AALTO UNIVERSITY SCHOOL OF SCIENCE Degree Programme in Industrial Engineering and Management

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CHANGE ANALYTICS: EXPLORING THE DATA-DRIVEN MANAGEMENT OF ORGANIZATIONAL CHANGE

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Abstract

This thesis explores the potential of data-driven change management and, more generally, examines how analytics can be incorporated into the management of organizational change. In addressing this agenda, this study draws on both change management and data analytics literature to outline the emergent *change analytics* concept. Moreover, twelve propositions are developed about the relationship between change management and analytics based on interviews with experts from both fields. The research findings reveal two overarching, interlinked dimensions of change analytics that are explored in further detail: (1) the organizational conditions that enable change analytics, and (2) the advantages that change analytics provide in managing change. First, organizations need to develop necessary analytics capabilities - including unified data management, fundamental analytics expertise, and supporting organizational culture - while recognizing the direct and indirect constraints on analytics, in order to embed analytics into everyday change management. Second, through the systematic application of analytics, organizations can measure and monitor individual employee differences, situational conditions, and group dynamics, as well as detect high-impact outliers within the employee populace. Moreover, data-driven change management involves implementing real-time feedback, quantifying accomplished change activities on an individual level, determining team-level change performance across the organization, continuously evaluating change measures to reduce bias and error, and predictively assessing change consequences and impediments to the introduction of new changes. Contrary to the traditional reactionary approach to navigating change-related complications, resistance, and antagonism, change analytics may enable organizations to predict such hurdles in advance, even before they manifest themselves in the workplace, thus enabling a more proactive approach to change management.

Keywords organizational change, change management, people analytics, change analytics



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Sammandrag

Denna studie undersöker användningen av data analytik inom förändringshantering. Studien kopplar litteratur inom både förändringshantering och analytik för att studera konceptet förändringsanalytik. Utöver detta utvecklas det tolv förslag om förhållandet mellan förändringshantering och analytik, som baserar sig på intervjuer med experter från båda fälten. Forskningen avslöjar två kritiska dimensioner av förändringsanalytik som utforskas mer närgående: vad möjliggör förändringsanalytik och vad förändringsanalytik möjliggör. För det första måste organisationer utveckla nödvändiga duglighter, som enhetlig datahantering, grundläggande analytikerkunskap och stödjande organisationskultur, samt förstå de direkta och indirekta analytiska begränsningarna, för att integrera analytik i den dagliga förändringshanteringen. För det andra kan organisationer systematiskt använda analytik för att övervaka och mäta individuella skillnader mellan arbetstagare, rådande organisationskontexter och faktorer som påverkar gruppdynamik, samt upptäcka individer som avviker ur mängden. Dessutom möjliggör förändringsanalytik realtidsfeedback, kvantifiering av genomförda förändringsaktiviteter på en individuell nivå, avgörandet av förändringar inom organsiationsprestanda, kontinuerligt utvärdera förändringsåtgärder och förutspå förändringskonsekvenser. I stället för det traditionella reaktionära sättet att hantera organisationsförändringar, möjliggör förändringsanalytik användingen av mera proaktiva metoder för att utföra organisationsförändringar.

Nyckelord organisationsförändring, förändringshantering, data analytik, förändringsanalytik

DEFINITIONS

Organizational change Organizational change occurs when an organization transitions from its current state to some desired future state. Such change involves the process of changing an organization's strategy, structure, process, and culture, as well as the effect of such changes on the organization (Armenakis, Harris, and Mossholder, 1993). While organizational change has been studied through various lenses, this thesis adopts a people-centric perspective on change, where the individual attitudes, beliefs, and behavior of the organization's employees are viewed as the fundamental drivers and determinants of organizational change (Choi, 2011).

Change recipientA change recipient denotes an individual employee
within an organization that is influenced by, and
influences, organizational change. Studies on change
recipients emphasize the role of the individual in the
change process; recipient reactions to change form a
critical determinant of the extent to which any change can
succeed (Oreg, Vakola, and Armenakis, 2011).
Organizations change and act solely through their
constituent members, and successful change will only
endure once change recipients modify their on-the-job
behaviors (Jones, Jimmieson, and Griffiths, 2005).

Data analytics Data analytics is an overarching concept denoting the evaluation of data with the aim of generating insights that aid a firm's business functions (Cooper, 2012). Typically, this process involves some form of data

collection and management, modeling and analysis, and the interpretation of the results of the analysis, in order to generate new insight, including the subsequent application of these insights to support decision-making. One area of data analytics that has received a lot of attention in recent years is big data, a concept that denotes data that meets criteria in terms of its volume, velocity, and variety, and that requires new forms of analysis to derive insights that support decision-making (Gandomi and Haider, 2015).

TABLE OF CONTENTS

D	DEFINITIONS		
1	IN	FRODUCTION	9
	11	Research problem question and objectives	12
	1.2	Scope of the thesis	13
	1.3	Structure of the thesis	14
	1.0		
2	LI	FERATURE REVIEW	16
	2.1	Managing organizational change	16
		2.1.1 Change recipients	17
		2.1.2 Elements of change	18
		2.1.3 Navigating change	27
	2.2	Data analytics	31
		2.2.1 Essential characteristics of analytics	31
		2.2.2 People analytics	36
	2.3	Theoretical framework	39
3	MF	ETHODOLOGY	44
	3.1	Research approach	44
	3.2	Data collection	46
	3.3	Data analysis	48
	3.4	Research evaluation	51
4	FI	NDINGS	55
•	<u>4</u> 1	The state of change analytics	
	T. 1	4 1 1 Change management	55
		4.1.1 Change management	55
	42	Factors that encourage augmenting change management with analytics	<i>5</i> 7 60
	1.2	4.2.1 Personalization	60
		4.2.2 Contextualization	61
		4.2.3 Interactivity	
		4.2.4 Recurrence	63
		4.2.5 Transparency	64
		4.2.6 Diffusion of information	65
		4.2.7 Summary of the findings	67
	4.3	3 Factors that impeded augmenting change management with analytics	
		4.3.1 Ambiguous data management	68
		4.3.2 The big brother problem	69
		4.3.3 Implementational complexities	70
		4.3.4 Limitations of big data	71
		4.3.5 Summary of the findings	72
5	DIS	SCUSSION	73
-	5 1	Changing change management	73
	5.2	Change analytics capabilities	

5.3 Data-driven change management	
5.4 Revised theoretical framework	
6 CONCLUSION	
6.1 Practical implications	
6.2 Limitations and suggestions for future research	
REFERENCES	
APPENDICES	

LIST OF TABLES

Table 1. Codes of interviews.	48
Table 2. Factors that encourage augmenting change management with analytics	57
Table 3. Factors that impede augmenting change management with analytics7	72

LIST OF FIGURES

Figure 1. A conceptual model of organizational change	.20
Figure 2. A conceptual model of data analytics.	.33
Figure 3. A conceptual model of data-driven change management.	.40
Figure 4. Excerpt of the code-aggregation data structure	. 50
Figure 5. Revised theoretical framework.	.95

1 INTRODUCTION

Effective competition, even long-term survival, hinges on an organization's ability to adapt to new circumstances, especially in complex and turbulent market environments (Beer and Nohria, 2000; Piderit, 2000; Stacey, 2007; Kanter, 2008). This notion, which alludes to a form of corporate Darwinism, is echoed by the results of a global survey conducted by McKinsey and Company (Aiken and Keller, 2009) that deduced that only by constantly changing could organizations hope to endure. Nonetheless, almost antithetically, the same survey also concluded that two out of every three change projects ultimately fail. This contrast is corroborated by academia, where scholars have long indicated that organizational change projects, more often than not, end in failure (Beer and Nohria, 2000; Smith, 2002; Burnes, 2009). While this prevailing narrative has received some critique - Hughes' (2011) examination of work that strongly point to a high failure rate in change projects concludes that the empirical evidence purported in these studies is not definitive - the vast majority of management literature provides a clear indication that organizations are struggling with organizational change.

There is a growing consensus among change management scholars that the key determinant of the long-term success of organizational change lies not in the efforts nor power of will of a singular change agent; rather, it is driven by the attitudes and behaviour of the individual members of the organization, often denominated as *change recipients* (Balogun and Johnson, 2005; Bartunek et al., 2006; Bouckenooghe, 2010; Choi, 2011). This perspective suggests that an organization is essentially an extension of its individual members; consequently, organizations can only act and change through these members (George and Jones, 2001). Hence, the implementation of lasting change initiatives requires the successful and persistent alteration of individual behaviour (Jones, Jimmieson, and Griffiths, 2005). However, while this literature has fostered debate on the role of employees in organizational change, there is still a lack of empirical research that provides actionable techniques on understanding and managing organizational change at this nuanced level (By, 2005).

Deciphering the complexities of organizational change is a process that is recognized as dependent on a multitude of contingencies (Burnes, 2009). Transforming that understanding into a concrete set of actions requires a more nuanced approach than the currently prevailing, generic management strategies. (Dunphy and Stace, 1993; Kirsch et al., 2013; Parry, 2015). Dunphy and Stace (1993) emphasize that models of change need to be situational, contingent on the current stage and state of the change, as well as the surrounding organizational conditions. Understanding and applying such a model, which includes the antecedents and change-specific factors that drive employee attitudes and behaviour, is key to successfully managing change (Armenakis, Harris, and Mossholder, 1993). Specifically, determining the individual differences between employees, as well as understanding the composition of employee groups, enables organizations to proactively determine team-specific actions and interventions that steer change projects along optimal paths towards successful outcomes (Kirsch et al., 2013). To facilitate this, technology has long been integrated into change management, but while current implementations have yielded results, much stands yet to be gained. Recent advances in data analytics and the availability of affordable computational power have paved the way for a more systematic, data-driven approach to organizational governance and human resource (HR) management (Kiron, 2017; Domingos, 2015). Similarly, intelligent data, analytics, and algorithms could provide a wealth of opportunities for augmenting the management of organizational change (Ewenstein, Smith, and Solongar, 2015).

To concretize the agenda of this thesis, let us consider an intuitive linkage between data analytics and change management. Illustrative of the applicability of data analytics as a supporting function for decision-making processes is a simple linear regression - a fundamental analytical method to estimate relationships between variables. Specifically, linear regression is used to determine the impact that a set of independent variables have on a selected dependent variable (Cohen et al., 2013). The independent variables can be understood as the inputs, or arguments, of a function, while the dependent variable would be the resulting output of that function. Additionally, the relationship between these variables is potentially affected by a third

variable, a moderator variable, which influences the direction and/or strength of the relation (Baron and Kenny, 1986). To contextualize this, consider the following example, and the effect its results carries on a hypothetical decision-making process: a firm initiates periodic change initiatives that affect a wide array of employees, who are all individually different. What if these relative differences could be measured, and their effect on change outcomes quantified? Past change initiatives infer that certain approaches have a higher comparative success rate, thus identifying a significant moderator that distinguishes between the reactions of different groups of employees would enable managers to steer employees along personalized pathways towards successful change acceptance. Inductively, this line of reasoning can be extended to incorporate other dimensions of the change process. The emergence of new techniques that allow for collecting and processing more nuanced and comprehensive data, combined with machine learning, automation, visualization, and other novel methods that allow organizations to sense, monitor, and predict complex individual behaviour suggest that change management will be increasingly transformed by analytics (Erb, 2016; Kirsch et al., 2013).

Change analytics is a nascent line of research that examines the impact of incorporating intelligent data into the management of organizational change (Geller and Mazor, 2011). In this thesis, I develop a model of data-driven change management, incorporating supporting conditions and key augmentative factors, that can serve as the basis for future studies on change analytics. Subsequent research can then build on this research to explain why certain compositions of employee group dynamics, situational factors, and change project characteristics generate high-performing change while other combinations end in failure. Worth noting is that the focus of this thesis is not to ascertain which interventions are suitable for particular change initiatives; rather, the aim is to explore the current potential of integrating analytics-driven techniques into change management.

1.1 Research problem, question, and objectives

This is an empirical, exploratory study into the data-driven management of organizational change. The purpose of this thesis is to outline the essential characteristics of a data-driven change management model and to investigate how change analytics could provide a fundamental technology that would enable organizations to manage their employees on a more granular level. The explicit research problem is outlined as follows:

Data analytics enable a more nuanced understanding of various business functions. However, current models of change management lack a robust and actionable integration of such analytics.

The emphasis is on delineating the key factors that determine the adoption of changes by the change recipients of an organization and to explore how these factors can be identified and influenced through a data-driven approach to change management, including both the benefits of such an approach, as well as the main impediments. Specifically, this study intends to answer the following research question:

How can analytics-driven techniques influence the management of organizational change?

I distinguish between a few topics encompassed in the research question. To determine the influence of analytics-driven techniques on change management, the key characteristics of both change management and analytics need to be understood. Moreover, to capture the necessary organizational conditions that enable change analytics, as well as the subsequent benefits that change analytics yield, both encouraging and impeding factors to data-driven change management need to be examined. To align these aspects of the research questions with the overall structure and progression of the thesis, and to ensure that the research question is answered in full, I introduce four contained and concrete research objectives that I intend to achieve over the course of this study:

- *I. Examine current approaches to change management and data analytics;*
- *II. Establish a theoretical framework that conceptualizes data-driven change management;*
- *III. Identify supporting and impeding factors of data-driven change management through a number of expert interviews;*
- *IV.* Develop a set of propositions about the relationship between change management and analytics based on the findings and integrate these into the theoretical framework.

1.2 Scope of the thesis

Organizational change stems from a need to adapt to shifting market conditions, in order to gain a competitive edge and overcome the inevitable obstacles to success that an increasingly globalized and technologically disruptive environment spawns (Tushman and Anderson, 1986; Kitchen and Daly, 2002; Marković, 2008). Both internal, organization-specific attributes and the interorganizational environment serve as important influencers of organizational change. While external input has undoubtedly a remarkable influence on the initiation and implementation of organizational change projects, this study only investigates data analytics linked to the internals of a firm. Hence, the assessment of external analytics functions, such as market research and competitive analysis, falls outside the scope of this thesis.

Another initial demarcation for this thesis is that the initiation of change programmes is only examined in cursory detail. Change programmes are often derived from the overarching strategy of the organization, which are strongly affected by environmental factors, such as the degree of competition, relative power of market entities, and other industry structures (e.g. Porter, 2008). This thesis examines the change process and its immediate implications, but does not review the underlying strategic motives behind the initiation of changes. This thesis explores what is technologically possible, and how that translates into organizational outcomes. I will intentionally postpone any ethical considerations because I postulate that such considerations are best done once a clear understanding of the various applications and impediments is formed. Moreover, as many forms of personal data collection are subject to regulation on both national and international levels, any legal ramifications that the examined applications of analytics may carry are similarly left outside of the scope of the thesis.

1.3 Structure of the thesis

This thesis consists of six chapters. Following this introductory chapter, I review academic literature that is relevant for the purposes of this study. First, I present an overview of the current literature on organizational change, change management, and the main drivers of change. Second, I explore both traditional and nascent methods of data collection and analysis, and how the insights provided by these methods can be translated into insights that aid organizational decision-making. Finally, I conclude the chapter by compiling the findings of this literature review into a theoretical framework that links these separate streams of research.

In the third chapter, I present the methodology of this study. Here, I establish the research approach and motivate the selection of sample. Moreover, I present the methods I applied for data collection and analysis. I conclude the chapter by assessing the research using criteria that are typically applied in evaluating qualitative studies.

In the fourth chapter, I delineate the results of the research. The current state of datadriven change management is presented, including perspectives on both the managerial and analytical side of managing organizational change. The advantages of a more data-driven approach to change management are delineated. Further, the principal impediments to data-driven change management are explicated. In the fifth chapter, the acquired results are analyzed, discussed, and compared to existing literature. A set of propositions are derived, based on which the initial theoretical model is extended, and a revised version of the framework is presented.

In the final chapter, the thesis is concluded. A summary of the main findings, and their practical implications is provided. Limitations of the study, and avenues for future research that these limitations reveal are explored.

2 LITERATURE REVIEW

This chapter reviews literature that is relevant for understanding the central concepts of this study. First, I provide an overview of key constructs relating to organizational change, change management, and the main determinants and factors of the change process, followed by an exploration of different aspects of navigating change. Second, the essential characteristics of the collection, analysis, and application of intelligent data in support of organizational decision-making is presented. Finally, a synthesis of both literatures is compiled into a theoretical framework that functions as the basis for the ensuing research.

2.1 Managing organizational change

Change is a prevalent element of organizational life, both on operational and strategic levels (Burnes, 2004); By (2005) argues that change is more rapid than ever before within current business environments. Consequently, in order to attain, and subsequently retain, the ability to compete in highly competitive and continuously shifting business environments, firms need to successfully manage change initiatives. Broadly conceptualized as *change management*, this endeavor has been defined as a continual process, where an organization's culture, structure, and capabilities are periodically renewed to serve the needs of its customers, both internal and external to the organization (Brightman and Moran, 2001).

Change management has been recognized as a vital organizational undertaking, but has also proven to be a major challenge for managers. Smith (2002) presents a review of the success rates for different types of organizational change, ranging from the deployment of a new organizational strategy with a comparatively high success rate of 58% to the more dismal 19% success rate that a culture change attained. The median for all types of organizational change was given as 33%. Beer and Nohria (2000) confirm that around ²/₃ of all change projects are ultimately end in failure. Evidently, fostering organizational change is a difficult, but necessary practice for the continued survival of an organization.

This section continues in the following manner. Next, the focal shift in change management literature from the champion of change initiatives, the change agent, to those affected by change, the change recipients, is examined. The different dimensions of change, from the perspective of the change recipient, are explicated and given structure. Concludingly, the role of communication in organizational change is explored.

2.1.1 Change recipients

The failure of many organizational change initiatives to reach their intended objective has been reported as an implementation failure, rather than an inherent flaw of the change undertaking itself (Klein and Sorra, 1996; Kotter, 1996). Traditionally, change management literature has focused on a focal character that functions as an initiator and champion for organizational change, *the change agent*. However, Armenakis, Harris, and Mossholder (1993), and other scholars, posit that a primary reason for the inability of change efforts to reach their aims is not some form of innate incompetence of these change leaders, but an underestimation of the role of the individuals that constitute the change organization. On a fundamental level, the proposition is that organizations act solely as an extension of their employees. Thus, persistent, long term change will only occur when individuals modify their workplace behavior (Jones, Jimmieson, and Griffiths, 2005).

The earlier macro perspective on organizational change has been supplemented by a more nuanced view of individuals as the foci for organizational change (Choi, 2011; Schneider, Brief and Guzzo, 1996; Armenakis and Harris, 2009). Alongside the change agent, these *change recipients* have emerged as a driving force for organizational change, and further, are viewed as critical determinants of the success of change initiatives. To elaborate, a large chunk of literature on organizational change related phenomena adopt a narrative where *organizations* plan for, implement, and react to change (e.g. Armenakis and Bedeian, 1999; Alderfer, 1977; Porras and Silvers, 1991; Pasmore and Fagans, 1992). Paramount to the collective organization, and at the root of change events, however, is the behavior of the change recipient (Oreg, Vakola,

and Armenakis, 2011). While often encapsulated within organizational level studies to some extent, the role of the individual, and the reactions of the individual to organizational change, has emerged as a distinct line of research. There is a growing consensus among scholars that understanding organizational change processes is decisively augmented through the study of employees' attitudes towards change (Armenakis, Harris, and Mossholder, 1993; Herold and Fedor, 2004; Oreg, 2006; Oreg, Vakola, and Armenakis, 2011).

2.1.2 Elements of change

The study of individuals as central elements of organizational change has been researched extensively, and from varying perspectives, from as early as the 1940s (Coch and French, 1948). While the subject has a long tradition, there are several different, and sometimes contradictory approaches to organizational change (Devos and Buelens, 2003). Nonetheless, it is still beneficial to establish a common structure for organizational change processes, in order to understand how employee behavior is molded through different facets of change. The aim of this review is not to provide a comprehensive model for organizational change, but rather integrate central concepts of change as they relate to change recipients, thus providing a provisional frame for understanding the core drivers and interlinkages between different components of change.

Scholars have examined the composition and management of organizational change from a multitude of perspectives, often focusing on the key performance drivers of change projects (Burke and Litwin, 1992; Appelbaum and Wohl, 2000; Armenakis and Harris, 2009). While drawing on these models, the role of the change recipient as a key driver of change performance is emphasized. To frame this, I adopt a processual perspective on change (Appelbaum and Wohl, 2000), conceptualizing change as a process that is contingent on both individual employee factors (Armenakis and Harris, 2009), organizational conditions (Burnes and Jackson, 2011), and the stage that the change programme is currently in (Kirsch et al., 2013). Choi (2011), in a comprehensive study of employees' attitudes towards change, examines the impact of attitudinal constructs on different elements of change processes. The study distinguishes between attitudes that are generic - linked to the extant organizational environment independent of change programmes - and specific - related to a particular change initiative. Adopting a more demarcative perspective, Oreg, Vakola, and Armenakis (2011) propose a model for the categorization of organizational change, as it relates to change recipients, based on an inductive review of previous research from the period 1948-2007. The premise of the model is that change antecedents, the reasons for change recipients' reactions rather than the reaction itself, predict either change recipients' explicit reactions, or more incidental change consequences. Echoing Choi's (2011) notion of generic and specific characteristics of change into prechange antecedents, described as conditions that existed prior to the introduction of change, and are therefore independent of it, and change antecedents, which comprise factors related to the change itself.

Building on these studies, and further extending them with additional literature, this study conceptualizes organizational change as comprised of three overarching, sequential stages: the prechange context; the change context; and change outcomes. This model is presented in Figure 1. The prechange conditions is categorized as the pre-existing background factors that the organization, including the individuals therein, is subject to; this category is split into three subcategories: factors pertaining to the individual; factors originating from the surrounding organizational environment; and the accumulated impact of past change projects. Change conditions involves both the influence of the actual content of the change, as well as elements relating to the process of change and the subjective notions, beliefs and attitudes that change recipients direct at a change initiative. Finally, change outcomes are separated into individual-level direct reactions to change and indirect consequences of change, as well as organization-level performance outcomes.

The prechange conditions form the set of precursor factors that generate attitudes towards change (Choi, 2011). These are altered, negated, or even compounded by situational factors specific to the change conditions, and ultimately result in change outcomes. The relationship between the overarching categories is depicted as circular, even continuous to a degree, as change outcomes ultimately alter the extant conditions within an organization. This feedback loop is concretized as a dimension within the prechange conditions, as the effects of past changes. Next, the individual elements of the model are examined in detail.



Figure 1. A conceptual model of organizational change.

Prechange conditions

The prechange conditions within an organization refers to the extant set of circumstances that predate the initiation of a specific change project. A distinction is made between individual factors, organizational factors, and the effect of historical change projects, all of which are expounded upon below.

Individual factors. Scholars argue that some individuals are predisposed to respond in a particular manner when facing changes (Judge et al., 1999). These characteristics manifest themselves as particular personality traits, general attitudes, coping strategies, motivational needs, and demographic differences (Choi, 2011; Oreg, Vakola, and Armenakis, 2011). Personality traits are often linked to individuals' perception of control (Martin, Jones, and Callan, 2005), and this concept has been extended to encompass the self-efficacy of the recipients (Herold, Fedor, and Caldwell., 2007). Additionally, the predisposition of recipients to either positive or negative affective states has been linked to change recipients' reactions; positive affectivity correlates with an inclination towards accepting change (Iverson, 1996), while negative affectivity is associated with job dissatisfaction (Naswall et al., 2005). Choi (2011) links personality to the attitudes of employees towards change, remarking that certain traits may influence the way a person feels towards changes in general; however, this relationship may be superseded by more specific attitudes about a particular change. Worth mentioning is that Choi (2011) specifically emphasizes that the positive relationship between personality variables and attitudes towards change is solely confirmed for general attitudes towards change, and studies have shown that this linkage is rendered irrelevant by the decisive effects of specific change contexts. Different coping methods have been studied in conjunction with organizational change. Recipients with dispositions towards problem-solving coping styles have been shown to exhibit readiness for change, while adopters of maladaptive defense mechanisms generally induced resistance towards change (Bovey and Hede, 2001). Change recipients driven by higher order needs, such as personal growth, and with a high personal initiative were found to be more receptive to change initiatives. Last, such demographic variables as tenure, level of education, union membership, and position within the organization have been found to influence recipients' behavior within the context of organizational change (Iverson, 1996; Oreg, Vakola, and Armenakis, 2011). Additionally, in an inductive review of age-related factors and motivation, Kooij et al. (2007) conclude that advancing physical age and accompanying factors that relate to age and aging may have a negative influence on work motivation.

Organizational factors. The state of the organizational environment preceding the change involves conditions that affect recipient behavior. The level of support that the organization provides, and by extension, the level of trustworthiness that management exhibits, correlates positively with the acceptance of change (Oreg, Vakola, and Armenakis, 2011). The nature of the work that is performed generally affects recipient perceptions: usage of a variety of skills, psychologically demanding tasks that allow

for a degree of autonomy, task significance, and feedback on performance are all positively linked with positive attitudinal constructs (Cunningham et al., 2002). Organizational culture that fosters commitment influences change; factors relating to the level of commitment that a change recipient directs at the organization, including the alignment of personal and organizational values, the willingness to compete, and the long-term inclination to remain with the organization, correlate with an increased readiness for change (Schneider, Brief and Guzzo, 1996; Iverson, 1996; Mowday, Steers, and Porter, 1979). Conversely, high levels of commitment may also induce resistance to change, as employees might be comfortable with the extant set of conditions within the organization, and therefore wish to preserve things as they are. Aspects of leadership, such as effective leadership practices and balanced emotional commitment from managers, are linked to higher degrees of readiness and commitment to change (Huy, 2002). Oreg, Vakola, and Armenakis (2011) suggest that one of the most influential factors for change outcomes is the extent to which change recipients trust management. Other scholars echo this sentiment, emphasizing the quality of relationships between management and employees (Schneider, Brief and Guzzo, 1996; Choi, 2011).

Effects of past changes. Choi (2011) notes that the impact of past change events is not transient; rather, the accumulation of historical changes influences the appropriation of new changes within organizations. Devos, Buelens, and Bouckenooghe (2007) notes that a successful history of change may lead to a positive view of new change projects. Contrastingly, past change efforts that are not entirely or distinctly successful invoke feelings of cynicism about changes (Watt and Piotrowski, 2008; Choi, 2011). Pettigrew (2000) notes that performant organizations with a track record of successful changes can implement many different types of changes with less effort, ranging from structural measures to cultural projects. Essentially, change outcomes - both positive and negative - impact the prechange context of organizations, influencing the adoption rate and eventual success, of new change projects.

Change conditions

Once a change project is initiated, factors linked to the implicit and explicit composition of the change compound, and sometimes supersede, the antecedent predispositions of change recipients to change. The core attributes of organizational change are often conceptualized as *content*, *process*, and *context*, where the terms *people* or *perceptions* are sometimes substituted in for context (Armenakis and Bedeian, 1999; Oreg, Vakola, and Armenakis, 2011). In this work, the change conditions encompass the content of the change, the process of the change, and the perceptions people exhibit about the change. This work distinguishes between the prechange conditions and the change conditions, in order to better portray the causal relationship between antecedents and change-specific factors, as well as the manner in which they affect employee behavior.

Content. The nature or type of change being implemented is an intuitive determinant of change recipient behavior. Many different types of change have been reviewed, including restructuring, reengineering, corporate culture programmes, and the introduction of new technologies (Devos and Buelens, 2003). Beer and Nohria (2000) distinguish between two different content drivers of organizational change: shifts in economic factors and alterations to organizational capabilities. The former focuses on reducing costs, and often results in layoffs, while the latter emphasizes initiatives involving culture, behavior and attitudes, which less seldom result in job losses. Self, Armenakis, and Schaninger (2001) employ a similar model, differentiating between content changes that significantly affect the lives of employees and changes that only carry a moderate impact. Corroboratively, Devos and Buelens (2003) suggest that employees are more open to change if the content of change is less severe. An additional dimension of change content is changes made to the office plan. Changes to the working environment may yield either positive or negative outcomes - a shift from traditional working spaces to an open-plan office resulted in a decrease in job satisfaction, while the consolidation of several 8-hour shifts into fewer, but longer 12hour shifts increased job satisfaction (Pierce and Dunham, 1992).

Process. The manner in which change is implemented is an oft-studied category of change. The degree to which change recipients participate in the planning and implementation of a change is a strong indicator of change outcomes. Bartunek et al. (2006) found that participation in a change initiative increased the experience of positive emotions. Involvement is linked to a sense of agency, control, contribution, and even competence (Armenakis and Bedeian, 1999; Steel and Lloyd, 1988). The availability of information, as well as the sharing of information is a strong influence on change outcomes. Shum, Bove, and Auh (2008) link information sharing about change as a positive influence on change commitment. Increased quality and quantity of information during change are linked to acceptance and support for the change (Wanberg and Banas, 2000; Oreg, Vakola, and Armenakis, 2011). Contrastingly, Oreg (2006) indicates that additional information actually corresponded with negative evaluations of change; the author emphasizes that it is not solely the quantity of information that determines change reactions, but also the quality and content of the information. The support of change agents or opinion leaders is highlighted as a primary component of organizational change. This type of backing during change is associated positively with readiness to change (Armenakis, Harris, and Mossholder, 1993). Further, Huy (2002) suggests that beneficial change adaption is fostered through emotional commitment patterns that are balanced: middle managers should emotionally commit to change projects, while simultaneously accounting for employee work details and potentially diverging emotions. Finally, factors such as commitment to a specific change (Choi, 2011) and membership in organizational units where the change process is implemented more fully (Bartunek et al., 2006) have been associated with positive change outcomes.

Perceptions. Oreg, Vakola, and Armenakis (2011) distinguish between changes that are considered beneficial and changes that are viewed as harmful, in a personal context. In addition to this demarcation, this study includes other elements of recipient perceptions within this category. These subjective perceptions are often linked to the more objective change categories - while change content reflects on the substance of a change and change process infers the manner in which a change is implemented, the

perceptions of change are linked to the implications of a change. Employees attitudes towards change are attributed to situational variables particular to a change (Choi, 2011). Attitude scholars posit that specific attitudes predict behavior better than general attitudes do (Eagly and Chaiken, 1993); correspondingly, Choi (2011) concludes that change specific attitudes are better predictors of change outcomes. Scholars have indicated that beliefs about the appropriateness of a change, which can be inferred from the fit between a change initiative and an organization's vision (Parish, Cadwallader, and Busch, 2008), influence employee commitment to change; ancillary factors, such as employee perceptions about improved performance, implementation success, and individual learning regarding the change all impacted the change. Related to the appropriateness of change is the change recipients' perceptions of the organization's capabilities to accommodate change (Eby et al., 2000).

Change outcomes

The previous categories examine the general conditions and more situational factors that form the antecedents to change outcomes. These outcomes involve three perspectives on the outcomes of a change: direct reactions, indirect consequences, and performance outcomes. While the reactions and consequences impact employees on an individual level, the performance outcome refers to organizational-level variables that function as a form of collective embodiment of the reactions to and consequences of change.

Direct reactions. Oreg, Vakola, and Armenakis (2011) demarcate employee reactions into three components: affective, cognitive, and behavioral. Affective reactions involve the emotional response to changes, reflecting how change recipients feel regarding the change; studies generally focus on the positive framing of changes, often involving pleasantness, satisfaction, and the affective dimension of commitment (Bartunek et al., 2006; Armenaki, Harris, and Mossholder, 1993), or the negative reactions to change, including stress, anxiety, and fatigue (Oreg, 2006; Pierce and Dunham, 1992). Cognitive reactions relate to recipients' evaluation of a change's value for themselves, for the organization, or both; scholars have studied this

dimension of reactions from perspectives of sensemaking and sensegiving (Gioia and Chittipeddi, 1991; Bartunek et al., 2006), from rationalizations of the benefits or costs of the change (Gaertner, 1989), and other cognitive conceptualizations (Oreg, Vakola, and Armenakis, 2011). Perhaps the most relevant category of reactions for this study, the behavioral category, concerns the intended behavior of the change recipient in response to a change. This aspect has been studied from perspectives relating to recipient actions in support or resistance of a change (Oreg, 2006), as well as the degree of employee participation in change-initiated activities (Oreg, 2003; Jones, Jimmieson, and Griffiths., 2005).

Indirect consequences. In addition to the more explicit reactions that organizational changes elicit, there are often indirect, implicit, and delayed consequences that also impact recipients. Oreg, Vakola, and Armenakis (2011) divide these into work-related and personal consequences. Work-related consequences reflect recipient orientation towards the organization post-change, such as organizational commitment, job satisfaction, and intentions to quit. Personal consequences involve the psychological well-being of the change recipients, including the assessment of depression, stress and irritation, and perceived control and uncertainty (Axtell et al., 2002; Bordia et al., 2004; Allen et al., 2007). Worth mentioning is that many of the studies that Oreg, Vakola, and Armenakis (2011) reviewed indicated that many of the prechange organizational factors are also considered to be indirectly resultant of changes, such as trust in management being in an indirect consequence of change.

Performance outcomes. Parry (2015) outlines four criteria for defining "highperformance change", which include the following four elements: realized benefits from the change, business performance, capability to manage change, and preparedness to initiate further changes. First, the realized benefits from the change involves achieving the operational objectives of the project, such as staying on schedule and actually completing the project. Second, the daily level of business performance should not deteriorate during changes; rather, employee efficiency and productivity should increase over time. Third, over the course of the change, peoples' capabilities relating to change should be developed, including organizational roles and processes. Finally, while completing the current change project is paramount, the organization also has to retain the ability to undertake further change; Parry (2015) exemplifies this by noting that change is unsuccessful if employees remain negatively affective towards the change or if key personnel have left as a consequence of the change.

Conclusively, organizational change, and how it affects change recipients, can be typified as a sequence of three overarching elements: the prechange conditions, the change conditions, and the consequent change outcomes. Underlying this processual model is the way employee attitudes effectively mediate how accepting employees are towards changes (Armenakis and Harris, 2009; Choi, 2011). Hence, effective change management needs to address change recipients on an individual level, in order to steer individuals and groups successfully through organizational change. The next section elaborates on this aspect of change management, describing the role of communication as a key mechanism for involving and committing employees to both ongoing and forthcoming changes.

2.1.3 Navigating change

Managing organizational change is a systematic, complex undertaking that requires managers to understand the nature of the change, successfully navigate the associated challenges, and intervene with appropriate measures when required. Many scholars have pointed to uncertainty as a key consequence of organizational change for employees (DiFonzo and Bordia, 1998; Bordia et al., 2004; Allen et al., 2007) - while change is often given a positive connotation apropos to organizational transformations, as a means of improving or reinventing a business, it often negatively affects employee morale and productivity (DiFonzo and Bordia, 1998). Richardson and Denton (1996) indicate that communication regarding changes mitigates many of the implicit difficulties associated with organizational change. This view is corroborated by DiFonzo and Bordia (1998), who put forward the claim that the proper management of uncertainty is the key differentiator between effective and ineffective

communication strategies. Other scholars further echo this sentiment: Elving (2005) concluded that open and frequent communication impact both readiness for change and ameliorates change-related uncertainties, while Brown and Eisenhardt (1997) link extensive communication with successful organizational changes.

Change communication occurs on many dimensions within an organization. Allen et al. (2007) suggest that change-related uncertainties may be optimally addressed through the usage of different sources of communication, where strategic information is provided by senior management, while direct supervisors are preferred in implementational matters. Bartunek et al. (2006) highlight the need to involve employees in change. The authors note that participation in change initiatives gave rise to a positive emotional response to changes; involvement led to an increase in the experience of gains. Tangentially, Parry (2015) develops the claim that effective change leadership starts with the change participants that want to change and progressively involves more participants until eventually reaching the entire organization. Involving those affected by change and building understanding throughout an organization allows organizations to implement changes more successfully (DiFonzo and Bordia, 1998; Parry, 2015).

Change is complex and often turbulent. Management literature highlights a number of factors, including the transformational nature of change processes and the multitude of contingencies that change hinges on (Burke and Litwin, 1992). A core challenge for change management strategies is the situational nature of change (Dunphy and Stace, 1993), where models need to account for the shifts in the organizational environment that change initiatives are contingent on. Choi (2011) highlights the contextual nature of change recipient attitudes, suggesting that the notion of personality traits should be conceptualized as states, as individuals' experiences change over time, often over the course of a change project. Correspondingly, change communication needs to address the shifting nature of change organizations. Brown and Eisenhardt (1997) indicate that continuous change requires real-time communications, coupled with a flexible management structure, in order to foster innovation and collaboration.

Communication takes on many forms and its effectiveness is often linked to both the source of the change and the channel through which it is communicated (Hovland and Weiss, 1951; Westmyer, DiCioccio, and Rubin, 1998). Hambrick and Lovelace (2017), in a study on the effectiveness of executive symbolism, put forward the notion that the affective responses to messages in support of some new theme is contingent on "the attributes of the action itself, the reputation of the executive, and predispositions of respective members to the theme". The authors conclude that symbolic action in support of a theme is often ineffective in evoking positive affective reactions from recipients that are predisposed against the proposed changes. Westmyer, DiCioccio, and Rubin (1998) argue that the selection of effective communication channels is an imperative component of communications competence. Communication channels should be chosen based on two aspects: the appropriateness of the channel (i.e. the channel should be socially acceptable) and the effectiveness of the channel (i.e. the channel needs to aptly transmit the requisite information).

Parry (2015) states that organizations often manage change by applying universal best practices that often result in either ineffective interventions or fail altogether. This limitation is pervasive of much of the traditional management literature; for instance, one of the most popular models for managing change, the Kotter change model, provides a set of eight generic rules first proposed by Kotter (1996), based on his personal business experience, and later further developed by Kotter and Cohen (2002). In a review of the model, Appelbaum et al. (2012) found no evidence that refuted the model, but concluded that the model suffered from several limitations and a lack of scientific rigor. Other models, ranging from Lewin's (1947) early tripartite "unfreeze, movement, refreeze" model, to more recent and extensive frameworks such as Kanter et al.'s (1992, in By, 2005) "Ten Commandments for Executing Change" and Luecke's (2003) "Seven Steps" suffer from similar shortcomings. Dunphy and Stace (1993) argue against the generic nature of such models, emphasizing approaches that reflect the situational context of an organization, further noting that models of change management should opt for a "one best way for each" approach in favor of the

prevailing "one best way for all" (By, 2005). As Parry (2015) concisely puts it: "a onesize fits all approach to change will likely fail".

The effectiveness of communication rests on many conditions, including the content of the message (e.g. Hambrick and Lovelace, 2017), use of persuasive language (e.g. Gioia and Chittipeddi, 1991), and the attributes of the manager (e.g. Gilley, Gilley, and McMillan, 2009); however, these factors are all ultimately mediated by the individual characteristics and current attitudes of the change recipients. The development of more targeted methods of management is clearly viewed as an appropriate direction for advancing change management, but many firms still employ approaches that do not recognize the complexities of change nor the fundamental determinants of successful change adoption. Applebaum et al. (2012), in reference to the popularity of Kotter's universal change management model, remark that it "appears to derive its popularity more from its direct and usable format than from any scientific consensus on the results". Establishing the complex relationships and feedback loops that are intrinsic to organizational change, and transforming that conceptualization into practice, has historically been difficult, due to the contingent nature of the change itself (Dunphy and Stace, 1993), as well as the multitude of linked factors that determine the progress and outcome of change (Pettigrew, Woodman, and Cameron, 2001). Kirsch et al. (2013) emphasize that the analysis of such systems requires real-time evaluation and readjustment, validation and management of large datasets, and even entirely new analytical techniques to make sense of the complex and interrelated nature of the data. Through the recent advances in data analytics and computer science, the effective examination and conceptualization of organizational change as a holistic process is enabled at a heretofore unprecedented degree (Kirsch et al 2013; Henke et al, 2016). In the next chapter, I explore the promise and potential of incorporating data analytics, as a means to enable and support a more nuanced approach to change management.

2.2 Data analytics

The systematic application of data as a key driver for improving the robustness of decision-making is widely considered a valuable, even necessary, practice for businesses. McAfee and Brynjolfsson (2012) suggest that firms that consider themselves "data-driven" achieve consistently higher performance on several financial and operational measures, compared to those that do not. They note that organizations in the top third of their industry in data-driven decision-making were on average 5% and 6% more productive and more profitable than their competitors, respectively. The emergence of big data, and its ancillary resources, tools, and applications, has given rise to a myriad of opportunities for transforming business processes and decision-making through the application of data analysis (e.g. Manovich, 2011; Chen and Zhang, 2014; Wamba et al. 2015). Contextualized to this study, the incorporation of a more data-driven approach to change management enables a more detailed understanding of when and how change interventions should be applied.

The structure of this chapter is as follows. Next, the fragmentation of literature surrounding data analytics is reviewed and a convergent definition, within the context and scope of this work, for the concept *data analytics* is presented, including its essential characteristics. Current applications of analytics in businesses are explored, with a focus on the use of analytics to understand and explain human behavior.

2.2.1 Essential characteristics of analytics

The fundamental objective of any analysis is to gain further insight into some phenomena. Van Barneveld, Arnold, and Campbell (2012) collate a number of definitions for the term *analytics*, concluding that analytics is understood as "data-driven decision-making". Research around this core concept is fragmented into different lines of study, with varying usage of terminology. The term *data science* and its practitioners, data scientists, have received growing attention by researchers and academic publications, with the Harvard Business Review (Davenport and Patil, 2012) hailing the occupation as "the sexiest job of the 21st century". Cleveland (2001) characterizes data science as an expansion of statistics, epitomized by the

incorporation of advanced applications of computer science. The concept has evolved to encompass the study of data sets of such complexity that they are difficult to interpret with traditional analytics tools, often termed *big data*. Ubiquitous in most business fields, the denomination big data has received much attention from scholars. Ward and Barker (2013) collate a wide array of definitions of the term in an attempt to arrive at a concise and clear delineation of the concept; concludingly, they state that most definitions allude to three principal constituents of big data: size, the volume of the dataset; complexity, the structural, behavioral, and permutational factors of the dataset.

Growing attention has been bestowed upon a parallel line of study, *business intelligence* and *analytics* (BI&A), by both academics and industry over the past two decades (Watson and Wixom, 2007; Watson, 2009; Chen, Chiang, and Storey, 2012). BI&A is referred to as "the techniques, technologies, systems, practices, methodologies, and applications that analyze critical business data to help an enterprise better understand its business and market and make timely business decisions" (Chen, Chiang, and Storey, 2012). Essentially, this perspective on analytics emphasizes the integration of data into business-related decision-making processes, in order to attain a more performant organization.

Finally, the notion of making sense of large datasets has been expressed in many different ways, including: data mining, knowledge extraction, information discovery, information harvesting, data archaeology, and data pattern processing. Fayyad, Piatetsky-Shapiro, and Smyth (1996) employ *knowledge discovery in databases* to refer to the overall process of discovering useful knowledge from data, while, for instance, data mining is a specific application of algorithms for identifying patterns from this data. For the purposes of this study, *data analytics*, or simply *analytics*, is considered an umbrella concept for the evaluation of data with the explicit aim of generating outcomes that aid the decision-making process of a firm. To formalize this

definition, I incorporate the exploratory aspect of analytics (Cooper, 2012) into the earlier definition by Van Barneveld, Arnold, and Campbell (2012).

Analytics is the process of developing actionable insight through discovery, modeling and analysis, and interpretation of data.

The idea of *actionable insight* is applied to convey that the objective of analytics is to generate results that directly increase the understanding of those involved in the decision-making process (Cooper, 2012). *Discovery* refers to the problem definition and exploratory element of analytics; the identification, collection, and management of relevant data for subsequent and/or concurrent analysis. Modeling and *analysis* is concerned with applying statistical models or other forms of analysis against real-world or simulated data. *Interpretation* involves making sense of the results of the analysis, and subsequently conveying that information in the most comprehensible form onwards to the relevant parties. Worth noting is that this definition is more about the organizational perspective on using data for decision-making and action-planning, in contrast to definitions that emphasize the mechanics of how it is processed by a computer. A representation of the components of analytics is given in Figure 2, and expounded upon below.



Figure 2. A conceptual model of data analytics.

Discovery

This discovery stage integrates Cooper (2012) emphasis of a problem definition with what Labrinidis and Jagadish (2012) conceptualize as data management - existing literature includes the following elements for the initial stage of analytics: problem definition, data collection, and data management. At the root of analytics is some form of problem definition, a more-or-less explicitly stated purpose and objective for the ensuing analysis (Cooper, 2012). A natural progression from defining the problem is to identify what data to collect, and to subsequently begin acquiring it. While this process can take almost any form - the data may already exist in a database, or it might have to be collected or simulated - within this context the emergence of new sources of data is worth noting, especially within the incorporation of information technology; Chen, Chiang, and Storey (2012) highlight the multitude of techniques that allow organizations to tap into text, web, social networks, and sensors, all of which enable the acquisition and monitoring of real-time metrics, feedback, and progress. Data management involves the storage, cleaning, and processing of the data. As the volume of data grows, so do the requirements for more advanced data warehouses and dispersed cloud-based databases (Kimball and Ross, 2011). The collection and combination of unstructured (e.g. text documents) and structured (e.g. rows in a table) data requires specific technologies, which also have to account for the volume and complexity of the data.

Modeling and analysis

The middle stage of this categorization involves making sense of the acquired data, to uncover patterns, and to evaluate the resulting conclusions (Tomar et al., 2016). While there are many different ways of analyzing data, ranging from qualitative to quantitative, from supervised to unsupervised, and from traditional statistical modelling to machine learning and artificial intelligence, all of these approaches strive towards modifying, aggregating, and linking the available data in ways that reveal insight about the analyzed phenomena. For the purposes of this study, it is not necessary to construe a comprehensive classification of the myriad of analytical methods available, rather the focus is on examining and emphasizing the impact of new technologies. Such technologies provide the infrastructure - cloud computation (e.g. Amazon Web Services), distributed parallel processing (e.g. MapReduce and Hadoop), and libraries that enable streamlined development of analytical software (e.g. Tensorflow and the R programming language) - that allow for the creation of more advanced analytical methods, including text, video, audio, and social media analysis, as well as predictive modeling of future outcomes (Gandomi and Haider, 2015). The outcomes of this stage range from a single figure that epitomizes the essence of the underlying analysis, to highly complex learning algorithms that require massive computational power; the important detail is that this outcome provides an answer to the underlying research problem.

Interpretation

The previous stage involved making sense of different types of data, and if successful, results in some form of conclusion or finding. However, this finding might not be very intuitive, especially for someone not accustomed to the field of study. The actionable insights of analytics are actually gleaned from a comprehensible interpretation of the findings. A more formalized approach to this is visual analytics (Keim et al., 2008; Ellis and Mansmann, 2010), which aims at integrating the "best of both worlds" of statistical analysis and human cognition, where information is synthesized and integrated into decision-making with the goal of arriving at "timely, defensible, and understandable assessments [that can be] communicated effectively for action" (Keim et al., 2008). In essence, visual analytics aims at creating interfaces that allows the user the ability to visually view a representation of data and then iteratively interact with that interface to infer further insight from the data. Keim et al. (2008) highlight the importance of the "sensemaking loop", where user interactions are used to tune the underlying analytical process, thus incorporating those insights into the initial stages of the analysis. These ideas are not confined only to the realm of visual analytics, but also included in the general discourse surrounding the implications of big data: Tomar et al. (2016) emphasize a similar paradigm shift, describing the intermediary between data and decision-making as a coupling of the computing contribution - gathering, storing and visualizing data - and the human contribution - analyzing, interacting, and

decision-making - as a way to enable organizations to tie analytics more closely to management decisions.

2.2.2 People analytics

The recent, and even not so recent, advances within data analytics have given it a prominent position within many businesses. For many of these businesses, people are a key determinant of their success - their customers are people, their products or services are used by people, and their workforce consists of people. As a logical progression, this has led firms to develop analytics to aid them in understanding their primary constituents. These analytical tools and techniques include customer-facing algorithms, highly targeted advertising, new approaches to talent management, and systematic methods of tracking adoption of organizational changes.

The integration of analytics and algorithms into services often serves to drive consumer attention and behavior to some specific area of that service. Domingos (2015) highlights the difference between two of the most prominent learning algorithms: Netflix's and Amazon's respective recommenders. While Netflix's algorithm recommends odd and fringe series that the user might not normally view, Amazon often directs traffic towards similar and related products. In essence, each algorithm is optimized according to the business model of that service: Netflix needs to drive demand into the long tail of little-known movies, which cost less to license, while Amazon is primarily concerned with creating additional sales, as popular and expensive products actually simplify their logistics. Moreover, the usage of algorithms has enabled organizations to use a more systematic approach in determining the selection of services: Carr (2013) suggests that Netflix determines which movies and TV shows to produce (e.g. House of Cards) by evaluating viewer preferences instead of leaning on a creative director's intuition and experience.

Another dimension of analytics that has a direct influence on the customer business relationship is the increasing degree of segmentation and customization that has been incorporated into modern advertising. The rise of social media platforms has enabled
marketing analysts to identify, categorize, and target potential customers at a heretofore unprecedented level, using a form of digital ethnography (Murthy, 2008). Issenberg (2013) recounts how the Obama 2012 US presidential campaign was able to leverage analytics to "view the electorate the way local candidates do: as a collection of people who make up a more perfect union, each of them approachable on his or her terms". Essentially, the campaign cross-referenced their large voter database with social media profiles in order to understand which types of voters were more likely to be swayed, and by which signals. Subsequently, the campaign substituted traditional national-level television broadcasts with "narrowcast" local advertisements directed towards specific segments, based on related social media chatter, thus achieving better voter acquisition at a lower cost. Lampitt (2013) notes the organizational changes that allowed the Obama campaign to efficiently adopt new analytics: data access and storage was centralized around a simpler platform, barriers were removed through a flatter organizational structure, and multitalented analysts were hired in place of "hardcore engineers". In a much-publicized investigative piece titled "The Data That Turned the World Upside Down", Grassegger and Krogerus (2017) present a detailed analysis of the analytical approach to voter activation adopted by the 2016 Trump campaign. The authors reveal that by correlating the results of a five-factor personality survey¹ that was conducted through Facebook with the respondents' social media activity, such as which pages they have "liked", enables the construction of a psychometric profile, a profile that can be inferred for a much larger group of people by extrapolating the results of the respondent sample to the general population, based on their social media activity. Grassegger and Krogerus (2017) suggest that through such a profile, a probabilistic representation of several key factors can be deduced, such as alcohol use, parental status, and perhaps most importantly, political party affiliation. This allowed the campaign to move away from traditional demographic metrics, such as age and gender, and to tap highly specific metrics for individual voters, which could be harnessed to create targeted messages for particular voter segments. For instance, a

¹ A comprehensive personality test that measures five personality dimensions: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism, often represented by the acronym OCEAN (Barrick and Mount, 1991)

voter with a psychometric profile that pointed towards a personality with neurotic tendencies received communication that emphasized the importance of gun rights.

Intraorganizational analytics have similarly risen to prominence, both amongst academics, business and the general public. In 2011, the New York Times posted an article titled "Google's Quest to Build a Better Boss" (Bryant, 2011), which chronicles the tech giant's ongoing research into what they term *people analytics* - a data-driven deep-dive into discovering which factors affect the wellbeing and performance of Google's employees. The author states that the generic management models that most companies adopt often lack both actionability and validity, meaning that they do not prioritize which management functions are important nor are they presented with convincing evidence. Gathering tens of thousands of observations about managers, including performance reviews and feedback surveys, the project determined that rather than technical expertise, periodic individual coaching, expressing interest in the employee and frequent personalized feedback were essential to a successful manager. Additionally, Erb (2016) lists many general use cases for people analytics, including modeling successful employee behavior based on employee data, internal communication analysis, detailed monitoring of individual employees, stress level analysis for occupational well-being, forecasting leadership potential, and early detection of employee quitting intentions.

People analytics has been applied as an umbrella concept to denote data analytics in human resource management, specifically as a means of sensing, understanding, and predicting employee behavior (Waber, 2013). The predictive component of such analytics has provided further benefits to talent management, including algorithms for retaining and hiring employees, and for determining the performance of employees (Geller and Mazor, 2011; Sullivan, 2013; Edwards and Fenwick, 2016). In a McKinsey Quarterly report (Fecheyr-Lippens, Schaninger, and Tanner, 2015), the authors note that some of their high-profile clients have saved millions while improving employee engagement by analyzing critical pain points - such as unequal compensation levels, ineffective retention bonuses, and inadequate employee training. The implications are

resounding, since HR has traditionally revolved around personal relationships, manager experience, and gut-instincts, rather than scientifically-inclined deep analysis (Fecheyr-Lippens, Schaninger, and Tanner, 2015).

The agenda of this thesis is to investigate the potential in linking change management and analytics, here conceptualized as change analytics, a facet of people analytics (Geller and Mazor, 2011). Traditionally, people analytics has been researched as an advanced form of general HR or talent management. Organizational change and change management, as drivers of organizational endurance and performance, have only recently received due attention from scholars interested in linking analytics and management. An extensive study in this area was conducted by Kirsch et al. (2013), in which a conceptual model of the performance drivers of organizational change projects is outlined. This model involves two outcome variables, realizing business benefits and business performance; and six key drivers, the amount of change and turbulence, available resources, alignment with the company's vision and direction, quality of change management, work roles and emotional energy. Geller and Mazor (2011), in a Deloitte report describing the technological transformation of HR, adopt a perspective on change management that emphasizes the mitigation of risk across strategy, process, technology, and people. Change analytics, in this context, serve as a principal approach to identifying resistance hotspots, understanding where exactly to make change interventions, and to align leadership with the most pressing implementation challenges. Common to these studies is an emphasis on the inherently complex nature of change projects, as organizational changes are often subject to intricate relationships and feedback loops; hence, new techniques that allow for the analysis of complex, interrelated, and situational data are required in order to capture the intricacies of organizational change.

2.3 Theoretical framework

The objective of this thesis is to understand how change management can be augmented by understanding change recipients on a more nuanced level through the application of data analytics. More specifically, this thesis explores data-driven organizational change communication, including the supporting and impeding factors pertaining to it, as well as how it conforms to the larger change management frame. On an overarching level, this study explores mechanisms relating to *change analytics*, a change-related contextualization of the people analytics concept (Geller and Mazor, 2011). In this section, I introduce a theoretical framework that is based on the earlier review of change management and data analytics literature. This conceptual model functions as the basis for the empirical component of this thesis. The framework is presented in Figure 3 below.



Figure 3. A conceptual model of data-driven change management.

The framework presents a conceptualization of the two organizational processes that are reviewed in the literature review - the analytics process and the change process and their intermediary, data-driven change management. The fundamental proposition is that change management operates as an interactive layer between the analytical process and the organizational change, relaying the key drivers of organizational change to the analytical process and implementing the resulting insights. Naturally, the real-world iterative process is neither as linear nor straightforward as the conceptual model propositions; rather, the aim is to illustrate the interlinkages between analytics processes and change management, as well as the general direction of the causal sequence. The two major components of the model are delineated in detail below.

Organizational change

Change is a complex process that is influenced by various contingencies and interrelated factors. The conceptualization of this change process presented here, including its antecedents and outcomes, is derived from the earlier model presented in Figure 1 (see *section 2.1.2 Elements of organizational change*). A further distinction is made between the change drivers, the factors that determine the nature of the change outcome, and outcome variables, the metrics that explain the success of the change. Worth reiterating is that realized outcomes often impact future changes, thus indirectly also affecting subsequent change drivers, conceptualized here as a component of the prechange context.

Change drivers encompass both the prechange and change contexts, here composed of six underlying factors that affect how change recipients view and ultimately react to organizational changes: within the prechange context, individual factors, organizational factors, and effects of past changes; within the change-specific context, the content, process, and perceptions direction towards the change. Choi (2011) notes that the attributes of the change-specific context often overrule factors that are tied to the prechange context and the organization in general.

Outcome variables outline the results of the change from three different perspectives: the direct individual reactions to change, the indirect consequences that changes have on employees, and the organization-level performance outcomes. It is difficult to demarcate clear boundaries between these categories, as change consequences are often conditional on the explicit reactions to change, and performance outcomes can

be understood as a collective aggregate of the reactions and consequences of individual change recipients. Moreover, it is essential to note that the management of change affects not only the performance of the change initiative itself, but also impacts the overall organizational performance. To achieve the best outcomes, management needs to address change on multiple levels, attending to the individual differences between employee attitudes, values and needs, while concurrently considering the characteristics of the change project and surrounding organization.

Change analytics

Hallencreutz and Turner (2011) distinguish between two distinctive perspectives on change management: the view that change can be planned and managed (By, 2005), and the view that change is an organic process that is, by its nature, unmanageable (Burnes, 2009). Kirsch et al. (2013) suggest that both perspectives may hold true, as change can be understood as a complex, even chaotic, process that needs to be managed on an emergent and ongoing basis. This requires ongoing measurements, feedback, and analysis of the relevant drivers of change, followed by appropriate communications, actions, and interventions (Kirsch et al., 2013; Oreg, Vakola, and Armenakis, 2011); the management of change needs to be data-based and informed of the states, characteristics and behavioral dynamics of the individuals and groups affected by the changes (Parry, 2015).

This model addresses these considerations by connecting data-driven change management with the analytics process illustrated in Figure 2 (see section 2.2.1 The essential characteristics of analytics). For the purposes of this thesis, change management within this context is examined primarily from a communication-focused perspective. Communication is viewed as a bilateral process that serves two principal purposes as an intermediary between managers and change recipients: (1) it enables measurement and monitoring of key factors that drive change performance, while furthering awareness of these factors, by providing change recipients with an outlet for feedback (Burke and Litwin, 1992), and (2) it serves as a key mechanism for guiding individuals and groups through organizational change (Elving, 2005). Integrating

analytics enables the discovery, analysis, and interpretation of the acquired data, subsequently generating insights that can be turned into personalized actions, interventions, and recommendations (Kirsch et al., 2013).

Overall, the theoretical framework provides a basis for examining the key supportive factors and key characteristics of data-driven change management. The empirical part of this study investigates the appropriateness of this model in practice, by exploring the supporting and impeding factors relating to this analytics-driven approach to change management. The focus is on developing and extending the central component of the model: data-driven change management. Further, the research examines whether this framework requires any alterations or extensions to better reflect the portrayed mechanisms.

3 METHODOLOGY

The purpose of this thesis was to explore data-driven change management techniques, and more generally, to examine how analytics can be incorporated into the management of organizational change. Formally, the intent was to answer the following research question:

How can analytics-driven techniques influence the management of organizational change?

This research is relevant, since change analytics - the application of analytics to understand change recipients on a more nuanced level - is an emerging field that is relatively underresearched; extensive data-driven approaches to managing change show great potential, but the conditions that unlock this potential are still undetermined, as are the concrete benefits and impediments. Therefore, new research is warranted, in order to better recognize the potential of this concept.

In this chapter, the methodology of this study is delineated. The chosen research approach is introduced and justified, and the principal methods that are applied to collect and analyze data are described. Concludingly, the quality, trustworthiness, and generalizability of the research is assessed.

3.1 Research approach

While both change management and data analytics have received considerable attention from scholars as singular fields, the research on the intersection of the two is considerably sparser. Due to the narrow amount of existing research and theory on change analytics, the nature of this research is explorative and tentatively theory building - I intend to determine the key mechanisms that enable change management to incorporate more data-driven methods. Essentially, this can be understood as giving an unknown area a provisional model, which in subsequent (theory-testing) research can be tested against reality (Wengraf, 2001). As the concept has not received much research, most of the available information is based on opinions and ideas.

Interviewing a range of specialists from different fields provides a broad and robust base of knowledge, which is suitable for studying phenomena with limited prior insights. In general, scholars have supported for the notion that more open and qualitative methods are suitable for exploring such mechanisms (Eriksson and Kovalainen, 2008).

Change analytics, and the more general people analytics, are nascent fields of research in both academia and industry. The organizations that are at the forefront of developing and implementing such analytics are firms that seek to create organizations that are adaptable to changes. Empirically, such organizations share three attributes: they employ a large number of knowledge workers, are early adopters of new (management) technologies, and reside in industries where a rapidly shifting business environment is the status quo. These attributes intrinsically incentivize the usage of change analytics, as such organizations employ a large workforce that needs effective management, possess the expertise and resources to develop, invest in, and apply analytics, and are driven by external market factors. For the purposes of this study, the target organization profile is designated as tech organizations that employ more than 1000 people. As my empirical objective is to conduct interviews with experts in both change management and analytics, both top-level directors and human resource managers are suitable interview candidates. To generate further insight from an analytics perspective, academics in relevant fields of computer science were also included as potential interviewees.

The research design is primarily inductive by nature (Williams, 2011), as the studied mechanisms are emergent and underresearched, lending the research an open-ended and exploratory quality by its very nature. While the aim of this research is to arrive at a number of generalizable conclusions, it is worth noting that it is probably difficult to study the entirety of the concept within the limits of one study.

3.2 Data collection

In this study, the primary form of collecting data was through semi-structured, in-depth interviews that were divided into three overarching themes (e.g. Hirsjärvi and Hurme, 2004). These interviews were conducted with experts in either change management or analytics; in a few instances, both. As there were few instances where the interviewee was an authority on both change management and analytics, a semi-structured approach was adopted, where the discussed topics were outlined and given a relevant background as the interview progressed. This format provided a suitable method for ensuring a consistent understanding of the concepts across the range of interviewee expertise. Further, the structure of the interviews allowed for an increased flexibility in the focus of the interview: the topics that were more relevant for the interviewee, and where the interviewee could provide the most insight, were emphasized and discussed at greater length. I also base the selection of a semi-structured method on the notion that it is an appropriate interview format for research questions that attempt to determine mechanisms that are emergent and less well-specified (Gioia, Corley, and Hamilton, 2013). Ultimately, establishing a common context for the discussed themes, while still maintaining a degree of flexibility, improves the reliability of the results (Hirsjärvi and Hurme, 2004).

The interview questions were construed based on literature, and categorized under a set of themes, where each theme formed an overarching whole about a particular dimension of the study. Three themes were chosen: change management, data analytics, and the intersection of these two. The earlier themes also provided context for the final, most essential theme. An interview guide was used to make sure that all significant topics were attended to throughout the interview process. This guide is included in the thesis in both English and Finnish, in Appendices 1 and 2, respectively. Although every interview touched upon all themes, the order of the questions within a theme was kept adaptable to promote the talkative and informal nature of the interview, in order to promote discussion and to allow for the asking of more insightful, and perhaps also more probing, follow-up questions.

Six interviews were conducted in the period June-July 2017. The main selection criteria for the interviewees was that they had some form of expertise either in change management or in data analytics. The interviewees were identified based on the job descriptions of relevant employees at the target organizations, and further validated by asking the selected organizations for suitable interviewee candidates. One interview was conducted in English - as the interview candidate did not speak Finnish - while the other five were conducted in Finnish; it is important that both parties of the interview share a common language, as the use of language is central to the semi-structured method (Leech, 2002). Allowing interviewees to communicate in a language that they are proficient in enabled them to more comprehensively explicate their ideas and opinions, which improved the quality and depth of the interview answers. This further guaranteed that the central concepts and definitions were better understood, and that there was a smaller chance of misinterpretation due to any language barriers.

The interviews were recorded and transcribed, with the explicit purpose of the interview participants. The interviews varied in length between 45 and 90 minutes, and were conducted face-to-face at the premises of the target organization. Notes were taken over the course of each interview to record ongoing thoughts, which is viewed by Eisenhardt (1989) as important in the development of new theory. During transcription, the interviews conducted in Finnish have been translated to English. Although I have strived to translate the intended meaning of each comment as accurately as possible, there remains a risk that a degree of nuance has been lost in the translation or interpretation process. In addition, to increase the legibility of the transcriptions, I have modified sentence structures and removed pause fillers. All interviews were transcribed anonymously, in accordance with an agreement with the interviewees. The codes for the interview participants are presented in Table 1 below.

#	Job description	Category	Organizational type	Code
1	Chief Technology Officer	Executive	Energy Provider	E#1
2	Director, Analytics & IoT	Executive	Technology Solutions	E#2
3	Nordic Change Management Lead	Change manager	Technology Solutions	CM#1
4	Talent Management Lead	Change manager	Technology Solutions	CM#2
5	Assistant Professor, Big Data	Academic	University	P#1
6	Assistant Professor, Social Network Analysis	Academic	University	P#2

Table 1. Codes of interviews.

3.3 Data analysis

The analytical process in this work followed a grounded theory development analysis of interview data (Gioia, Corley, and Hamilton, 2013). The general progression of the analysis process included the following stages: transcription; categorization and codification; comparison and combination; and synthesis and interpretation. The details of this process are delineated below.

Each interview was manually transcribed, including the previously mentioned modifications to structure and wording to improve comprehensibility. On a general level, I employed the thematic analysis method, which is appropriate for studying thematic semi-structured data (Guest, MacQueen, and Namey, 2011). Thematic analysis is the most widely used qualitative approach to conduct interview analysis, allowing researchers to move from a broad review of the data toward uncovering patterns and linkages within the data (Burnard, 1991). These patterns and themes are

structured in a logical way using appropriate encoding (Hirsjärvi and Hurme, 2004). More specifically, I drew on the overarching principles of the *Gioia Methodology* (Gioia, Corley, and Hamilton, 2013), a systematic approach to new concept development which aims to bring scholarly rigor to qualitative research. The premise of this method is to distinguish between the information that is acquired from the interviewees (informant-centric), and information that has been linked to theory (theory-centric). These are referred to as 1st-order codes and 2nd-order themes, respectively. The general approach is to initially develop a compendium of 1st-order terms, which are then organized and categorized into 2nd-order themes. Next, the 2nd-order themes are distilled into overarching theoretical dimensions. Finally, these codes, themes, and theoretical dimensions are assembled into a "data structure" that functions as the basis for formulating a model of the studied phenomena.

I started with open coding (Strauss and Corbin, 1998), which included reviewing the interview transcriptions and codifying the content of the interviews (1st-order codes). During this stage, many initial categories emerged, and the ascribed terminology adheres closely to the one used by the interviewees.

In the next phase, I started ordering and comparing the identified 1st-order codes, noting both similarities and differences. This process is similar to the notion of axial coding, as described by Strauss and Corbin (1998), but is also echoed by other scholars, as in Eisenhardt's (1989) cross-interview pattern search. It is within this stage that the initial codes are abstracted to a more theoretical plane; the informant-centric terminology is refined using relevant theory, and similar concepts are combined to overarching themes, while dissimilar themes receive further demarcation. Gioia and Chittipeddi (1991) term this as "gestalt analysis", where the researcher examines the acquired codes on multiple levels - both from the perspective of the informant as well as from the more conceptual view of the researcher. To improve the facilitation of this stage, I also reviewed notes that were written either during or directly after an interview; these notes often contained ongoing ideas and thoughts with tentative associations between observations and the conceptual.

The final stage of this analysis process involved the distillation of the 2nd-order themes into "aggregate dimensions" (Gioia, Corley, and Hamilton, 2013). In this stage, the 2nd-order themes are assessed, where the main point of consideration is whether these emerging themes infer concepts that might help explain the phenomena that is being observed. This iterative process resulted in the data structure presented in Figure 4, which shows how the theoretical concepts I developed are grounded in the empirical data. For the full data structure, see Appendix 3.



Figure 4. Excerpt of the code-aggregation data structure.

3.4 Research evaluation

Research is traditionally assessed through measures of quality, trustworthiness, and generalizability (Eriksson and Kovalainen, 2008). This assessment is not categorical to the end of the research process, but rather is conducted throughout the entire study (Hirsjärvi and Hurme, 2004). Next, I delineate the steps I took and the tests I conducted to uphold the quality, trustworthiness, and generalizability of this study.

The overall quality of a study is often reflected in the quality of the different components of the research (Bergman and Coxon, 2005). More specific measures of quality, such as validity and reliability, are examined later in this section, as components of the trustworthiness of the research. For this study, measures of overall quality involve the quality of the selection of the interview candidates, the quality of the data collection, and the quality of the interpretation (Bergman and Coxon, 2005). As mentioned earlier, the relevance of the interviewees was enhanced by defining a specific demarcation for which organizations to include in the search for potential candidates, by asking the companies to present suitable candidates, by asking the interviewees to state their background and field of expertise, and by moderating the interview progression so that the degree and field of expertise of the interviewee was further assessed during the interview process itself. The quality of the data collection was substantiated by the research methodology, as described in the previous chapter, and further enhanced by transcribing the interviews immediately after the conclusion of an interview, so that the interviews were still fresh in memory, allowing the codification to capture as much as possible of the original, intended meaning of the interviewees' comments. The quality of the interpretation, and the subsequent synthesis and discussion of the results, is inferred from the entirety of this work; herein, I present the context of my study, justify the research methods, delineate the findings, and substantiate my interpretation of those findings.

The trustworthiness of a study is often derived from two underlying concepts: reliability and validity (Hirsjärvi and Hurme, 2004). Reliability is inferred from replicability, where the research can be duplicated with the same findings by the same

researcher, whilst studying the same phenomena (Hirsjärvi and Hurme, 2004). I put forward the claim that this study is reliable, since I have extensively and thoroughly described my research approach and methodology, and hence could reproduce my findings. However, I stress that the field of study is nascent and will likely shift over time. Correspondingly, the ideas and opinions expressed by the interviewees may also change. Further, while this study operates on the grounds that the underlying mechanisms and key characteristics of the studied phenomena will remain consistent over time, due to the exponential and disruptive nature of technological change I emphasize that the purpose and scope of the study is to generate provisional models that allow for future revision. Validity is a key component of the credibility of the research results, and therefore it is considered a key criterion to gauge research trustworthiness. Cook and Campbell (1979) present four different measures of validity that are commonly used to evaluate empirical research: statistical validity, construct validity, internal validity, and external validity. Statistical validity specifically relates to quantitative studies, and therefore is not relevant for the purposes of this research. Construct validity is the degree to which a study measures that which it purports to be measuring, or alternatively, answers the question: do the measures adopted by the study reflect the studied phenomena. This study is grounded on a theoretical framework that draws on existing research on change management and data analytics, and hence the argument is posed that construct validity is relatively high. Internal validity is a measure of the causal relationship between an independent variable and a dependent variable. Internal validity is not typically applied for exploratory theory building research, and consequently is not applicable for this study. External validity refers to establishing the generalizable context of the research. I put forward the argument that the degree of external validity is relatively high in this work, as the research findings are supported by earlier work in adjacent contexts. However, I emphasize that the sample size in this study is still limited, making the results less generalizable.

While the previously delineated measures for validity are applicable for both quantitative and qualitative research, scholars have developed more specific methods

for qualitative analysis (Hirsjärvi and Hurme, 2004; Eriksson and Kovalainen, 2008). Three common ways are outlined by Eriksson and Kovalainen (2008): triangulation, member check, and analytic induction. Triangulation involves comparing the collected data with other perspectives and sources (Hirsjärvi and Hurme, 2004) - if other sources corroborate the information provided by the interviewees, the acquired results are validated to a higher degree. This research is grounded on evidence drawn from multiple sources, including both empirical and conceptual references. Member check involves presenting the interviewees with the interpretations of the research (Janesick, 1994). As part of the interview process, at the end of each interview theme, I summarized the interpreted gist of that topic, and asked the interviewee whether they agree with my interpretation of it. The objective of analytical induction is to define causal explanations for phenomena, following a systematic, iterative and flexible process (Hirsjärvi and Hurme, 2004). The applied research methodology (Gioia, Corley, and Hamilton, 2013) follows an inductive and iterative process for both data collection and analysis, which intrinsically aligns with the principles of analytical induction.

The third dimension of research evaluation is often the generalizability of the findings. Generalizability is inferred from the degree that the findings and conclusions from a sample population can be extended to the population at large. Morse (1999) suggests that in qualitative research, generalizability refers to the extent to which theory that is developed in one study can be exported to explain similar phenomena in other studies. Essentially, generalizability can be understood as a measure for whether the findings of a study can be applied in a larger context (Golafshani, 2003). As this study is of an exploratory nature, it is worth noting that its primary objective is to discover and expand theories on emerging phenomena, and make logical generalizations to a conceptual understanding, not reach probabilistic generalizations (Horsburgh, 2003). While the results of this study provide a provisional model for explaining data-driven change management, it is not necessarily descriptive of all organizations nor comprehensive of all facets of the phenomena. Further, as the field is nascent and

strongly affected by the development of adjacent technologies, its characteristics are bound to change over time.

Concludingly, it is worth acknowledging the ethical aspect of performing research. The fundamental guiding principle of ethically sound research is that other researchers, and the work of other researchers, should be treated with respect. In practice, this means that work conducted by other should be credited to the respective authors, with correct citations, quotations, and references. Moreover, the participants of research should also be respected, meaning that the information acquired during an interview is employed in a mutually agreed upon manner. In essence, the interviewee should not be wronged or mistreated through his or her participation in the study. This can be guaranteed by considering interview answers as confidential, and by codifying the interviews anonymously (Eriksson and Kovalainen, 2008). This study follows the aforementioned principles, and has therefore been conducted in an ethical manner.

4 FINDINGS

This chapter details the results of this research. First, I relate the interview candidates' perspectives on the current state of change analytics, which includes their views on both change management and data analytics. Second, I delineate factors that encourage the introduction of data-driven change management. Finally, I present the contraposition, namely impediments to the integration of analytics into change management.

4.1 The state of change analytics

This section introduces the views of the interview participants on the state of change management and continues by presenting the participants' perspectives on data analytics.

4.1.1 Change management

The first theme that was discussed with the interview participants involved change management, where the main points of discussion included the interviewees views on organizational change, the main drivers of change, and the role of communication in managing change.

Continuous organizational change

Most interview participants agreed that change is a fundamental constituent of organizations. More specifically, the propounded view was that organizations are essentially in a constant state of change, where small-scale, local changes are completed alongside more significant change programmes in an almost continuous manner. The change managers note:

"In the IT industry, change is always taking place. There are larger strategic changes taking place every year. Internal projects, such as the launch of new tools, and other change processes might need special coordination, but I would say that change is actually the 'norm' here." (CM#1)

"Organizational change can be viewed as these large defined events - such as structural changes - but organizations really change all the time. Today's organizations try to continuously adapt to changing technology, customer needs, and even society." (CM#2)

Key drivers of change

The second notion that was given prominence involved the driver of changes. The managers agreed with the notion of employee-driven organizational change, where change is largely determined by individual behavior. The underlying argument that was put forward suggested that organizational change is governed and driven by interactions of the employees. Involving employees in change was seen as critical, as individuals function as 'magnets' for change – recipients that are favorable towards changes are able to influence other employees into accepting and committing to change. Recognizing the individual, human element of organizational change was seen as a defining aspect of successful change management.

"An organization is, to me, interaction between people and change is effected through those people." (E#2)

"Great managers are those that, from the very beginning, take a people perspective [to managing change]." (CM#2)

"You need to identify those employees that believe in the change, that understand where the change is moving. These people function as 'magnets' for driving change, where they first gather the employees that are excited about changes, thus initiating the change, after which the change progressively spreads throughout the organization." (CM#2)

Managing change through communication

In regard to different methods of managing change, the importance of effective communication was emphasized. While organizational change is driven by the employees that influence, and are influenced by the change, on an ongoing basis, change projects are often initiated on a strategic level, from a higher hierarchical level. To facilitate changes that are initiated on a higher level, the change managers first need to understand the motive and purpose of the changes, in order to communicate this onwards to their staff in an appropriate manner. This notion, that change managers and leaders function as a form of translator or clarifier for the change message, was voiced repeatedly. As one manager exemplifies:

"From a manager's perspective, you have to be aware of what we are doing, and why, so that you can communicate the essence of that to those affected by the change. I need to be able to get that information from wherever the change is initiated - to be included 'in the loop'. Especially in a large organization, where changes can be initiated on a Nordic, European, or global level ... I need to have the knowledge to transform that message, to make sense of it, so that I can relay it onwards to those affected by it in a sensible manner." (CM#1)

Finally, most interview participants emphasized the importance of communication as a key determinant of organizational change success.

"As a whole, managing change is a difficult task [in a large, diverse organization]. Top management needs to clearly communicate the driving strategic objectives. In an organization with multiple hierarchical levels, top management needs to figure out how to communicate [strategy] to all employees. This requires time and continuous, long-term communication." (E#1)

"There are a lot of different forms of communication, but they are all vital. Especially when they are done correctly, and especially when they are personalized." (CM#2)

"Through active communication, the [employee] learning curve can be shortened. You can advance the learning curve by involving people, while shortening the 'lead time' [of the learning curve] through communication." (E#2)

4.1.2 Data analytics

The second theme of the interview involved data analytics. The use of data and analytics in organizations was discussed from a general perspective, which included deliberation on how extensively analytics is currently adopted and applied in organizations. Further, the key benefits and challenges that analytics provide were discussed. Worth noting is that the benefits and challenges mentioned in this section are of a broad nature, while the more change-specific advantages and impediments are explored in detail in the next sections.

Analytics adoption in organizations

Most interview participants agreed that data analytics is still in a very early developmental phase, in terms of how extensively and effectively firms understand and apply its methods. One academic noted that the current incorporation of analytics is in a "discovery" stage, where firms are collecting all the data that they can get their hands on, but do not really apply or utilized it to a high degree.

"There are these firms - Netflix and others - where their ideology seems to be that behind every business decision, there needs to be data. But, it is still unclear how much of that is actually put into practice, is the data actually used to support decision making." (P#1)

"There are many organizations with a vast amount of data, but that only use a very small part of it. There is a lot of potential to do considerably better and more applicable analytics to support decision-making, about the organization, workforce, specific capabilities, and what kind of potential and desire employees have to develop." (CM#2)

Others corroborated that data analytics is still relatively underutilized, but also pointed out that the role of data is growing within their organizations. However, the analytics focus seems to be on supporting the primary business processes of the organizations, which often did not include organizational change. The inclusion of data analytics as a component of change management was evident, but less absolute; while other business functions were seen as clearly data-driven, the perceptions of change management in this context varied greatly.

"In regard to using data in change management, very little. On a business project level, we use customer data, behavioral data, and production data. But in change management, in regard to what things are measured, I do not feel like I have such data [similar level of data as in projects]" (E#1)

"Managing people is such an abstract thing - how the data would be collected, and how you would use it on an individual level. I think this is a challenge, but if this could be digitized, it would definitely be beneficial." (CM#1)

"Analytics is becoming more available - and when I talk about 'analytics', I am referring to change analytics - and organizations are using the data that they have more extensively and accurately. However, it is still used quite little." (CM#2)

Key benefits and challenges

Another theme that emerged was the combination of different types of data. Both managers and academics posited that one of the current trends is the combination of data, not only across business units, but also across fields of science. The interviewee commented the following:

"For instance, [with big data] you are able to analyze healthcare data, in order to determine the causes for diseases. In such a case, we can offer the technical expertise, but we also need to include medical professionals, in order to facilitate the interpretation [of the data]." (CM#1)

"All aspects of our lives are digitized and now, suddenly, we have data about everything. And now that data is available, which was not the case before. To me, big data is the breaking of barriers between sciences ... we used to think that, to handle physics data, you had to be a physicist ... big data has forced us to acknowledge that the essence of the method [of analysis] is the same, no matter the field" (P#2)

One interesting dichotomy emerged between during the discussion on the applicability of more advanced methods of analysis, such as big data and machine learning. Whereas the managers' appraisals of these methods focused largely on the positive implications of big data, the academics mainly focused on the practical limitations of these methods. These responses indicate that the underlying technology behind general big data applications is still relatively immature, as there are questions both in terms of its general usefulness and specific application. To illustrate, one change manager commented the following:

"If you think about, for instance, artificial intelligence, and the amount of data and analytics potential that this provides, the benefits are staggering." (CM#2)

On the other hand, one professor noted this about the challenges:

"Even if [implementing analytics] sounds like a good idea, it does not necessarily mean that it is possible to accomplish. Unless there is a lot of data that just happens to have the relevant features ... [Organizations] have to think very thoroughly about which measurements to conduct." (P#1)

4.2 Factors that encourage augmenting change management with analytics

Various factors that data-driven change management enables were described by the interview participants.

4.2.1 Personalization

All of the interviewees mentioned the benefits of personalizing change management, emphasizing the need to recognize individual differences between employees. The interviewees noted that during a change, people would react differently in regard to the change itself, but would also face individually different challenges in adjusting to new changes. On a general level, the sentiment was that some individuals would "throw themselves into the next challenge", while others "dragged their feet" in response to new changes. As one manager disclosed:

"Everyone deals with a change in their workplace in different ways ... some are excited and directly accept changes, while others are less sure of the [changes]. Then there are those that are immediately opposed to changes, who would rather stay in the comfort zone." (CM#1)

More specifically, the managers felt that there were many dimensions to how teams react to change, especially when measured against performance. Addressing leadership and employee emotions is key to driving successful change, but it has to be accomplished on a team-specific level. Analytics enable a more nuanced analysis of groups of people, or even individuals. One manager described their approach to tracking change:

"We have a change tracking tool, that I use daily. It provides information on a teamlevel ... it allows us to view, on a very granular level, how teams are performing, relative to benchmark data. For instance, if team leadership is above or below the norm, if the team is high or low performing, what kind of emotional states are prevalent - are people motivated, do they feel that they can be creative." (CM#2)

"It gives you recommended action for each team based on their specific composition and team dynamic ... which frequency and sequence of actions that transitions low performers to high performers." (CM#2) Systematically tracking team-level performance across the organization enables managers to guide specific teams through organizational changes using a set of 'best practice' actions that are designed for particular teams with specific compositions.

4.2.2 Contextualization

The interviewees stressed that change managers need to be aware of the prevailing situational factors in the organization while managing change. Understanding the prechange conditions that are prevalent within the organization, while addressing the change-specific factors that moderate this context, is imperative for change management, as these factors directly affect the change outcomes.

"It is important to know, for instance during a culture change, what state the organization is currently in. You need to understand context for the change - what is the current situation, what are the prevalent factors in the organization - so that you know where you are starting from and where you are going." (CM#1)

Analytics provides mechanisms for identifying and analyzing organization-wide conditions. The interviewed academics noted that one of the main trends in analytics is the consolidation of data into a centralized location. Connecting and comparing datasets - across business units and fields of science - provides a more comprehensive representation of the current state of the organization. To concretize the value of a consolidated data platform, one interview exemplifies the benefits of an overarching system that allows organizations to make connections across business units:

"Companies traditionally have their data very dispersed, spread out across a lot of different systems. In many organizations however, there are projects that attempt to consolidate this data into one centralized place, collecting all the information from different data sources. This is then used as the base, from which analytics projects can start." (P#1)

"Consolidation of data enables cross-linkages. For instance, insurance firms have traditionally had separate systems for fraud detection and call centers. Now, it would be interesting to link whether there is a correlation between calls to the call center and attempts at fraud. If these systems are separate, these connections are not made." (P#1)

4.2.3 Interactivity

Many interviewees commented on the importance of creating an interactive, two-way flow of information, where the change recipients are included in the feedback loop. Management needs to be aware of how change recipients react to change communications, in order to consider employee attitudes and opinions. On one hand, the organization benefits from receiving ideas and opinions about changes, both in terms of the perceived benefit/harm of proposed changes, as well as the actual outcomes and consequences of changes. On the other hand, employees benefit from an increased level of involvement in the change, as they are able to influence the change and are given a measure of control, while also experiencing gains by being included in the discussion.

"If communication is made too much via email, it results in that I don't know how people react to the message. Communication needs to be interactive, to enable people to influence [changes]." (E#2)

"Involving people in your [analytics] process would help. In return, you will also get feedback about what other features [management] should be looking at." (P#2)

In developing interactive communication, analytics can be harnessed to provide the basis for reciprocal discussion, as employee feedback and sentiments can be logged and catalogued in a systematic manner. Using analytics as a means supporting discussion was seen as valuable, but the managers commented that the results need to be presented in a comprehensible manner, in order to make the insights therein accessible to as many people within the organization as possible. While the presented insights would still be subject to debate and argumentation, they would provide a common ground from which iterative and interactive discussions between employees and management could evolve in a mutually beneficial manner. One manager notes the following:

"You need to present [analytics] to people in a form that is understandable to any and all employees and team leaders. In this way, they are able to apply the organization's analytics [in daily operations]." (CM#2) "When you show [change analytics] in a fact-based manner, discussion about these things becomes much more constructive and easier, as they don't fall into the 'he said, she said' conflict. They are facts, and they are discussed as such." (CM#2)

The interview participants agreed that different data-augmented means of engaging employees in organizational change could provide benefits to change management. Involving people in changes through technological tools or interfaces could lessen the threat of new changes, while at the same time involving employees more naturally and intuitively in the change process.

4.2.4 Recurrence

The interviewees agreed that change communication needs to be recurrent – management needs to be involved in the change throughout its lifecycle. The managers remarked that while there is often much internal buildup and promotion surrounding new and engaging change initiatives, as the projects move forward, the level of communication may diminish or even cease entirely. Leadership needs to visibly commit to changes, and to continue that commitment throughout the change project, in order to acquire and retain the commitment of their employees. Moreover, change managers need to be attentive of how employee attitudes develop over the duration of change projects.

"Often you see projects, where there is a lot of hype surrounding the initiation of the project - and there are often great expectations - but once the project is started, 'radio silence' [lack of communication]. There needs to be follow-up." (CM#1)

"Managers need to take 'time-outs', and listen to the people [change recipients] to get feedback, and find out how individual employees feel regarding how the change has progressed and if it is moving in the right direction." (CM#1)

The interviewees posited that communications need to continue on a continuous basis throughout change programmes. Following up on change progress involved ensuring that performance milestones were met, tracking the overall direction and progress of the change, while also attending to the emotional factors of the employees. The managers saw significant benefits in analytics within this domain, specifically in that analytics would allow organizations to generate data and insight in real-time, thus allowing change managers to navigate change based on currently relevant and timely information.

"For instance, a team leader is interested in what she knows about her customer, her team members, and her business - she is concerned with how to make the best possible decisions based on the available data. Analytics enables generation of data that is understandable for her - digitally, visually, automatically updating [in real-time] - and subsequently, decisions are based on [data from] today, not last month or quarter." (CM#2)

4.2.5 Transparency

The interview participants asserted that a low level of transparency in regard to communications about changes often had a direct impact on how receptive people were about the developments taking place. Conversely, transparent communication that extends through several hierarchical levels would enable managers to more competently relay the change message to their employees. Creating a more open workplace, in regard to the availability of information about corporate actions, increases the level of trust that employees direct towards the organization, which corresponds to a higher degree of commitment to a change. One particularly illustrative point that the managers emphasized was that it was essential that the principles behind a change were made explicit to the employees. Providing change recipients with the motivations behind corporate actions would, in turn, increase the acceptance of change amongst recipients. As one change manager notes:

"You can't just order people to act in a different way, for instance simply stating that, starting from next week, you will use this new tool. You need to explain why these changes are taking place, and what the rationale and reason behind them are - otherwise, people will not accept the changes." (CM#1)

The interviewees further noted that, to enable employees to learn from changes, organizations need to make relevant information and material concerning the changes available, and to indicate where that information can be accessed.

"Employees are encouraged to learn and educate themselves ... and it is important to communicate where that information is available." (CM#1)

"You need to enable people to learn from a change, as change requires new skills and knowledge, you need to make [relevant] information available." (E#2)

In augmenting transparency, analytics was seen as a point of entry for enabling employees to discover information that would otherwise be obscured or that was previously inaccessible. To exemplify, one interview participant highlighted the benefits of an analytics-powered interface that identified documents that were likely to be interesting to the user, giving the user access to information that would normally have remained obscured or simply out of reach.

"We have adopted a type of intelligent search [tool], which, once opened, immediately presents a number of documents that somehow relate to me. These documents may relate to customers, they might be documents that have been modified by my team members or documents by people that I have been following, they might relate to discussions on Yammer [intraorganizational social media]. This tool gives me access to information that I normally would not have known to search." (E#2)

4.2.6 Diffusion of information

Many of the interviewed managers accentuated the importance of spreading information about ongoing and impeding organizational changes, with an emphasis on clarifying how these changes will influence the lives of the change recipients. As changes often alter the accustomed order of the workplace, people get anxious about the consequences of these changes. The interviewees highlighted the importance of making people aware of new changes and further, making people understand the changes taking place.

"Employees should be made aware of what [change management] is doing, and why. The question that is on people's minds is 'how does this change affect me'." (CM#1)

Improving the diffusion of information about changes in an organization was seen as being a function of the quantity and quality of information. In regard to quantity, the primary benefit of adopting more technology is the availability of new avenues of transmitting information - many organizations already employ a wide variety of intraorganizational ICT tools. As one manager notes:

"Communication is very multi-faceted. Communication is accomplished through face-to-face discussions, email, phone calls, we use chat tools. Small changes are often communicated through more informal channels - team meetings and such - while larger changes are informed through informative events or broadcasts." (CM#1)

"I believe that communication is extremely important - both in change management and administration in general, there can never be too much communication. The organization needs to communicate what is happening, and why, to those affected by it." (CM#1)

More specifically, in addition to increasing the volume of communication, managers highlighted the need for detailed communication. The managers reiterated that a vital part of their jobs was the clarification of the change message into more concrete terms. To exemplify, one manager explained that this often involved connecting smaller, local changes to the overarching change programme.

"You can't just tell people that 'let us start changing.' The local changes need to be connected to the [more comprehensive] strategy." (E#1)

Essentially, enabling a more thorough understanding of change messages involves developing concretizations that are easily interpretable. Linking this to analytics, the interviewees stressed the importance of the interpretation of the analytics results, to make analytics relevant and actionable, so that it is supportive to specific employee groups:

"The value lies in interpreting [analytics]. We have fact based information - for instance, a team may currently perform at a high level, but their pace is not sustainable, while another team might be in a completely different situation. These teams need a completely different type of support. The discussion revolves around the data, which needs to be targeted to specific teams or units with specific challenges." (CM#2)

4.2.7 Summary of the findings

The following table compiles the findings of this section.

Table 2.	Factors t	hat encour	age au	gmenting	change	management	with ana	lvtics.
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Supporting factor	Mechanism			
Personalization	 Accounting for individual differences Systematically tracking changes on a team-level Implementing personalized recommendations based on team dynamics, composition, and relative performance 			
Contextualization	 Recognize the current state of the organization Consolidate data to enable cross-linkages 			
Interactivity	 Two-way feedback between change management and recipients Effective analytics that can be used by everyone in daily operations 			
Recurrence	 Leadership commitment that extends beyond initial hype Real-time, analytics-driven decision-making and feedback 			
Transparency	Trust linkages across hierarchyDiscover previously inaccessible information			
Diffusion of information	 Frequent usage of multiple communication channels Concretization of strategic change message by linking it to local changes 			

4.3 Factors that impeded integrating change management with analytics

Various limitations and hindrances to data-driven change management were described by the interview participants.

4.3.1 Ambiguous data management

As noted in the earlier section on the state of change analytics, organizations are ramping up the collection and consolidation of data. However, the managers indicated that while these efforts are increasing across the board, there seems to be a general lack of direction in regard to what data is collected, how it is collected, and what is actually accomplished with it. This sentiment was echoed by the academics, who expressed doubt over the actual insights gleaned from the current approach to data management. Specifically, this view seemed to originate from the impression that organizations did not have clearly defined goals for what data to collect nor for what express purpose this data was to be used. Subsequently, organizations adopt haphazard "shotgun approaches" to the collection of data, where breadth and quantity are favored in lieu of accuracy and planning. One academic revealed the following:

"Regarding Finnish industry, we are still at a discovery stage in analytics, where organizations have started conducting small-scale data experiments and to systematically collect data. Now that organizations have started to accumulate data, the question is progressively becoming 'what can we actually do with this data'." (P#1)

Regarding the ambiguity of the actual data collection methods, many interview participants commented on the difficulties of acquiring data on individual behavior. Employees modify their behavior if they know that they are monitored, which makes it difficult to collect unbiased data on employee attitudes. Essentially, if employees believe that they stand to gain something, or are able to avoid problems if they behave in a certain way, they will naturally adopt such a mode of behavior. One academic noted the following:

"As you implement [analytics], there is a danger in that the system that you are measuring also reacts [to the measurements]. Whatever you measure, people will react to it ... outcomes of analytics should be reported as the uncertain things they are, so that the employees would not have an incentive to change their behavior." (P#2)

The interviewees also commented on the challenges associated with storing and managing this data, as confidential data is required to be kept anonymous. As anonymity is not assured solely through direct methods, such as encoding and encryption, but also needs to account for indirect traceability, this was seen as a substantial impediment. In this context, traceability means that while information might be coded in an anonymous manner, if it can be traced back to the source by identifying the composition of variables, the ensuing database is not truly anonymous. One executive exemplified the challenge as follows:

"It's not enough to obscure name, address, and other 'obvious' identifiers. For instance, in regard to occupational health, you might refer to the 'CEO' [without name], but everyone knows who that is, as that organization has only ever had one CEO. There can be a lot of identificatory markets, which by themselves are completely anonymous, but once they are connected might clearly point to a specific individual." (E#2)

4.3.2 The big brother problem

Whereas the previous factor examined impediments to the detailed acquisition of data, there is an equally important dimension relating to the (undesired) effects of a more granular perusal of data on management styles. Analytics enable leveraging previously untapped data sources to discover information from places where it was previously hidden; intuitively, this information could be used for profiling individual employees. Employees with differing profiles may respond to different management styles; hence, effective change management would require accounting for such differences. However, the interviewees displayed some trepidation over treating employees differently based on data profiling. Referring to a hypothetical question about attempting to tailor change communications to a specific type of person, one interviewee commented the following:

"That is a difficult question. For instance, if you start sending customized emails to employees, these employees and their colleagues would very quickly realize that they were getting differing emails. This would lead to trouble [for management]." (P#1)

This opinion was prevalent while discussing segmentation of employees based on psychological profiling and the customized communication style or content that could be subsequently achieved. Managers were hesitant that presenting information in a different light or behaving in a different manner towards particular employees would create an adverse work environment; some managers explicitly made references to an Orwellian "big brother" style of management.

"I'm afraid of a 'big brother' effect ... there is a risk [in extensive analytics] that people are reduced to 'means of production'." (E#2)

4.3.3 Implementational complexities

A common topic of discussion that arose during the interview process was the inherent complexity of implementing analytics in change management - organizational change projects are complex entities that are contingent on many factors, relating to the situational nature of change projects and the various individuals that affect and are affected by such changes. Inadequately implemented analytics may give rise to inaccurate results that fail to consider the interrelated nature of the drivers of organizational change. One interviewee commented the following:

"[An organization] is a complex system. We have to be careful about how confident we are about the results we analyze. We might think that a certain person is blocking everything, but with additional information, you might realize that there is actually another, deeper problem that is the root cause." (P#2)

The interviews yielded another point of consideration parallel to the inherent difficulty of capturing organizational change in an analytics system. Change analytics is an emergent field that has only recently been applied in industry. The interviewees indicated that while organizations might have accumulated the necessary data to conduct change analytics, organizations may still lack the necessary capabilities and expertise to conduct such analytics.

"In regard to change analytics, I think that organizations often do not have the capability to use it. It requires a different sort of background expertise and knowledge [that organizations do not currently possess]." (CM#2)

"If you think about a large scale organizational change, it is still unclear for me how you would apply analytics to facilitate that. However, I do think that you could, as we have data about past changes, current organizational state, and individual employees." (CM#1)

The final implementational impediment that was indicated by the interviewees involved the cost of change analytics. As evidenced by the previous implementational impediments, both organizational change and analytics are complex endeavors. Therefore, they require substantial investments. The interviewees suggested that organizations need to concretely connect analytics to specific business decisions, in order to justify the cost and complexity of analytics.

"The benefits have to outweigh the cost [in implementing analytics]. There is a challenge here. Technology experts are in love with technology, and have a vision about everything that you can do, but the challenge is to concretize how this data aids specific business decisions. And how much is that going to cost." (P#1)

4.3.4 Limitations of big data

Although the interview participants regularly affirmed the potential benefits of big data, the comments were often tempered with a note of hesitation. Essentially, most interviewees recognized the advantages that new methods of data collection and analysis could deliver, but were uncertain of their specific application and expressed concern over the perceived limitations. The academics stressed the need for large datasets that are needed for predictive analysis, especially in regard to analyzing individual behavior. One academic noted that to achieve sufficient volumes, organizations would either have to have a very large workforce - making these methods only useful for a handful of organizations in Finland - or opt for external, interorganizational shared solutions.

"To conduct predictive analysis, you need very robust historical data. This might be hard to acquire in a change process, where the situation is always a little unique ... [External firms] would have enough historical data to conduct such analysis." (P#1)

Another challenge that surfaced was the inherent limitations of typical big data information sources, concretized by the interviewees with examples from social media

analysis. The underlying argument that the interviewees posed was that this type of data was intrinsically of low quality; especially social media data analysis was seen as correspondent to high levels of noise, weak explanatory power, and inherent biases in regard to sentiment. As one academic reveals:

"Sentiment analysis is very common in analyzing social media. However, it is very easy to find only bias in such data. For instance, if you sample social media for a specific brand, you will most likely only the fanboys and fanboys, that are all have a very positive opinion [about the brand]." (P#1)

4.3.5 Summary of the findings

The following table compiles the findings of this section.

Impeding factor	Mechanism		
Ambiguous data management	 Deficient planning of data collection Employee monitoring alters individual reactions Anonymity requirements extensive 		
The big brother problem	 Tailored communications may give rise to disagreements Extensive analytics may lead to a controlling work environment 		
Implementational complexities	 Organizational change is complex and contingent on many interrelated factors Change analytics requires extensive data expertise Direct business benefits unclear 		
Limitations of big data	 Big data algorithms and techniques require large datasets that only few organizations possess Social media and sensory data often contain sentiment bias that is difficult to control for 		

Table 3. Factors that impede augmenting change management with analytics.
5 DISCUSSION

In this chapter, the research findings are discussed and interpreted in further detail. First, an overview of the developmental direction of data-driven change management is presented, based on the results of the study. Second, the findings are developed into a set of propositions for how organizations can build support for change analytics and how analytics improve change management.

5.1 Changing change management

Change management has evolved substantially since Lewin's (1947) early three-stage model of organizational changes. Scholars have indicated the need for models that address the complexities of change, accounting for the interrelated nature of the entities that influence, and are influenced by, organizational change (By, 2005; Burnes, 2009; Oreg, Vakola, and Armenakis, 2011); such models need to be based on "reliable, valid, robust, data-based information" regarding the key drivers of organizational change, and provide actionable insight that can be transformed into concrete actions and interventions that enable organizations to performantly achieve their change objectives (Kirsch et al., 2013; Burnes, 2011). The sentiment that employee attitudes, cognition, and intended behavior are key determinants of change success has risen in prominence both in literature (Oreg et al., 2016; Choi, 2011) and in business practice (Accenture, 2015). Alongside this, the other focal aspect of this study, the advocacy of analytics-driven techniques that enable the study of the situational, contingent, and individual factors that influence organizational change (Dunphy and Stace, 1993; Parry, 2015), while nascent as a field of study, carries substantial promise for both academia and industry. Corroboratively, the results of this research highlight that datadriven approaches carry benefits in promoting personalization, contextualization, interactivity, recurrence, transparency, and diffusion of information in change management and communication. However, the findings also suggest that there are significant impediments to enabling deep analytics, including current data management inadequacies, resistance to personal surveillance, complexities relating to implementation, and inherent limitations of big data. Overall, the findings illustrate that while the general view of change management within the studied organizations

aligns with management literature, there are some shortcomings regarding the approach to and application of analytics-driven techniques.

This study reveals that while organizations are exploring avenues for integrating analytics into the management of organizational change, there are few comprehensive applications and no sweeping paradigms. This is largely echoed by management literature, highlighting the challenges associated with integrating new technological methods into existing processes (Anton, Petouhoff, and Schwartz, 2003); given the ubiquitous, permeating, and diverse nature of change projects, the alteration of existing methods is an extensive and complex endeavor (Pettigrew, Woodman, and Cameron, 2001). The results of this study affirm the supporting role that surrounding organizational frames carry in determining the extent to which analytics is applied in change management. The findings infer that change management often struggles with deficiencies relating to a lack of analytics knowledge, absence of accessible tools and data, and hierarchical or cultural impediments. These factors are used as the basis for the first category of propositions, delineated in further detail in the next section.

Interestingly, and equally imperative to the incorporation of analytics into the fabric of everyday management, is the ambiguity surrounding the precise advantages that analytics presents. Some factors are implicitly understood, but not explicitly concretized nor formalized; managers perceived that analytics is an augmentative tool, but the specific applications remain obscured. For instance, managers recognize that organizational change that pertain to individuals needs to be given reason and rationale, often through some form of personalized contextualization of the occurring changes, but the determination of when, how, and to whom is often based on gut feeling or intuition (Fecheyr-Lippens, Schaninger, and Tanner, 2015), rather than systematic analysis. Within the context of the traditionally experience-driven approaches to HR, the application of predictive algorithms and hyper-personalized customization naturally seems esoteric and even superfluous. Ultimately, the prevailing understanding of and approach to change management seem to be principally based on historically derived heuristics that, while based on some form of

data, forego the benefits of real-time, contextual, situational, personalized, and predictive analytics.

The initially proposed model of data-driven change management is supported by the results of the study, but is not descriptively exhaustive. The findings depict a dichotomy between the necessary organizational capabilities that enable analytics in change management and the subsequent change management techniques that analytics enables in turn; essentially, key factors that enable change analytics and key factors that change analytics enable. In the following sections, the characteristics of this sequence are explored in detail, and a number of propositions are derived based on the relationship between change management and analytics. The narrative aim of these sections is to progressively move from a wider organizational lens on developing capabilities that support analytics to a more focused perspective on the implementational benefits and potential of analytics in augmenting the management of organizational change.

5.2 Change analytics capabilities

The research findings indicate that while analytics enable and advance many of the fundamental components of change management, a paramount precursor to the implementation of these data-driven methods of management is the development of a supporting organization, in terms of both technological ability, as well as internal context. Management literature has explored the adaptation to technological change from many perspectives, whether it be adjusting to disruptive technologies (Tushman and Anderson, 1986; Bower and Christensen, 1995) or integrating resulting new practices and processes (Anton, Petouhoff, and Schwartz, 2003); the overwhelming majority suggest that the capacity to integrate changes often determines whether an organization is successful or not. Drawing on the results of this research, this study addresses the development of critical change analytics capabilities from two primary perspectives: the development of necessary supporting conditions and the circumvention of direct and indirect impediments relating to the application of analytics in organizations.

Necessary conditions for enabling analytics in change management

The effectiveness of any analysis or algorithm is determined by the underlying data (Domingos, 2015). While there sometimes exists an explicit and distinct shortage of data, the more prevailing challenge facing organizations for the past few decades is not a lack of data, but rather inadequate management and exploitation of the available data (Fayyad, Piatetsky-Shapiro, and Smyth, 1996; Geller and Mazor, 2011). Kiron (2017) views this as the foundation for data-driven organizations - cataloguing, categorizing, and processing data, but more imperatively, the subsequent translation of that data into tangible value. This view is supported by the research findings, which emphasize the challenge of making sense of an overwhelming amount of data that is both difficult to access and difficult to decipher due to irregular structure and storage.

Business intelligence experts advocate for a central nucleus for storing and managing organizational data (Brown, Court, and McGuire, 2014; Gaskell, 2016), accomplishing adherence to common standards, techniques, and tools. Issenberg (2013) and Lampitt (2013), in their respective reviews of the use of big data in the Obama 2012 presidential campaign, highlight the effectiveness of a unified approach to analytics. Adopting a centralized data environment reduced the barriers between disparate data, and providing standardized access and methods of analysis enabled efficient collaboration between teams (Lampitt, 2013). Subsequently, the organization was able to generate rapid and real-time decisions regarding where, when, and how to target potential voters. The centralization of information enables more effective data management, enforcing common structures, processes, and rules, which enable more relevant analysis through the exploitation of multiple sources of data in parallel.

Providing access to data and tools is essential, but insufficient per se. Barton and Court (2012), emphasize the need to link analytics to relevant real-world challenges. To be effective, the models and tools that analytics give rise to have to provide relevant answers to questions that managers face on a regular basis. Inductively, involving management in the analytical process would, almost implicitly, drive models and tools

in a more change-relevant direction. Literature suggests that developing and diffusing analytics knowledge across many hierarchies enables organizations to generate further gains from processes. McAfee and Brynjolfsson (2012) indicate that domain expertise is critical to knowing which problems to tackle and in which manner, while data expertise allows managers to codify, catalogue, and distill that knowledge into actionable insight. Corroboratively, the research findings indicate that while change managers generally considered analytics to carry great potential in supporting change management, few recognized or suggested specific implementations. The benefits of developing a broader analytics knowledge base are twofold: the organization is able to derive more relevant insights from involved managers, while managers are better equipped to use the resulting analytics tools and algorithms.

In addition to the preceding factors, to embed analytics in the fabric of everyday operations, organizations need to decrease structural and cultural impediments, whilst developing procedures and processes (Wixom and Watson, 2001; Fecheyr-Lippens, Schaninger, and Tanner, 2015; Barton and Court, 2012; Peppard and Marchand, 2013). The findings of the research reveal that while the managers lauded the potential benefits of analytics on a general level, few regularly consulted analytics tools as part of routine decision-making relating to managing change. Others corroborate and even emphasize this point - Goran, LaBerge, Srinivasan (2017) suggest that weaknesses in organizational culture, such as a general aversion to risk and siloed functional units, are one of the main obstacles to digitalization. Moreover, a nondigital overall culture was seen to strongly correlate with negative economic performance.

Change management decisions are typically based more on gut-feeling and experience, rather than systematically informed by data (Fecheyr-Lippens, Schaninger, and Tanner, 2015). This disjunction stems at least partly from a lack of organizational support, both in terms of hierarchy (Lampitt, 2013) and culture (Peppard and Marchand, 2013). Lampitt (2013) suggest that organizations need to provide freedom to pursue ideas and strive to erase barriers between both organizational units and analytics. This is echoed by McAfee and Brynjolfsson (2012), who suggest that firms

need to minimize organizational red tape through flexible procedures and processes. Culture, on an overarching level, frames how people make decisions, collaborate, and share knowledge (Peppard and Marchand, 2013). Discussing analytics within educational systems, Arnold et al. (2014) suggest that analytics must become "institutionalized at multiple levels" throughout organizations in order truly be transformational. Contextualized to managing organizational change, integrating analytics into organizations is a function of the availability and access to data, the knowledge and involvement of the managers, and the supporting structure and culture of the organization.

Proposition 1a. Organizations that consolidate data into a simple, accessible, and centralized platform are able to analyze data across business units and create more comprehensive representations of the current state and composition of the organization.

Proposition 1b. Organizations that develop change managers' baseline analytics knowledge are able to involve managers in the development of more relevant analytics tools and algorithms.

Proposition 1c. Organizations that develop supporting structures, processes, and culture around the usage and application of analytics are able to embed analytics in everyday operations to a higher degree.

Direct and indirect constraints on analytics

The findings revealed that, apart from the organizational factors that relate to internal structure and context, analytics exhibits a number of direct and indirect constraints on the use and application of analytics in an organizational context. While there are many perspectives on what constitutes a constraint and what these are in the context of big data and analytics, the results indicate two essential dimensions: the requirements for (big) data and the potential intrusiveness of extensive analytics.

A fundamental need for analytics is a baseline requirement of data (McAfee and Brynjolfsson, 2012). As analytics turns more advanced and the objectives grow more detailed, so do the requirements on the volume and comprehensiveness of the underlying dataset (Erevelles, Fukawa, and Swayne, 2015). While new methods of analysis, such as machine learning and neural networks, provide a certain freedom in analyzing complex and even unstructured data (Jordan and Mitchell, 2015), these methods intrinsically require large datasets. The management and processing of such datasets is essential to enabling analytics (see Proposition 1a), but equally critical is acquiring and identifying which data has substance. Implementing comprehensive data collection arrangements is a significant undertaking, especially for smaller organizations or divisions, especially in regard to determining which data to collect and how to link that data to concrete business metrics. Moreover, smaller or newer organizations do not have the necessary volume of data to derive many significant results from analytics. The argument that is put forward here is to augment inductive analytics (e.g. Anderson, 1983) - usually characterized by a measure first, analyze second approach - that are often used in business intelligence and big data (Erevelles, Fukawa, and Swayne, 2015) with a more deductive process (Lawson, 2005). To elaborate, there exists a wealth of prior data on employee drivers and determinants, in the form of management literature and external services; why not then derive hypotheses based on such precedents and focus internal analytics on answering narrower, but also more relevant questions. For instance, organizations may adopt existing best practices to guide general change management, while using an inductive perspective to generate insight on specific, ongoing course corrections that may be required. Worth noting is that an inductive process, embracing a greater degree of "ignorance" as Erevelles, Fukawa, and Swayne (2015) suggest, may uncover more hidden people insights. However, organizations that are unable to acquire sufficiently comprehensive data on their own need not forego the other benefits of an analyticsdriven approach.

Proposition 2. Organizations that combine deductive and inductive analytics are able to extend and augment limited existing data.

The other constraint that the research findings highlight relates to recipient reactions to the implementation of analytics. Analytics enable a more personal level of oversight over employees, which might be perceived as intrusive by those affected by it (Introna, 2000; Alge, 2001). Introna (2000) highlights the mismatch between the argument put forward by employers that some form of workplace surveillance is essential for "security, safety, and productivity" and individuals' appeals for more privacy. Fundamentally, analytics is fueled by data, and in the case of people analytics, the required data is always highly personal (Peck, 2013). The challenge lies in that the benefits of change analytics may be largely negated if the implementation is perceived as threatening by the employees. More generally, incorporating analytics into change management is also a form of change, and those affected by it may resist those changes as a form of psychological reactance (Ford, Ford, and D'Amelio, 2008; Nesterkin, 2013).

Peck (2013) argues that while analytics cedes evaluation of people to algorithms, traditional approach to determining professional potential is rife with human biases, which equally distorts the objectivity of any assessment. Moreover, literature highlights the benefits of a more personal approach to collecting, analyzing, and applying data. For instance, sensory monitoring, such as using a wearable fitness tracker to measure and record activity, has been shown to provide tangible benefits in health care (e.g. Cadmus-Bertram et al., 2015). There exist objective benefits from more detailed individual analysis, but employees may object to this level of scrutiny. An adjacent field that has received much study is the customization of online advertisement, and the effect this has on the perceived intrusiveness of the advertisement in question (Truong and Simmons, 2010; Van Doom and Hoekstra, 2013). Van Doom and Hoekstra (2013) suggest that an increased level of personalization of advertising is correlated with an increased perception of intrusiveness; the experience of intrusiveness in turn disrupts the interaction with the content, thus resulting in a negative customer reaction. The authors further indicate

that an overtly personalized message induces resistance, as it may instill a sense of a lack of control of one's personal information (Edwards et al. 2002).

Contextualized to change management, literature states that combating resistance to change can be accomplished by validating change by building internal support; in practice, this is accomplished through transparent and frequent communications and by involving employees in the change process (Fernandez and Rainey, 2006; Choi, 2011). Aladwani (2001), in a study on employee resistance to the implementation of an enterprise resource planning (ERP) system, suggests that management needs to acquire employee support in three steps: favorable awareness, favorable feelings, and favorable adoption intention. In order to build awareness, management needs to clearly communicate the benefits and general operations of the system. To attain a favorable affective response, organizations need to engage employees in the system, for instance through hands-on training. Finally, organizations need to ensure the support of influential employees and employee groups, by encouraging them to participate in the implementation process. Drawing on these studies, the predominant approach to overcoming employee resistance involves open and frequent communications that highlight both the benefits and practical implications of the change, while simultaneously engaging employees in the implementation process.

Proposition 3. Organizations that legitimate extensive analytics through frequent, transparent, and engaging processes are able to mitigate resistance to such analytics.

5.3 Data-driven change management

Once an organization establishes the fundamental capabilities that enable change analytics and recognizes the constraints of such analytics, the applicational benefits of analytics on managing organizational change may be realized. This section explores data-driven change management from two primary perspectives. First, the descriptive power of analytics is reviewed, meaning the increased ability to sense, identify, and understand change-related factors on a more granular level. Second, the data-driven approaches to managing change are explored, including new techniques that enable more appropriate and effective actions, interventions, and communications.

Augmented identification

Change recipients are key to affecting persistent on-the-job changes (Meyer et al., 2007; Weeks et al., 2004). Complicating the management of such individuals is that they accept and resist changes based on their own individual interests, interests that might even be antithetical to those of the organization (Oreg, 2003). Employees are inherently and uniquely different from each other, and thus their dispositional inclination towards changes varies accordingly. To exemplify, different national identities may lead to widely differing perceptions of organizational changes (Kirsch, Chelliah, and Parry, 2012). Moving from the prechange conditions to the change-specific factors that govern the manner in which people react to changes (see section 2.1.2) show that the drivers that determine whether an employee will accept or resist a change initiative are both varied and sometimes highly specific to an individual or a group of individuals. Determining which employee characteristics drives the adoption of changes allows managers to separate and emphasize the information that is uniquely relevant to the change recipient.

Still, managers often struggle with correctly recognizing the composition of diverse attitudes both in employee teams, as well as in the organizational collective (Sanchez-Burks and Huy, 2008). Analytics enables a more systematic categorization of the relationship between recipient characteristics and attitudes and change project attributes. Subsequently, analytics provide the fundamental technology for detecting causal linkages between which attributes of change resonate with which individual types. Ewenstein, Smith, and Sologar (2015), in an article published by McKinsey and Company, note that managers should attempt to personalize the change experience, by linking the changes to a personally meaningful context. Aligning communications with a certain theme often elicits a positive affective response from those predisposed or neutral to this topic (Hambrick and Lovelace, 2017). Hambrick and Lovelace (2017) also note that theme-aligned communications seldom elicit positive responses from

antagonistic employees; in communicating with such employees, communication where the prominence of the particular theme is diminished is more effective. Furthering the perspective on symbolically framing change events, Fiss and Zajac (2006) indicate that organizations use specific language that resonates with particular shareholder preferences; the "same" data can be framed in such a way as to elicit different experiences from different employee groups. Corroborating the effectiveness of targeting the framing and presentation of individual communications, Grassegger and Krogerus (2017) suggest that matching the content and narrative of a message to particular personality types increases the effectiveness of such communications by a magnitude. Contextualized to change management, Oreg (2003) establishes a "Resistance to Change Scale" that predicts people's affective reactions to change based on recipients' dispositional inclination to resist changes; combined with analytics, such as a scale could be used to tailor change communications to employees in accordance with the sources of resistance as suggested by the scale.

Proposition 4. Organizations that distinguish between individual characteristical differences are able to emphasize attributes of change that resonate with particular employee groups.

Employee attitudes are malleable and shift over time, which complicates sensing, identifying, and affecting employee reactions to change (Choi, 2011). In analyzing change recipient attitudes, Choi (2011) suggest that personality traits should be conceptualized as states, contingent on the conditions within the organization, the specifics of the change that is taking place, and the prevailing state of the recipient on a given day. To elaborate, consider the attitudinal difference between someone on a day when they are in a good mood versus that someone on a day when they are in a good mood versus that someone on a day when they are in a bad mood - literature suggests that people assess future prospects more optimistically when they are in a good mood (Hirshleifer and Shumway, 2003). The findings echo this sentiment, emphasizing that individuals are more open, accepting, and committed to changes that are made comprehensible by linking overarching changes to changes that are more relevant to the change recipient.

Continuously collecting and analyzing data allows organizations to consider the situational elements of change management. Associating current changes to factors that are currently situationally meaningful increases the likelihood of earning the support and acceptance of the change recipients (Choi, 2011), both on an intellectual and emotional level. Amassing data on the day-to-day attitudes of employees may even enable organizations to determine whether an individual is especially responsive to changes on a particular day. Moreover, as organizations are increasingly in states of constant change, understanding the pattern of past changes and their effects - both positive and negative - on recipient attitudes is crucial to successful change management (Devos, Buelens, and Bouckenooghe, 2007). If the felt effects of past changes are generally negative, change communication needs to distinguish the new change from the past failures. On the other hand, if past effects are positive, the managers can emphasize the appropriateness and legitimacy of past practices (Fernandez and Rainey, 2006).

Proposition 5. Organizations that identify prevailing situational attitudinal states are able to associate changes to more personally relevant contexts.

The interrelated relationship across different hierarchical levels mediates how employees feel about changes. Parry (2015) suggests that change radiates outward, starting with change leaders and employees that want to change, and gradually followed by employees with prior relationships of trust with the change agents. This reliance extends beyond the formal organizational hierarchy, involving social ties and networks within the organization (Balkundi and Harrison, 2006).

The traditional perspective on employee change commitment suggests that change recipients need to cognitively understand proposed changes before they are able to emotionally commit to them, moving from awareness to commitment to change (Gitsham, 2012). However, Parry (2015) suggests that organizations with a high degree of trust are able to subvert this pattern; in such teams, the emotional

commitment to change is almost instinctive, meaning that employees trust the manager to introduce changes that ultimately generate benefits for the team. Firms that are able to achieve this on an organizational level can begin implementing and accelerating changes without first having to provide the plethora of background details that are commonly required.

On a conceptual level, change is driven forward through a "trust grid", where support for change needs to be aligned on multiple levels within an organization for it to be effectively adopted (Parry, 2015). The findings highlight that managers need to understand how to translate the strategic vision behind a given change project into a more concrete frame for the recipients. To employ the trust grid, analytics can be used to identify the formal and informal relationships between employees, and subsequently determine conducive pathways for change communications to percolate through the organization. Thus, the change message is given a more valid and favorable context, improving individual responsiveness to change (Hambrick and Lovelace, 2017).

Proposition 6. Organizations that determine trust linkages across both formal hierarchy and informal social ties are able to relay communications through more effective channels.

The interview participants revealed that in regard to individual disposition towards changes, there is often a small number of individuals that display a significantly greater resistance to change than the other change recipients (Oreg, 2003). Such outliers present a critical impediment to the propagation of changes, since change managers often need to spend a disproportionate amount of time and effort controlling for this minority. Conversely, but equally significant, is that such outliers may function as "change brokers", employees who serve as facilitators of interactions and information across employee groups within organizational networks, thus "bridging" relationships within organizations (Burt, 1999). These employees are often influential - if management can persuade brokers to be early adopters and proponents of change, it can boost the odds that a transformational effort will succeed. (Cross, Parise, and Weiss, 2007).

Analytics, especially big data analytics, is well suited to identifying outliers within datasets, generally studied under the rubric anomaly detection (Park and Patcha, 2007). Big data has been applied in detecting bank and credit fraud, structural defect, medical problems or errors in text (Chandola, Banerjee, and Kumar, 2009). An interesting development within anomaly detection is the introduction of unsupervised techniques, where the objective is to detect non-predefined outliers within unlabeled data (Chandola, Banerjee, and Kumar, 2009). In an organizational context, where change-driving factors are extensive and the relationship between antecedents, specific attributes, and outcomes is often complex (Kirsch et al., 2013), unsupervised analytics may prove effective in identifying outliers that deviate strongly from the baseline data. Determining which employee groups are particularly supportive, or conversely antagonistic, to change initiatives allows managers to focus change communications to such high-priority outliers.

Proposition 7. Organizations that identify change recipient outliers are better able to determine the priority, sequence, and emphasis of change communications.

Implementation of new techniques

In addition to improving the refinement and comprehensiveness of detecting and monitoring change-driving factors, data-driven change management involves analytics-powered techniques to transform insight into implementation. These methods range from tools that aid individual employees in understanding and adjusting to change to organization-wide algorithms that allow managers to proactively provide supporting and intervening action.

Research on organizational change highlight the use of real-time communication to foster innovation, both as a means of sharing information as well as a tool for improving collaboration (Brown and Eisenhardt, 1997; Eisenhardt and Martin, 2000). Moreover, germane to the successful implementation of change projects, the findings

indicate that organizations that provide frequent communications are able to involve change recipients more extensively (Gilley, Gilley, and McMillan, 2009). Conversely, insufficient, infrequent communications are linked to change deficiencies and decreasing employee engagement (Kanter and Mirvis, 1989)

The real-time evaluation of employees is a facet of change management that digitalization has advanced. In particular, organizations can measure and monitor employee performance and attitudes in regard to change projects, and relay that feedback onwards to the employees (Ewenstein, Smith, and Sologar, 2015). Providing an employee with information that is relevant to the currently prevalent changes and the specific role that the employee has within the change, improves the actionability of that information. Thus, organizations that can manage change on an ongoing, real-time basis, are able to accurately and recurrently steer changes towards optimal outcomes (Kirsch et al., 2013). On an individual level, real-time feedback based on current data gives change recipients both the ability to adjust their change-related behavior and the opportunity to observe the impact of those adjustments (Ewenstein, Smith, and Sologar, 2015).

Proposition 8. Organizations that provide real-time feedback are better able to recurrently adjust recipient progression through change.

Individual employees within change organizations are seldom aware of the overarching progress of change projects (Ewenstein, Smith, and Sologar, 2015). Communications are often imprecise or ambiguous about the current state of changes, leaving employees uncertain about how the ongoing changes are going to unfold. Organizations need to quantify change progress using actionable metrics that are concrete and meaningful for employees (Balogun, 2006). Moreover, demonstrating progress to change recipients, in a manner that illustrates and highlights their own contribution to the overarching change scheme, improves the experience of meaningfulness and even drives participation (Oreg, Vakola, and Armenakis, 2011).

One of the augmentative factors that analytics-driven technologies provide, as highlighted by Brown, Court, and McGuire (2014), is the development of user interfaces that integrate into day-to-day operations, displaying information that is previously hidden or unavailable to employees. Both educational (Duval and Verbert, 2012) and medicinal fields (Neuhauser et al., 2013) have successfully introduced such interfaces. Verbert et al. (2013) explore the application of dashboards within learning analytics, indicating that such dashboards carry great potential in improving awareness, sensemaking, and reflection. In health care, Neuhauser et al. (2013) accentuate the potential that artificial intelligence carries in improving the relevance to users' needs for personalized, timely, and interactive communication. For instance, comprehensive analytics-driven systems allow patients to self-track health metrics such as pain, stress, and medication; enter clinical data; and automatically upload weight data using smart scales and exercise and sleep data using wearable body monitors, ultimately resulting in positive health outcomes (Neuhauser et al., 2013). Contextualized to organizational change, such interfaces can show employees their own individual progress in real-time and more advanced tools can even illustrate individual contribution toward collective change objectives (Ewenstein, Smith, and Sologar, 2015). An interesting emergent area of organizational technology-based intervention is the gamification of work (Lieberoth, 2015; Ruhi, 2015). By integrating game mechanics into general work, organizations can engage employees in creative ways, improve their productivity, and induce positive behavioral outcomes; similarly, expressing change-related goals as game mechanics could foster higher levels of employee engagement (Ruhi, 2015).

Proposition 9. Organizations that quantify and demonstrate accomplished change activities are better able to motivate individuals to contribute to change.

Demonstrating change progress on an individual level carries significant benefits for developing employee engagement and awareness. Moreover, on an organization plane, the quantification of change progress across the organization allows managers to oversee the progression of change throughout the organization. The pace of adoption is different across teams and units, as well as the relative performance of teams before, during, and after changes. Parry (2015) goes beyond traditional project plans and schedules that indicate the current state of change projects but falter in providing comprehensive and predictive information about upcoming challenges and impediments, proposing a "change map" that captures more of the multidimensional complexity of organizational change. Parry's (2015) analysis shows that groups undergoing change initiatives often fall into clusters; the change map visualizes these clusters as regions on the map, aggregated into different regions that shows areas of similar performance, characteristics, and dynamics, moving from regions of lowperformance to high-performance. Change managers can chart the paths that teams have taken over the course of change programmes, where teams move sequentially from region to region either in a beneficial or disadvantageous direction. Analyzing these paths allows organizations to determine what sequences of interventions generated effective pathways for which team types.

Visualizations of complex systems have been used to augment analytical reasoning and to derive more insightful interpretations of such systems (Pike et al., 2009). Visual analytics has been applied to improve disaster responses, analyze financial markets, and strengthen cybersecurity (Thomas and Cook, 2006; Savikhin et al., 2011; Keim et al., 2008). Keim et al. (2008) indicate that visual analytics allow decision makers to focus their full attention - both cognitive and perceptual - towards augmenting the discovery process, combining human flexibility, creativity, and background knowledge with the computational power of modern processors. Germane to change management, providing managers with a consolidated overview of how different teams have adapted to changes and how far along they are in that process relative to each other, enables managers to more effectively govern that progress.

Proposition 10. Organizations that visualize the distribution of change progress are better able to govern the progress of different employee groups relative to each other.

Parallel to reviewing the relative state and progress of different teams, to successfully account for the emergent (Burnes, 2009) and situational nature of change (Dunphy and Stace, 1993), organizations need to frequently assess and test the effectiveness of the current actions, interventions, and communications. One perspective on organizational change is that it is a complex, chaotic process that needs to be managed continuously as it unfolds (Kirsch et al., 2013). Accounting for change drivers across several situational variables on an ongoing basis is a comprehensive task, where change managers traditionally rely heavily on personal experience to determine optimal actions (Fecheyr-Lippens, Schaninger, and Tanner, 2015). Nevertheless, modern analytics allow organizations to acquire and analyze unprecedented amounts of data in real-time, which translates into up-to-date knowledge about the state and performance of any monitored variables. Harnessing analytics to make systematic and up-to-date evaluations of change management methods, in order to determine which approaches are effective, and which are not, allow organizations to refine future procedures and processes to be more impactful.

One notable example of applying analytics to continuously evaluate organizational decisions is the comprehensive usage of technology to reinforce organizational culture at Bridgewater Associates, one of the largest hedge funds in the world (Kegan, Fleming, and Miller, 2014; Wieland, 2015). Key to decision-making within the firm is the Dot Collector, an application that allows employees to rate one another in real-time during meetings (Burton and Kishan, 2017). In keeping with the funds governing principles of "radical truth" and "radical transparency" (Delevingne and Celarier, 2011), the accumulated ratings are aggregated and analyzed, with the resulting insights used to systematically weigh and evaluate employee interaction, contribution, and ultimately, the validity of the decisions that are made. While this approach is not applicable for all types of organizations, it illustrates one of the key advantages of analytics – by systematically assessing the logical reasoning behind decisions, the organizations can effectively reduce the effect of human bias and error (Manyika, 2017). Moreover, while reducing such bias, adopting a system that continuously

evaluates organizational action allows organizations to catalogue and monitor the efficacy of different approaches. To contextualize to change management, a field that is traditionally ruled by instinct and experience (Fecheyr-Lippens, Schaninger, and Tanner, 2015), the systematic, continuous, and up-to-date assessment of decisions would advance the development of change management practices that are probabilistically more effective and appropriate for a given set of determinant conditions, such as individual characteristics, group dynamics, or the situational context.

Proposition 11. Organizations that continuously evaluate change management are able to reduce the effects of human bias and error in managing ongoing change projects.

Both the research findings and management literature highlight the ability to anticipate events as one of the most impactful dimensions of analytics and big data (Manyika, 2017). Predictive analytics is a broad concept that denotes the determination of patterns in historical data in order to forecast future outcomes (Nyce, 2007); such analytics have been used in a range of industries and fields of science, including medical sciences (Raghupathi and Raghupathi, 2014), financial trading (Korn, 2011), and credit scoring (Nyce, 2007). From a people lens, analytics can forecast which people are likely to develop relationships, drop out of school, cancel a subscription, or get divorced (Siegel, 2016).

Predictive analytics rely on increasingly complex statistical methods - machine learning, neural networks, and artificial intelligence - to determine trends and correlations that may not be apparent to the human brain, but still enable it to better predict future events or behaviors (Nyce, 2007). The case of Target identifying a pregnant woman before her own father was even aware of it is particularly illustrative of both the ability and impact of predictive analytics (Duhigg, 2012). An analyst at Target was able to correlate seemingly unrelated consumer habits to different periods of pregnancy, enabling the retailer to direct highly targeted to customers purely based

on their purchasing behavior. Geller and Mazor (2011) outline the many ways in which predictive analytics can transform traditional HR. One aspect that they highlight is the ability to predict the risk of people leaving, by analyzing factors such as working hours, time to promotion, and compensation levels.

Predictive analytics allow a shift in perspective, from a reactive to proactive style of management (Kirsch et al., 2013) - from adjusting to what happened to anticipating what could happen. Change managers can implement interventions to problems that might not yet have fully emerged or become apparent in the workplace. Such proactive action mitigates the risk of organizational change, as managers are able to foster change acceptance, by anticipating and minimizing potential threatening factors related to change (Choi, 2011). Similarly, predictive analytics can be applied to assess long-term change consequences (Oreg, Vakola, and Armenakis, 2011), change induced effects that often impact employees in a delayed, indirect, or unforeseen manner.

Proposition 12. Organizations that predict change-impeding trends are able to act and intervene proactively to mitigate such impediments in advance.

5.4 Revised theoretical framework

The initial theoretical framework that was presented at the end of Chapter 2 provided an overview of how to bridge organizational change and analytics. The framework presented a conceptualization of the two organizational processes reviewed in the literature review - the analytics process and the change process - and their intermediary, data-driven change management. This model was developed by consolidating literature on change management and data analytics, and its appropriateness was examined in six in-depth interviews. The purpose of the interviews was to uncover the different ways that analytics is currently applied in managing change, by discussing the key factors that support and impede data-driven change management. The research findings mostly supported both the overarching idea behind the framework, as well as the main components of the model. Nonetheless, the research findings crystallized two overarching dimensions of change analytics: the capabilities that allow organizations to perform change analytics and the ways in which change analytics can be applied in organizational change. Developing change analytics capabilities is necessary, in order to acquire data and analytics proficiencies that support change management. These include advancing the availability and access to data, the knowledge and involvement of the managers, and the supporting structure and culture of the organization. Further, analytics carries both direct and indirect constraints that organizations need to recognize. Direct limitations are linked to the complexity of the studied phenomena, organizational change, a process that is driven by a lot of different factors that are both difficult to quantify and difficult to analyze. This study proposes that organizations can circumvent these by complementing the traditionally inductive analytics process with a deductive baseline; to apply existing information and literature to augment internal data with already established causal sequences and linkages between change drivers. The identified indirect limitations manifest once analytics is introduced in an organization - as analytics quantifies and monitors individual employees on a more personal level, these employees would naturally resist such intrusiveness. This study suggests that by providing reason and rationale through frequent and transparent communications, and by involving employees in the analytics process, such resistance can be reduced.

Once change analytics is supported in an organization, it allows organizations to identify change-related factors more granularly, and to act on that information in a quicker and more informed manner. Through the systematic use of analytics, organizations can monitor and measure individual employee differences, situational conditions, and group dynamics, as well as detect high-impact outliers within the employee populace. The described change management techniques involve real-time feedback, quantifying change progression on an employee-basis, determining teamlevel change performance across the organization, continuous evaluation and testing of change measures, and predictively assessing change consequences and impediments to the introduction of new changes. Perhaps most imperatively, change analytics allow organizations to adopt a more proactive mindset to change management. Instead of reacting to complications, resistance, and antagonism, analytics enable organizations to predict such hurdles in advance, even before they ostensibly manifest themselves in the workplace environment. Subsequently, managers may be able to circumvent these impediments in advance, paving the way for performant and unequivocal organizational change.

These insights are incorporated into the conceptual model by extending the central data-driven change management component of the initial theoretical framework. The underlying organizational capabilities, here termed change analytics capabilities, need to be developed in order to support data-driven change management; simultaneously, the direct and indirect limitations on change analytics need to be recognized and sidestepped. These factors are illustrated in the model as horizontal arrows. Datadriven change management, in turn, allows for the augmented identification of change drivers, while also facilitating the use of new management techniques. In the model, these are depicted as vertical arrows, while the parenthesized numbers at each factor indicate which propositions are referenced. Adhering to Burke and Litwin's (1992) rationale, and inspired by studies on complex adaptive systems in relation to organizations and organizational change (Anish and Gupta, 2010; Brown and Eisenhardt, 1997), complex ties and feedback loops are postulated, not just between supportive capabilities, success determinants, and change outcomes but also amongst these factors. The framework intentionally neglects to infer specific relationships or causal linkages between single variables of the model, as these fall outside the scope of the study, as well as the extent of the empirical results. Rather, the model propositions that change analytics capabilities support and enhance the ability to conduct data-driven change management, which consequently improves the success rate of organizational change. The altered and extended theoretical framework is illustrated in Figure 5 below.



Figure 5. Revised theoretical framework.

6 CONCLUSION

The purpose of this thesis was to explore data-driven change management techniques, and more generally, to examine how analytics can be incorporated into the management of organizational change. Formally, the intent was to answer the following research question:

How can analytics-driven techniques influence the management of organizational change?

In addition to exploring the key characteristics of data-driven change management, this thesis sets out to provide a conceptualization of change analytics that can be used as the basis for future empirical research. In addressing this agenda, I began by examining literature on the current approaches to change management and data analytics. Premised on this literature review, I established an initial theoretical framework that was used as the basis for the empirical part of the thesis, where the supporting and impeding factors of data-driven change management were explored. The findings indicate that analytics augment key factors of traditional change management, including the diffusion of information, transparency, contextualization, personalization, recurrence, and interactivity. Impeding factors involve overly ambiguous processes and objectives for collecting data, uncertainty relating to the intrusiveness of highly personalized analytics, implementational complexities, and the direct and indirect constraints of analytics.

To further extend these insights, I developed twelve propositions about the relationship between change management and analytics. Based on the findings, these propositions distinguish between four overarching dimensions of data-driven change management: developing the necessary organizational conditions to support analytics, recognizing the direct and indirect limitations of analytics, extensively identifying change-driving factors through analytics, and implementing new data-driven management techniques. These propositions are subsequently integrated into the initial framework, extending the insights therein by considering both factors related to supporting change analytics, as well as the benefits unlocked by applying change analytics. Hence, I argue that the research objectives have been met and that the research question has been answered. The presented model is a useful contribution to the nascent change analytics field and its existing body of literature, as it provides a foundation that can be applied and adapted in future studies, while the developed propositions serve as a sequence of concrete steps that executives can take, in order to develop their approach to data-driven change management. The practical implications of this thesis are explored further in the next section. In addition, the limitations of this study are presented, along with a set of suggestions for further research.

6.1 Practical implications

Experts on analytics tend to highlight the exponential nature of technological advancement, and the subsequent impact, which is often both radical and unanticipated, that such developments have on industries. Data and computational capability are increasing exponentially, which advances analytics at a correspondingly aggressive pace; the more data and computational you feed an algorithm, the better the results, as every new insight augments the prior foundation (McAfee et al., 2014). In the digital age, organizations can no longer rely on domain expertise alone, but have to foster culture that promotes a combination of domain and data expertise (Goran, LaBerge, and Srinivasan, 2017). The implications are especially significant in change management, a domain where decision-making has traditionally been dominated by instinct and experience rather than deep analysis (Fecheyr-Lippens, Schaninger, and Tanner, 2015). This thesis outlines two actionable dimensions of change analytics that organizations can leverage to advance their approach to managing organizational change.

The first dimension relates to developing organizational capabilities. To embed change analytics into the workplace, organizations need to develop the necessary conditions to support it. First, organizations should consider adopting a more centralized and standardized data platform, in order to provide simple access to the collected data, enabling more comprehensive and cross-organizational analytics. Second, developing the baseline analytics knowledge of change managers allows organizations to involve these managers in the development of more relevant analytics tools and algorithms. Third, recognizing and promoting organizational culture and practices that support the application of analytics in decision-making, collaboration, and knowledge sharing allows embedding analytics to a more extensive degree. Integrating analytics into organizations is here considered a function of the availability and access to data, the knowledge and involvement of the managers, and the supporting structure and culture of the organization. Beyond this, organizations need to be aware of the constraints on analytics, which often stem from deficient datasets, for instance, as smaller organizations may be unable to internally acquire data of sufficient volume and precision. This thesis advocates for a dual approach to analytics, where a deductive process - for instance, basing hypotheses on existing management literature - can be used to frame narrower inductive analytics. More indirectly, employees may resist change analytics, as analytics-driven techniques may entail a form of analysis that is perceived as more personally intrusive; organizations can mitigate such reactance by adopting transparent processes and communication, explicating the reasoning and rationale behind the implementation of such analytics. Involving employees in the analytics process, both in implementation and in practice, promotes mutually beneficial discussion, while also furthering participation and encouraging acceptance.

The second overarching dimension relates to different potential applications of change analytics, and how these applications augment traditional change management. The studied benefits form a dichotomy: analytics allow organizations to identify changedriving factors at a more granular level, while also providing new techniques and tools for implementing change management. Through the systematic use of analytics, organizations can monitor and measure individual employee differences, situational conditions, and group dynamics, as well as detect high-impact outliers within the employee populace. In designing their implementation of change analytics, organizations can use these propositions as inspiration and guide for which employee factors require measuring and monitoring. Organizations that enable a more extensive analysis of change-driving factors can, in parallel, employ change management techniques that take advantage of timely, comprehensive, and high-volume data. The proposed change management techniques involve real-time feedback, quantifying change progression on an employee-basis, determining team-level change performance across the organization, continuous evaluation and testing of change measures, and predictively assessing change consequences as well as impediments to the introduction of new changes.

Overall, change analytics carries the potential to significantly transform change management. By analyzing timely, comprehensive, situational, personalized, and predictive data, organizations can extend their understanding of the way their employees are influenced by past, present, and potential future changes. Subsequently, change managers can employ techniques that address this multitude of changedetermining factors in a more effective manner.

6.2 Limitations and suggestions for future research

Bridging literature on change management and analytics, the proposed framework provides a step forward in understanding the potential of change analytics and the factors that support and impede data-driven change management. As such, it has some limitations. First, as this research was mainly an exploratory endeavor, the proposed conceptual model is ultimately provisional by nature, and therefore needs further empirical validation. Organizational change projects are complex entities that require long-term empirical studies, in order to understand how particular factors, both individual and situational, correlate with different change outcomes. Studying change analytics and data-driven change management using a larger sample and over a longer period of time would provide a more comprehensive view and understanding of the topic. Second, more focused studies are required to determine specific linkages between antecedents, situational factors, and change outcomes. In such studies, researchers need to account for the interdependent nature of change driving factors, especially as people often change their behavior if they know that they are being monitored. Third, detailed studies are required on the realized benefits of change analytics, both in the short and long-term. To underline the value of change analytics on improving the success rate of organizational change, research on different concrete applications of change analytics and their impact on both firm performance and employee well-being should be conducted. Studying these effects is especially important, since ultimately, the goal for change analytics is not only to directly influence organizational change, but also to improve both the bottom-line of the firm, as well as the overall health of the organization.

Apart from a dystopian fear of the rule of machines popularized by science fiction, extensive analytics raises significant concerns regarding privacy, ethics, and lawfulness. As demarcated in the introductory chapter, a detailed investigation of these issues falls outside the scope of this study, but such topics nevertheless provide interesting material for future research. There is a thin line between the detailed monitoring of individual performance and overt surveillance (Morozov, 2013). Data on individual employees is not only subject to a compromise between privacy and analysis by the organization, but also to legal directives regarding employee rights (Introna, 2000). While the legal considerations vary by country, a recent example of the development of such legislation is the European Union's General Data Protection Regulation, which aims to provide more comprehensive data protection for private citizens (De Hert and Papakonstantinou, 2012). The regulation becomes enforceable in 2018. The implications on employee privacy and change analytics in the context of the regulatory environment provides rife opportunities for further study. The ethical issues that analytics introduces carry a similarly significant effect. For instance, being regularly classified as a low potential candidate by recruitment algorithms, through comparisons with other personal profiles, may negatively affect people's emotional well-being, motivation, and commitment (Peck, 2013).

Another interesting line of research relates to the suitable implementation of change analytics. This study presents a few actionable propositions regarding necessary capabilities that organizations need to develop in order to support change analytics. These are, however, general propositions that ignore particular organizational compositions, industry specificity, and the prioritization of certain actions; future research can investigate the selection and sequence of steps that different organizations need to take to implement change analytics. There are several imperative considerations: the effect of change analytics on organizational culture, the balance between full automation and simply aiding human decision-making, and the impact on other organizational departments (Gaskell, 2016). From a strategic perspective, future research can investigate how change analytics needs to be reflected in firm strategy, and how vision and direction should be aligned with a more data-driven form of organizational governance. More specifically, the successful implementation and application of analytics always requires the buy-in from top management as well as continued, long-term commitment. Overall, it would be interesting to understand which factors contribute to the introduction and adoption of change analytics.

This study outlines the emergent change analytics concept, and develops a set of propositions about the relationship between change management and data analytics that organizations can use as an initial blueprint for introducing data-driven approaches to change management. This thesis only offers a starting point for exploring the drivers and determinants of organizational change, and several important questions remain unanswered. Nevertheless, I believe that this thesis accurately conveys the transformational potential of change analytics, while contributing insights that can be refined, extended, and applied in future research.

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APPENDICES

APPENDIX 1: INTERVIEW GUIDE IN ENGLISH

PROFILE

Q1. Could you describe yourself, your work, and the organization that you are employed by?

SECTION 1: CHANGE MANAGEMENT

Q1. What does change management mean for you/your organization? When does it occur, and who does it involve? What are the central benefits/challenges? Is it/to what degree is it a continuous process? Why/ why not?

It has been suggested that *change recipients* are key determinants of the success of a change project. The motivation behind this is that change is made persistent only when individuals make definite changes to their on-the-job behavior.

Q2. What are your thoughts on this? How do you view the role of individual employees in regard to organizational changes?

I interpret change recipients as being affected by three different dimensions of organizational change - the general context (i.e. pre-existing circumstances, change context (i.e. conditions tied to a specific change), and change outcomes (i.e. direct reactions to changes, and indirect consequences of change). Change outcomes ultimately affect the general context, in that they create a "history" of past changes, which alters the general context of the organization.

Q3. Do you agree with the model in general? Do you agree/disagree with a particular element of it, and in what way? Do you agree with the cyclical nature of it?

As these elements determine (to a large part) the success of a change venture, it is important to understand how general and specific attitudes impact change outcomes. I divide the general context into: a) individual factors (e.g. individual psychological factors), b) organizational factors (e.g. corporate culture), and c) effects of past changes (e.g. positive/negative/unclear results of past changes). Change context is viewed as composed of the content of the change, the process of the change, and the perceptions to the content and process of the change. Change outcomes are direct reactions (i.e. affective, behavioral, and cognitive reactions), more indirect consequences (i.e. work-related (e.g. satisfaction) and personal (e.g. stress)), and performance outcomes (e.g. realized business goals and business performance).

Q4. Are there any missing elements of this model? Which factors affects the ultimate outcomes of the change to a higher degree? Which factors are more concretely visible in everyday work life, and how?

Q5. What types of approaches to change management are used at your organization? Which methods are effective, which are not? Why?

Q6. How is information about change communicated to employees? What channels are used for communication? Is there a difference between direct communication (e.g. face-to-face or through email) and indirect communication (e.g. indications of commitment)?

SECTION 2: DATA ANALYTICS

Q1. What is your view on how data analytics is currently applied in businesses? What do you see as the core elements of data analytics? Is it a continuous process?

For the purposes of this study, I include the following three elements as part of data analytics: discovery (i.e. problem definition, data collection, and data processing), analysis (i.e. supervised learning, unsupervised learning, extrapolation), and interpretation of data (i.e. visualization and reporting; generating conclusions that are "actionable"). The interpretation of data feeds into the discovery component, in that any conclusions that are generated often also provides insight into the discovery of data.

Q2. Does analytics function as a separate business unit, or is encompassed in other units? What advantages/disadvantages does this entail? What kind of resources (ICT, people, processes) are vital to data analytics?

Q3. What is your view on the emergence of big data? What kinds of benefits does big data provide to "traditional" analytics? What are the main challenges related to it?

Q4. How would you integrate analytics into (organizational) decision making processes? Which steps would you take to make an organization more data-driven?

SECTION 3: INTEGRATING CHANGE MANAGEMENT AND DATA ANALYTICS

An issue with current approaches to change management is often that the methods are too "one-size-fits-all". The primary purpose for investigating the benefits of integrating data analytics into change management is to create a more customized approach that would achieve better change outcomes from individuals or groups of individuals. The following model integrates data analytics as a central function of the model of organizational change presented in Theme 1. The general context and change context provide the frame for the change process, while the data analytics function collects and analyzes data that can be used to create more customized communication, thus inducing more succinct change outcomes.

Q1. Do you agree with this model? Why/ why not? Are there elements that are missing?

Methods that emphasize a "data-driven" approach to management - especially as it relates to managing people - allow for more informed decision making. To concretize, algorithms that predict which employees are most likely to resign, or which employees generate the highest returns, enable firms to develop more effective management processes.

Q2. What data do you currently collect about your employees? Is there data that you are currently not collecting, but would want to? Why/ why not?

Q3. How do you use the data that you collect? What organizational elements are involved?

This study focuses on the applications for using data analytics to better understand people. Recently, it was reported that during the US Presidential election, the Trump campaign analyzed voter's social media profiles in order to create more targeted advertisement. Another tangential example of how big data is used as a way to create more customized interaction with customers is how Netflix and Amazon use similar, but still different, recommendation algorithms to generate interest, but also to focus attention to specific products. Q4. What are your general thoughts about this? Could such methods be implemented on an organizational level? How? Are there any clear benefits/concerns? What data sources can you think of that could be used to conduct such analysis? What are your thoughts on the ethical aspect of analyzing such data?

Q5. By connecting analytics to communication, individual-level customized communication would be possible. How would this impact change management? What messages are especially important? What other modes of interaction (i.e. besides messages) could this affect? Are there individuals that are especially receptive to targeted communication?

Q6. What do you see as the future of change management, especially in regard to the use of technology and/or analytics?

APPENDIX 2: INTERVIEW GUIDE IN FINNISH

PROFIILI

Q1. Voisitko kertoa itsestäsi, työstäsi ja organisaatiosta jossa työskentelet?

OSA 1: MUUTOSJOHTAMINEN

Q1. Mitä muutosjohtaminen tarkoittaa sinulle? Miten muutosjohtaminen on nähtävissä päivittäisessä työelämässä? Mitkä ovat mielestäsi muutosjohtamisen keskeiset haasteet/hidasteet?

On esitetty ajatus siitä, että onnistuneen organisaatiomuutoksen keskeinen tekijä on miten vahvasti organisaation työntekijät, ns. "Muutoksen vastaanottajat" (eng. Change recipients), hyväksyvät muutoksen. Ajatuksen ydin on, että organisaatiomuutos menestyy pysyvästi vain mikäli yrityksen työntekijät muuttavat työtapansa.

Q2. Miltä tämä kuulostaa/mitä ajatuksia tämä herättää? Mikä on näkemyksesi yksilöiden roolista organisaatiomuutoksessa?

Määritelmäni mukaan työntekijöihin vaikuttaa muutokseen liittyen kolme eri vaihetta/ulottuvuutta: yleinen konteksti (eli yrityksen yleinen tilanne/tausta, joka on jo olemassa ennen muutosta, tähän liittyvät tekijät), muutokseen liittyvä konteksti (eli tiettyyn muutokseen liittyvät tekijät), ja muutoksen vaikutukset (eli muutokseen liittyvät reaktiot sekä muutoksen seuraukset).

Q3. Miltä tämä kuulostaa/ mitä ajatuksia tämä herättää? Oletko samaa/eri mieltä jonkun tietyn osan suhteen? Mitä ajatuksia mallin jaksollisuus herättää?

Koska nämä tekijät määräävät pitkälti organisaatiomuutoksen menestyksen, on tärkeätä avata mallin osat ja syy-seuraussuhteet tarkemmin.

Yleinen konteksti: yksilölliset tekijät (esim. persoonallisuuden piirteet), organisaatiolliset tekijät (esim. kulttuuri), ja aikaisempien muutosten vaikutukset (esim. hyvät/huonot/epävarmat aikaisemmat muutokset).

Muutokseen liittyvä konteksti: sisällys (esim. minkä tyyppinen muutos), prosessi (esim. Muutoksen pituus, jne), ja näihin liittyvät käsitykset (esim. hyödyt/haitat).

Muutoksen vaikutukset: muutokseen liittyvät reaktiot (affektiiviset (feel), behavioraaliset (act), kognitiiviset (think)) ja muutoksen seuraukset (esim. työhyvinvointi, stressi)

Q4. Puuttuuko mallista jotain? Mitä ajatuksia syy-seuraussuhteet herättävät? Mitkä tekijät vaikuttavat muutoksen vaikutuksiin eniten? Mitkä tekijät ovat esillä päivittäisessä työelämässä?

Q5. Mitä eri muutosjohtamismenetelmiä on käytössä yrityksessänne? Mitkä menetelmät ovat tehokkaita, mitkä ei? Miksi?

Q6. Miten muutoksesta viestitään yrityksessänne? Mitä eri kanavia käytetään? Mitkä ovat tehokkaita, mitkä ei? Mitä epäsuoraa/nonverbaalista viestintää käytätte?

OSA 2: DATA-ANALYTIIKKA

Q1. Mikä on yleinen näkemyksesi data-analytiikan hyödyntämisestä yrityksessä? Mitkä ovat mielestäsi data-analytiikan pääosat? Tehdäänkö data-analytiikkaa jatkuvana prosessina, vai onko se jaksollinen?

Q2. Onko data-analytiikka erillinen osa yritystä, vai osana muita liiketoimintayksiköitä? Mitä resursseja käytetään data-analytiikkaan? ICT, ihmisiä, prosesseja? Miksi?

Q3. Mikä on näkemyksesi big data-konseptista? Miten big data eroaa perinteisestä analytiikasta? Mitkä ovat big datan hyödyt/haitat? Miten big dataa hyödynnetään yrityksessäsi?

Q4. Miten integroisit data-analytiikan organisation päätöksentekoon? Miten tekisit organisaatiosta enemmän datakeskeisen?

OSA 3: MUUTOSVIESTINTÄ

Nykyiset muutosjohtamismentelmät ovat pääkohtaisesti "one-size-fits-all". Organisaatiot jotka kohdentavata viestit analytiikan avulla saavat motivoitua henkilöstön paremmin kuin organisaatiot, jotka luottavat yleiseen kommunikointiin. Tässä mallissa olen integroinut näkemykseni organisaatiomuutoksesta (osa 1) ja data-analytiikasta (osa 2).

Q1. Miltä tämä kuulostaa/ mitä ajatuksia tämä herättää? Oletko samaa/eri mieltä jonkun tietyn osan suhteen? Miksi/miksi ei?

Modernit datakeskeiset lähestymistavat johtamiseen ja hallinointiin ovat nousseet tärkeään asemaan. Algoritmeilla voi esimerkiksi ennustaa miten tuottoisa tietty henkilö on, tai kuinka todennäköistä on, että työntekijä irtisanoutuu.

Q2. Mitä dataa keräätte/voisi kerätä työntekijöistänne? Onko dataa, jota ette kerää, mutta josta saattaisi olla hyötyä? Miksi?

Q3. Miten/missä tätä dataa hyödynnetään?

Yritän selvittää, miten analytiikan avulla voi paremmin ymmärtää ihmisiä. Esimerkiksi Yhdysvaltojen edellisessä presidentinvaalissa, raportoitiin, että Trumpin vaalikampanjassa analysoitiin mahdollisten äänestäjien SoMe profiileja. Näin pystyttiin kohdentamaan mainontaa paremmin. Toinen esimerkki analytiikan käytöstä viestinnässä on Netflixin ja Amazonin suositusalgoritmeissa, jolla ohjataan huomiota tiettyihin tuotteisiin/palveluihin.

Q4. Mitä ajatuksia tämä herättää? Voisiko tällaisia menetelmiä soveltaa yrityksen sisällä? Miten? Mikä on näkemyksesi tämän ajatuksen mahdollisista hyödyistä/haitoista? Mitä tietolähteitä tähän voisi hyödyntää? Mitä eettisiä kysymyksiä tähän liittyy?

Q5. Liittämällä analytiikka viestintään, yksilön tasolla kohdennettu viestintä olisi mahdollista. Mitä tämä mahdollistaisi muutosjohtamisessa? Mitkä viestit olisivat erityisen tärkeitä? Minkä tyyppisille henkilöille tällaiset viestit olisivat erityisen tehokkaita?

Q6. Mikä on yleinen näkemyksesi muutosjohtamisen tulevaisuudesta, etenkin teknologian/analytiikan käytön suhteen?

APPENDIX 3: DATA-AGGREGATE STRUCTURE

DATA-AGGREGATE STRUCTURE FOR FACTORS THAT SUPPORT THE INTEGRATION OF CHANGE MANAGEMENT AND ANALYTICS



DATA-AGGREGATE STRUCTURE FOR FACTORS THAT IMPEDE THE INTEGRATION OF CHANGE MANAGEMENT AND ANALYTICS

1st Order Codes	2nd Order Themes	Aggregate Dimensions
 "Shotgun approach" to gathering data Breadth and quantity of data favored Lack of planning and accuracy in collecting data 	Deficient planning of data collection	
 Difficulties of acquiring data on individual behavior Employees change behavior when monitored The "incentive structure" in analytics is flawed 	Employee monitoring alters reactions	Ambiguous data management
 Challenge of storing and managing data Ethical/legal concerns in gathering data, relating to confidentiality and anonymity Combination of variables also needs to be anonymous 	Anonymity requirements	
 Analytics leverages untapped data sources to discover previously hidden knowledge Managers hesitant over treating employees differently 	Tailored communications problematic	The hig brother
 Psychological profiling creates chasms between employees Tailored communications would give rise to discussion with colleagues 	Controlling work environment	problem
 Change projects are dependent on many factors Both situational and individual Inadequate analytics does not take into account complexity 	Complexity of change	
 Organizations lack the capability to use change analytics Unclear how analytics would be applied to facilitate large scale organizational change 	Lack of data expertise	Implementation complexities
 Benefits have to outweigh costs Challenge is to concretize how data aids specific business decisions 	Connection to business decisions	
 Large datasets are generally needed for analytics Organizations would either need very large workforce or adopt an external solution 	Big data requires big data	Limitations of
 Social media data and sensory input data contain a lot of noise Sentiment analysis has a lot of inherent bias in social media 	Weak predictive power	