learning in healthcare teams. *Journal of Business and Psychology, 29*(2), 311-321.

Osborn, R. N., & Hunt, J. G. J. (2007). Leadership and the choice of order: Complexity and hierarchical perspectives near the edge of chaos. *The Leadership Quarterly, 18*(4), 319–340.

Park, H. H., Zhou, Y., & Choi, M. (2018). When are individuals innovative? *Journal of Personnel Psychology, 17*(1), 1-11.

Parker, S., & Wall, T. D. (1998). *Job and work design: Organizing work to promote well-being and effectiveness* (Vol. 4). Thousand Oaks, CA: Sage.

Paulhus, D. L., & Vazire, S. (2007). The self-report method. *Handbook of Research Methods in Personality Psychology, 1*, 224-239.

Pearce, C. L., & Sims Jr, H. P. (2002). Vertical versus shared leadership as predictors of the effectiveness of change management teams: An examination of aversive, directive, transactional, transformational, and empowering leader behaviors. *Group Dynamics: Theory, Research, and Practice, 6*(2), 172-197.

Pearce, C. L., Sims Jr, H. P., Cox, J. F., Ball, G., Schnell, E., Smith, K. A., & Trevino, L. (2003). Transactors, transformers and beyond: A multi-method development of a theoretical typology of leadership. *Journal of Management development, 22*(4), 273-307.

Petrou, P., Demerouti, E., Peeters, M. C., Schaufeli, W. B., & Hetland, J. (2012). Crafting a job on a daily basis: Contextual correlates and the link to work engagement. *Journal of Organizational Behavior, 33*(8), 1120-1141.

Petrou, P., Demerouti, E., & Schaufeli, W. B. (2018). Crafting the change: The role of employee job crafting behaviors for successful organizational change. *Journal of Management, 44*(5), 1766-1792.

Pierce, J. L., Gardner, D. G., Cummings, L. L., & Dunham, R. B. (1989). Organization-based self-esteem: Construct definition, measurement, and validation. *Academy of Management Journal, 32*(2), 622-648.

Pitts, S. C., West, S. G., & Tein, J. Y. (1996). Longitudinal measurement models in evaluation research: Examining stability and change. *Evaluation and Program Planning, 19*(4), 333-350.

Ployhart, R. E., & Bliese, P. D. (2006). Individual ADAPTability (I-ADAPT) theory: Conceptualizing the antecedents, consequences, and measurement of individual differences in adaptability. In S. C. Burke, L. Pierce, & E. Salas (Eds.), *Understanding adaptability: A prerequisite for effective performance within complex environments* (pp. 3-39). Amsterdam: Elsevier.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879-903.

Podsakoff, P. M., & Organ, D. W. (1986). Self-reports in organizational research: Problems and prospects. *Journal of Management, 12*(4), 531-544.

Porteous, P. (2013). Localism: From adaptive to social leadership. *Policy Studies, 34*(5), 523-540.

Pulakos, E. D., Arad, S., Donovan, M. A., & Plamondon, K. E. (2000). Adaptability in the workplace: Development of a taxonomy of adaptive performance. *Journal of Applied Psychology, 85*(4), 612-624.

Pulakos, E. D., Schmitt, N., Dorsey, D. W., Arad, S., Borman, W. C., & Hedge, J. W.

(2002). Predicting adaptive performance: Further tests of a model of adaptability. *Human performance, 15*(4), 299-323.

Quick, J. C., Wright, T. A., Adkins, J. A., Nelson, D. L., & Quick, J. D. (2013). *Preventive stress management in organizations* (2nd ed.). Washington, DC: American Psychological Association.

Rafferty, A. E., & Griffin, M. A. (2006). Perceptions of organizational change: A stress and coping perspective. *Journal of Applied Psychology, 91*(5), 1154-1162.

Ramos-Villagrasa, P. J., Navarro, J., & García-Izquierdo, A. L. (2012). Chaotic dynamics and team effectiveness: Evidence from professional basketball. *European Journal of Work and Organizational Psychology, 21*(5), 778-802.

Raykov, T. (1997). Estimation of composite reliability for congeneric measures. *Applied Psychological Measurement, 21*(2), 173-184.

Redmond, M. R., Mumford, M. D., & Teach, R. (1993). Putting creativity to work: Effects of leader behavior on subordinate creativity. *Organizational Behavior and Human Decision Processes, 55*(1), 120-151.

Robertson, I. T., & Cooper, C. L. (2010). Full engagement: The integration of employee engagement and psychological well-being. *Leadership & Organization Development Journal, 31*(4), 324-336.

Roche, M., Haar, J. M., & Luthans, F. (2014). The role of mindfulness and psychological capital on the well-being of leaders. *Journal of Occupational Health Psychology, 19*(4), *476-489.*

Roussin, C. J., & Webber, S. S. (2012). Impact of organizational identification and psychological safety on initial perceptions of coworker trustworthiness. *Journal of Business and Psychology, 27*(3), 317-329.

Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology, 52*(1), 141-166.

Sagie, A. (1997). Leader direction and employee participation in decision making: Contradictory or compatible practices? *Applied Psychology, 46*(4), 387-415.

Sarin, S., & McDermott, C. (2003). The effect of team leader characteristics on learning, knowledge application, and performance of cross-functional new product development teams. *Decision Sciences, 34*(4), 707-739.

Sauer, S. J. (2011). Taking the reins: the effects of new leader status and leadership style on team performance. *Journal of Applied Psychology, 96*(3), *574-587*.

Schaufeli, W. B., Bakker, A. B., & Salanova, M. (2006). The measurement of work engagement with a short questionnaire: A cross-national study. *Educational and Psychological Measurement, 66*(4), 701-716.

Schmitz, C., & Ganesan, S. (2014). Managing customer and organizational complexity in sales organizations. *Journal of Marketing, 78*(6), 59-77.

Schneider, M., & Somers, M. (2006). Organizations as complex adaptive systems: Implications of Complexity Theory for leadership research. *The Leadership Quarterly, 17*(4), 351–365.

Schumacker, R. E., & Lomax, R. G. (2004). *A beginner's guide to structural equation modeling* (2nd ed.). Mahwah, N.J: Lawrence Erlbaum Associates.

Seligman, M. E., & Csikszentmihalyi, M. (2014). *Positive psychology: An introduction*. In (pp. 279-298). Amsterdam: Springer.

Shaffer, J. A., DeGeest, D., & Li, A. (2016). Tackling the problem of construct proliferation: A guide to assessing the discriminant validity of conceptually related constructs. *Organizational Research Methods, 19*(1), 80-110.

Shalley, C. E., Gilson, L. L., & Blum, T. C. (2009). Interactive effects of growth need strength, work context, and job complexity on self-reported creative performance. *Academy of Management Journal, 52*(3), 489-505.

Shalley, C. E., Zhou, J., & Oldham, G. R. (2004). The effects of personal and contextual characteristics on creativity: Where should we go from here? *Journal of Management, 30*(6), 933-958.

Shaw, J. D., & Gupta, N. (2004). Job complexity, performance, and well-being: When does supplies-values fit matter? *Personnel Psychology, 57*(4), 847-879.

Shoss, M. K., Witt, L. A., & Vera, D. (2012). When does adaptive performance lead to higher task performance? *Journal of Organizational Behavior, 33*(7), 910-924.

Silverthorne, C., & Wang, T. H. (2001). Situational leadership style as a predictor of success and productivity among Taiwanese business organizations. *The Journal of Psychology, 135*, 399-412.

Somech, A. (2006). The effects of leadership style and team process on performance and innovation in functionally heterogeneous teams. *Journal of Management, 32*(1), 132-157.

Spreitzer, G. M. (1995). Individual empowerment in the workplace: Dimensions, measurement and validation. *Academy of Management Journal, 38*(5), 1442–1465.

Spreitzer, G. M. (1996). Social structural characteristics of psychological empowerment. *Academy of Management Journal, 39*(2), 483-504.

Srivastava, A. K., & Krishna, A. (1991). A test of inverted "U"-hypothesis of stress-performance relationship in the industrial context. *Psychological Studies, 36*(1), 34-38.

Stacey, R. D. (2011). *Strategic management and organisational dynamics: The challenge of complexity to ways of thinking about organisations*. Harlow: Pearson Education.

Stacey, R. D., Griffin, D., & Shaw, P. (2002). *Complexity and Management: Fad or*

Radical Challenge to Systems Thinking. London: Routledge.

Stajkovic, A. D., & Luthans, F. (1998). Self-efficacy and work-related performance: A meta-analysis. *Psychological Bulletin, 124*(2), 240-261.

Stewart, I. (1989). *Does god play dice?* Oxford: Blackwell.

Styhre, A. (2002). Non-linear change in organizations: Organization change management informed by complexity theory. *Leadership & Organization Development Journal, 23*(6), 343-351.

Sung, Y. T., Chang, Y. T., Cheng, T. Y., & Tien, H. L. (2017). Development and validation of a work values scale for assessing high school students: A mixed methods approach. *European Journal of Psychological Assessment*, 1-18.

Tannenbaum, R., & Schmidt, W. H. (1958). *How to choose a leadership pattern*. Boston, MA: Harvard Business Review.

Tannenbaum, R., & Schmidt, W. H. (1973). *How to choose a leadership pattern*. Boston, MA: Harvard Business Review.

Tannenbaum, R., & Schmidt, W. H. (2009). *How to choose a leadership pattern*. Boston, MA: Harvard Business Review.

Terry, D. J. (1994). Determinants of coping: The role of stable and situational factors. *Journal of Personality and Social Psychology, 66*, 895–910

Tetenbaum, T. J. (1998). Shifting paradigms: From Newton to chaos. *Organizational Dynamics, 26*(4), 21–32.

Tetrick, L. E., & LaRocco, J. M. (1987). Understanding, prediction, and control as moderators of the relationships between perceived stress, satisfaction, and psychological well-being. *Journal of Applied Psychology, 72*(4), 538-543.

Thom, R. (1975). *Structural stability and morphogenesis*. Reading, MA: Benjamin.

Thomas, A. B. (2005). *Controversies in management: Issues, debates, answers*. London: Routledge.

Tierney, P., & Farmer, S. M. (2002). Creative self-efficacy: Its potential antecedents and relationship to creative performance. *Academy of Management Journal, 45*(6).

Tubre, T. C., & Collins, J. M. (2000). Jackson and Schuler (1985) revisited: A meta-analysis of the relationships between role ambiguity, role conflict, and job performance. *Journal of Management, 26*(1), 155-169.

Tucker, J. S., Pleban, R. J., & Gunther, K. M. (2010). The mediating effects of adaptive skill on values-performance relationships. *Human Performance, 23*(1), 81-99.

Tuckey, M. R., Bakker, A. B., & Dollard, M. F. (2012). Empowering leaders optimize working conditions for engagement: A multilevel study. *Journal of Occupational Health Psychology, 17*(1), 15-27.

Tummers, G. E., Landeweerd, J. A., Janssen, P. P., & van Merode, G. G. (2006). Organizational characteristics, work characteristics, and relationships with psychologic work reactions in nursing: A longitudinal study. *International Journal of Stress Management, 13*(2), 201-227.

Uhl-Bien, M., & Arena, M. (2017). Complexity leadership: Enabling people and organizations for adaptability. *Organizational Dynamics, 46*, 9-20.

Uhl-Bien, M., & Marion, R. (2009). Complexity leadership in bureaucratic forms of organizing: A meso model. *The Leadership Quarterly, 20*(4), 631–650.

Uhl-Bien, M., Marion, R., & McKelvey, B. (2007). Complexity leadership theory: Shifting leadership from the industrial age to the knowledge era. *The Leadership Quarterly, 18*(4), 298–318.

van Dam, K., Nikolova, I., & van Ruysseveldt, J. (2013). The importance of LMX and situational goal orientation as predictors of job crafting. *Gedrag & Organisatie, 26*(1), 66-84.

van der Voet, J., Kuipers, B., & Groeneveld, S. (2015). Held back and pushed forward: Leading change in a complex public sector environment. *Journal of Organizational Change Management, 28*(2), 290-300.

van Woerkom, M., Bakker, A. B., & Nishii, L. H. (2016). Accumulative job demands and support for strength use: Fine-tuning the job demands-resources model using conservation of resources theory. *Journal of Applied Psychology, 101*(1), 141-150.

Villa, J. R., Howell, J. P., Dorfman, P. W., & Daniel, D. L. (2003). Problems with detecting moderators in leadership research using moderated multiple regression. *The Leadership Quarterly, 14*(1), 3 – 23.

Visscher, K., & Rip, A. (2003). Coping with chaos in change processes. *Creativity and Innovation Management, 12*(2), 121-128.

Wallace, C., & Chen, G. (2006). A multilevel integration of personality, climate, self-regulation, and performance. *Personnel Psychology, 59*(3), 529-557.

Wang, C. J., Tsai, H. T., & Tsai, M. T. (2014). Linking transformational leadership and employee creativity in the hospitality industry: The influences of creative role identity, creative self-efficacy, and job complexity. *Tourism Management, 40*, 79–89.

Waterman, A. S. (1993). Two conceptions of happiness: Contrasts of personal expressiveness (eudaimonia) and hedonic enjoyment. *Journal of Personality and Social Psychology, 64*(4), 678-691.

Webster, D. M., & Kruglanski, A. W. (1994). Individual differences in need for cognitive closure. *Journal of Personality and Social Psychology, 67*(6), 1049-1062.

Wee, E. X., & Taylor, M. S. (2018). Attention to change: A multilevel theory on the process of emergent continuous organizational change. *Journal of Applied*

Psychology, 103(1), 1-13.

Weinstein, N., Brown, K. W., & Ryan, R. M. (2009). A multi-method examination of the effects of mindfulness on stress attribution, coping, and emotional well-being. *Journal of Research in Personality, 43*(3), 374-385.

Wendt, H., Euwema, M. C., & van Emmerik, I. H. (2009). Leadership and team cohesiveness across cultures. *The Leadership Quarterly, 20*(3), 358-370.

Weston, R., & Gore, P. A. (2006). A brief guide to structural equation modeling. *The Counseling Psychologist, 34*(5), 719-751.

Wheatley, M. (2011). *Leadership and the new science: Discovering order in a chaotic world*. Oakland, CA: Berrett-Koehler Publishers.

White, R. P., & Shullman, S. L. (2010). Acceptance of uncertainty as an indicator of effective leadership. *Consulting Psychology Journal: Practice and Research, 62*(2), *94-104*.

Widaman, K. F., Ferrer, E., & Conger, R. D. (2010). Factorial invariance within longitudinal structural equation models: Measuring the same construct across time. *Child Development Perspectives, 4*(1), 10-18.

Wong, S. I., & Giessner, S. R. (2016). The thin line between empowering and laissez-faire leadership: An expectancy-match perspective. *Journal of Management, 44*(2), 757-783.

Woodman, R. W., Sawyer, J. E., & Griffin, R. W. (1993). Toward a theory of organizational creativity. *Academy of Management Review, 18*(2), 293-321.

Wright, D. B., London, K., & Field, A. P. (2011). Using bootstrap estimation and the plug-in principle for clinical psychology data. *Journal of Experimental Psychopathology, 2*(2), 252-270.

Wright, T. A., & Cropanzano, R. (2000). Psychological well-being and job satisfaction as predictors of job performance. *Journal of Occupational Health Psychology,* *5*(1), 84-94.

Wrzesniewski, A., Dutton, J. E., & Debebe, G. (2003). Interpersonal sensemaking and the meaning of work. In B. Staw & R. Kramer (Eds.), *Research in organizational behavior* (Vol. 25, pp. 93–135). New York: Elseveier Science.

Yukl, G. (2013). *Leadership in organizations* (Vol. 8/E). Boston: Pearson.

Yukl, G., & Mahsud, R. (2010). Why flexible and adaptive leadership is essential. *Consulting Psychology Journal: Practice and Research, 62*(2), 81.

Zaccaro, S. J., Banks, D., Kiechel-Koles, L., Kemp, C., & Bader, P. (2009). *Leader and team adaptation: The influence and development of key attributes and processes*. United States Army Research Institute for the Behavioral and Social Sciences. Fairfax, VA.

Zaccaro, S. J., & DeChurch, L. A. (2012). Leadership forms and functions in multiteam systems. In S. J. Zaccaro, M. A. Marks, & L. A. DeChurch (Eds.), *Multiteam systems: An organizational form for dynamic and complex environments*. New York: Routledge.

Zhang, X., & Bartol, K. M. (2010). Linking empowering leadership and employee creativity: The influence of psychological empowerment, intrinsic motivation, and creative process engagement. *Academy of Management Journal, 53*(1), 107-128.

Zhang, Y., Waldman, D. A., Han, Y. L., & Li, X. B. (2015). Paradoxical leader behaviors in people management: Antecedents and consequences. *Academy of Management Journal, 58*(2), 538-566.

Zhou, J. (2003). When the presence of creative coworkers is related to creativity: role of supervisor close monitoring, developmental feedback, and creative personality. *Journal of Applied Psychology, 88*(3), 413-422.

Zivnuska, S., Kiewitz, C., Hochwarter, W. A., Perrewé, P. L., & Zellars, K. L.

(2002). What is too much or too little? The curvilinear effects of job tension on turnover intent, value attainment, and job satisfaction *Journal of Applied Social Psychology, 32*(7), 1344-1360.

Zopiatis, A., & Constanti, P. (2010). Leadership styles and burnout: Is there an association? *International Journal of Contemporary Hospitality Management, 22*(3), 300-320.