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## **Crunching the numbers Studying the enactment of analytics in an organization**

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# 5

## Discussion

In this chapter I review the main research findings that I have presented in this dissertation, in order to provide a response to the overall research question that has guided my research. Furthermore, I reflect on the boundary conditions of my findings. Also, I discuss the theoretical implications of this doctoral research and how it might inform directions for future research, as well as how the findings may contribute to practice. Finally, I close this chapter with some concluding remarks.

## 5.1 Introduction

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In this doctoral thesis I set out to study what happens when analytics is introduced in organizations. Analytics can be viewed as a technology of model-based rationality (March, 2006), which helps organizations reach favorable outcomes following the normative ideal of rationality (Cabantous & Gond, 2011; Jarzabkowski & Kaplan, 2015). More specifically, technologies of rationality help make choices based on a model-based assessment of the likelihoods of possible future ends and of pre-established preferences among those ends. In the introductory chapter of my thesis I discussed the need to take a sociomaterial practice perspective to study rationality, in order to address some of the conflicting issues (summarized in table 1.3) put forward by different theoretical perspectives on rationality (bounded rationality, political models, action rationality, symbolic perspective, and others). Nowadays rationality is still considered to be a normative ideal for guiding organizational actions (Cabantous & Gond, 2011; Jarzabkowski & Kaplan, 2015), while there are several intelligent tools and techniques available that can help overcome the limits of bounded rationality (March, 1994). Therefore, it becomes relevant to study how actors enact rationality in their practices. By taking a sociomaterial practice perspective (Feldman & Orlikowski, 2011; Nicolini, 2012), I recognize that rationality emerges from the doings of actors, who are embodied in specific contexts, and have situated knowledge. What is considered to be a rational way of acting is shaped by sociomaterial practices (Orlikowski, 2010), in which humans are entangled with the tools of model-based rationality. Thus, looking at the practices in which humans interact with such tools can help us better understand how they shape rationality. For my doctoral research, I decided to focus on analytics as the technology of model-based rationality. This choice was motivated by the fact that analytics includes very advanced tools and techniques for analyzing data and drawing insights to steer decisions and actions (Davenport & Harris, 2007; McAfee & Brynjolfsson, 2012), and thus makes an interesting case to study due to its efficiency and effectiveness in reaching perfect rationality. While both academic researchers (Agarwal & Dhar, 2014; Chen et al., 2012; Sharma et al., 2014) and practitioners (Kiron & Shockley, 2012; LaValle et al., 2011) are already on the bandwagon of analytics, little is known about how organizational members really use it in their practices. Therefore, my research was guided by the research question:

*RQ: How is the technology of analytics enacted, in the organizational quest for rationality?*

In order to answer my research question, I performed an inductive longitudinal qualitative study at TelCo, a large telecommunications provider. I studied the introduction of analytics in the Marketing & Sales department of the business market division, and performed interviews and ethnographic observations with account managers, sales managers, analysts, and other actors in order to understand how analytics was enacted in the different sociomaterial practices. The analysis of my data yielded three sub-topics of

this research that were addressed in the chapters 2, 3, and 4 of this thesis: studying how a clash of epistemologies unfolds when analytics is introduced in the organization (chapter 2); exploring the phenomenon of transparency that is afforded by digital technologies (chapter 3); and investigating what happens when analytics is used in the organizational setting for symbolic reasons (chapter 4).

In the remaining sections of this chapter I review the main research findings of chapters 2, 3 and 4, in order to provide a response to the main research question of this thesis. I discuss the theoretical implications of the research findings, how they inform directions for future research and how they contribute to practice. Then, I reflect on the boundary conditions of those findings. I continue with reviewing the theoretical implications of this thesis as whole, providing suggestions for future research and discussing general implications for practitioners. Finally, I close this chapter with some concluding remarks.

A summary of the key findings, responses to the overall research question, theoretical implications and practical implications of each chapter can be found in table 5.1.

Table 5.1 Research summary

Chapter	Specific research question	Key findings	Response to overall research question	Theoretical implications	Practical implications
Chapter 2 Epistemologies in clash: What happens when analytics lands in the organization?	How do knowing practices shape epistemologies in the workplace and what happens when organizational members are faced with a new epistemology?	-The confrontation between analysts and users of the analytics tools can bring out epistemological differences -It is hard for the different epistemologies to reconcile	-The organizational members who are expected to use analytics may refuse to incorporate it in their practice, because the epistemology embedded in their practice might be different from the epistemology entailed in the technology of analytics.	-Analytics triggers actors to reflect on and explicate their epistemologies. -Epistemological clashes can emerge across knowledge boundaries. -Findings contribute to the conversations on bounded rationality, political models of organizational action and interpretative perspectives on rationality.	-Managers should be aware that effortful work is needed to bridge different epistemologies and to change knowing practices. -Analysts will have to understand what kind of knowledge matters to the users, and take this into consideration when designing the analytics model
Chapter 3 Playing the numbers game: Dealing with transparency	How does the transparency afforded by digital technologies influence the way people enact these technologies in the workplace?	-Transparency afforded by analytics and digital technologies in general is performative: It influences how people interact with the technology, and often obscures what it is supposed to render transparent	-Transparency is sociomaterially constructed through the enactment of analytics, and it is performative, i.e. it is consequential on how organizational members further enact the technology of analytics.	-Unpacking the phenomenon of transparency afforded by digital technologies. -Taking a performativity perspective in organization studies can help better understand complex phenomena. - Findings contribute to the conversations on political models of organizational action and action rationality.	-The digital technology should be designed taking into consideration the practices of performance evaluation in the organization, as these will influence the way people use the technology.
Chapter 4 It comes back to bite you: The unintended consequences of symbolic adoption	How do actions of symbolic adoption influence the process of institutionalization and what unintended consequences arise for the actors who perform them?	- Symbolic actions of concealing users' non-conformity with the analytics interact with the symbolic actions of analysts for impression management, and unintendedly help institutionalize analytics in the organization and influence the practices of the users.	-The users may perform symbolic actions to conceal their resistance to use the technology of analytics. However, these symbolic actions can unintendedly help establish analytics as an institutionalized practice in the organization.	-Specifying the role of symbolic actions in establishing institutions. -Unpacking the process of symbolic adoption. -New epistemic ways of acting based on analytics insights influence the emergence of institutions. - Findings contribute to the conversations on organized anarchy and rationality as a symbolic construct.	-Managers should not rely only on data to decide whether a new technology should be used by their employees, as this data may have been generated for symbolic reasons. -Managers should be aware that exerting too much pressure on the employees could lead them to perform symbolic actions, in order to direct the attention away from their actual resistance.

## 5.2 Insights from chapter 2: Epistemologies in clash

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### 5.2.1 Key findings and response to the overall research question

Chapter 2 developed a knowledge perspective on analytics, in order to explain what happens when organizations introduce this technology. The knowledge perspective is aligned with the practice-based perspective (Feldman & Orlikowski, 2011; Nicolini, 2012) and conceives of knowledge as situated in historical, social and cultural contexts (Nicolini et al., 2003), focusing on the process of knowing as an ongoing social accomplishment emerging in everyday practice (Orlikowski, 2002). The introduction of analytics in TelCo's sales department was performed very problematically, as tensions emerged between the analysts, who developed the CLM model to automate customer management in TelCo's Sales Medium department, and the account managers of Sales Medium, who were responsible for sustaining the relationship with the medium-sized customers of TelCo and for generating leads. The knowledge perspective directed our attention to the study of knowledge boundaries (Bechky, 2003; Carlile, 2002, 2004) between those two groups.

One main finding of this chapter is that the tensions that emerged between the analysts and the account managers did not only occur because the two groups had very different knowing practices, but more fundamentally, because they had different epistemologies. Epistemology deals with questions such as what knowledge is, how it can be obtained, and how knowledge claims can be justified (Tsoukas, 2005). Certain philosophers (Goldman, 2007) have developed the notion of folk epistemology, which entails that all people develop interpretations and intuitions to think and reason about knowledge. The introduction of analytics in Sales Medium triggered the analysts and the account managers to develop such reasoning, and to explicate what is the source of knowledge, how knowledge can be obtained, and how knowledge statements are justified. Whereas the account managers viewed knowledge as relational, generated intuitively by their interpretations during their interactions with the customers, for the analysts knowledge is constituted in algorithmically processed patterns of information. Thus, the confrontation of analysts with the users of the analytics tools can bring out epistemological differences, which explain the difficulty for the two groups to collaborate and to incorporate their different ways of acting in the same practice (in the case of TelCo customer management and lead generation).

The second key finding of the chapter is that it is difficult for the different epistemologies to reconcile. In the study at TelCo we analyzed how the clash of the two epistemologies unfolded. While the two groups tried to resolve the tensions and to bridge their epistemologies, it was hard to accomplish that, and eventually only one epistemology prevailed (that of the analysts), resulting in a new knowing practice that did not involve the account managers anymore.

In response to the overall research question underlying this dissertation, this chapter suggests that organizational members who are expected to use the analytics tools may use them differently from what the analysts expect, or even refuse to use them at all. This can be explained because within their sociomaterial practices, people not only have situated knowledge and situated processes of knowing, but they also have situated understandings about what constitutes valid ways of knowing. The confrontation with analytics can bring out their epistemological differences with the epistemology entailed in the technology of analytics, and can lead to clashes and resistance to use the analytics tools.

### **5.2.2 Theoretical implications for the field of knowledge**

Chapter 2 specifically contributes to the literature on knowledge and knowledge collaboration in different ways: First of all, the study at TelCo illustrates how epistemologies are situated in knowing practices. The introduction of analytics brought about tensions between the analysts and account managers, who had different knowing practices for generating knowledge about managing the customers and generating leads. We can identify those tensions on the level of pragmatic boundaries (Carlile, 2002), which entail the differences in interests between actors from different groups. However, the tensions triggered both analysts and account managers to reflect on their knowing practices and to explicate what kind of knowledge mattered to them and how this was generated. In other words, the actors expressed their epistemological views, which were embedded in their practices. By illustrating the epistemological differences and how the clash of different epistemologies unfolded, the study develops further the notion of pragmatic boundaries and thus adds to the literature on knowledge collaboration (Bechky, 2003; Carlile, 2002, 2004; Majchrzak et al., 2012).

Furthermore, the case of analytics informs the research in knowledge collaboration by looking at how two groups try to integrate their knowing practices to perform the same practice. The literature on knowledge collaboration has traditionally looked at the collaboration between people from different communities of practice, who work in silos (Bechky, 2003; Bruns, 2012; Carlile, 2002, 2004). In the case of introducing analytics in Sales Medium at TelCo, the analysts and account managers had to integrate two different ways of doing the same practice, i.e. managing customers and generating leads. Whereas for the analysts this would be done with the use of the CLM model, for the account managers it entailed sustaining a personal relationship with their customers. Similar phenomena could emerge in other cases where analytics is introduced as a new epistemic way for performing a practice that already exists, such as introducing analytics to human resource practices (Davenport et al., 2010). Another area where this could be observed is the introduction of algorithmic ways of working in organizational practices, such as introducing algorithms in the practice of architectural design (Whyte et al., 2015).

Finally, the study at TelCo sheds light on the complexities that arise when organizations attempt to automate part of knowledge work with algorithms such as those involved in analytics artifacts. The datafication of everything nowadays has led to the development of techniques that can analyze vast amounts of data to yield patterns that cannot be explained, yet can trigger organizational action (McAfee & Brynjolfsson, 2012). However, as Newell (2014: 13) points out, such algorithmic approaches are always based on rules that are 'black-and-white', while in knowledge work what is the 'right thing to do' in a particular situation often requires value judgments that need to be performed on the spot and that include a more complicated thinking process than navigating through 'black-and-white' rules. The epistemological perspective taken in the study at TelCo illustrates the tensions that emerge in such instances, and raises concerns to the IS literature that considers IT as an actor in knowledge work (Newell, 2015).

### **5.2.3 Future research on knowledge collaboration**

This research could be extended in various directions concerning the field of knowledge and knowledge collaboration. First of all, the study at TelCo showed that only one epistemology prevailed inside TelCo, that of analytics. It would be interesting to study how the practice of customer management is performed in this way, without the relational expertise of account managers. Also, it would be useful to study whether the employees at the business partner organizations have fully embraced the epistemology of analytics, or whether they have developed other knowing practices that entail a different epistemology. In addition, the general developments at TelCo towards cutting costs (while dealing with difficult economic times for the telecommunications industry) influenced the turn of events. Further research should be performed in order to investigate whether different epistemologies can ever be reconciled, and how this could be achieved.

Overall, more research is needed to understand how humans work together with analytics and other technological artifacts such as algorithms and robots, and how they morph their ways of knowing as they become entangled with them in their sociomaterial practices (Orlikowski, 2010). More sophisticated tools are nowadays entering the organizational settings: robots in the field of healthcare, big data analytics in journalism, algorithmic design in architecture, and artificial intelligence websites that build themselves, cover a few examples of how breakthrough technologies that are currently introduced in organizational practices challenge the established ways of knowing for the actors involved (Newell, 2015). The material enactments of such technological artifacts are performative (Orlikowski & Scott, 2014, 2015), i.e. they are consequential for the outcomes that they produce, and reconfigure the organizational practices and processes that they relate to. Studying the sociomaterial practices in which humans are entangled with such technological artifacts could yield new insights, not only on how knowing practices evolve

(Nicolini et al., 2003; Orlikowski, 2002; Thompson, 2005); but also, on how individuals are embodied (Haraway, 1991) in a world infused with digital artifacts; or how expertise is enacted (Collins & Evans, 2007; Lave & Wenger, 1991; Ribeiro & Collins, 2007) in a sociomaterial practice in which knowing is enmeshed with data analytics and algorithmic ways of generating knowledge.

#### **5.2.4 Practical implications**

The insights from chapter 2 in the context of knowledge collaboration (Bechky, 2003; Carlile, 2002, 2004; Majchrzak et al., 2012) are relevant for analysts and managers who want to introduce analytics in the organization. First of all, managers need to realize that implementing analytics requires the collaboration between analysts and users. The initiative will most probably fail to leverage the promised advantages of analytics, if the analysts design the analytics artifacts in silos, separate from the users. Analysts need to work together with the users in order to morph organizational practices in a way that they will embed an amalgam of their different ways of knowing.

The study at TelCo showed that the introduction of analytics might be problematic if the users have a different epistemology from the epistemology advocated by the analysts who introduce the analytics artifact. Managers should be aware that effortful work is needed to bridge the different epistemologies. Training and other change management initiatives will be necessary for introducing analytics to the users, who will have to understand how it can support them in their work. But also, the analysts will have to invest time in understanding the knowing practices of the users, so that they can think from their perspective about what kind of knowledge matters and how this could be best generated with the help of analytics. In the case of TelCo for example, the analysts could have incorporated more data from the CRM system as input for the CLM model. They could have used natural language processing techniques that could process textual information stored by the account managers after interacting with their customers. For the account managers of TelCo, the situation of the customers changed very rapidly, thus they would often find the information of the CLM model outdated. An infrastructure that would enable real-time analytics could have overcome this issue. Overall, the analysts need to engage in continuous collaboration with the users. Implementing analytics is a dynamic process that always involves taking into consideration the knowing practices of the users, in order to make the analytics artifacts as useful as possible for them. One way for trying to understand the epistemology of the other group could be to spend some time in their function, in order to observe and practice their work. For example, the analysts could spend a week next to the account managers, to observe how they contacted the customers and even to contact some customers and try to generate leads. Practicing the

other group's practice might offer more insights on their way of working and possibly on their epistemology too.

## **5.3 Insights from chapter 3: The performativity of transparency**

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### **5.3.1 Key findings and response to the overall research question**

Chapter 3 unpacked the phenomenon of transparency that is afforded by analytics, as well as digital technologies in general. Transparency has been an important concept for management of organizations (Bennis et al., 2008; Bernstein, 2012; Hood & Heald, 2006), as it constitutes casting light upon behaviors, activities, routines, output and performance that emerge (usually) at the lower hierarchical levels of organizations, which would otherwise remain concealed (Roberts, 2009). The field of information systems has been concerned with the transparency afforded by digital technologies, as the data generated by digital technologies help observe organizational processes and employees' actions in real time. Data can also be stored for later investigation and thus can increase visibility and disciplinary power (Elmes et al., 2005; Leonardi et al., 2010; Zuboff, 1988). Chapter 3 focuses on how account managers rendered their actions visible through the use of the Customer Relationship Management system in TelCo Marketing & Sales. The CRM system included several analytical features that offered visibility to multiple stakeholders in real time, while it also informed about past actions and performance and it helped construct predictions about the future. The study takes a sociomaterial practice lens (Orlikowski, 2010) and focuses on how sociomaterial practices are temporally enacted, using the chordal triad of agency approach (Emirbayer & Mische, 1998), in order to illustrate how transparency and the lack thereof (i.e. opaqueness), emerge through the daily actions of account managers, while using the CRM system for managing their sales work.

The main finding of this chapter is that transparency is performative, in the sense that the action of making an object (artifact, action, information etc.) visible can change the object that is rendered transparent. More specifically, in the study at TelCo we saw that transparency was sociomaterially constructed in the interactions of the account managers and other stakeholders (sales managers, sales specialists, analysts, marketers) with the CRM system. Through the enactment of the CRM system, transparency could refer to transparency in the present, i.e. providing real-time observation of actions and relevant information; transparency in the past, i.e. providing historical overview of past actions and past performance; or transparency in the future, i.e. helping manage expectations and project future performance. Depending on their temporal orientation towards past, present, or future, the account managers would use the CRM system while being

influenced by the transparency that was afforded, and could submit data that would sometimes make their actions and information transparent, while at other times it would make them opaque. Thus, transparency triggered sociomaterial practices that revealed or concealed information about the actions of account managers and their customers.

As far as the main research question of this research is concerned, this chapter suggests that organizational members may use analytics in ways that could render their actions opaque rather than transparent, by “playing with the numbers” and with other data that is stored and later analyzed by the models. The notion of transparency is sociomaterially constructed through the enactment of analytics, and it is performative, thus it is consequential for how organizational members further enact the technology of analytics.

### **5.3.2 Theoretical implications for taking a performativity perspective to study technology in organizations**

Chapter 3 contributes to the literature on transparency in organizations. Transparency in general has been considered to be an effective way for governing organizations (Hansen & Flyverbom, 2015; Knorr Cetina & Bruegger, 2001) and researchers on the field of information systems have suggested that digital technologies can serve as an information panopticon in the organization (Burton-Jones, 2014; Zuboff, 1988), by providing visibility of information about employees' actions and performance. However, more recent perspectives question the role of transparency in organizations (Bernstein, 2012; Hood & Heald, 2006), and suggest that employees try to find ways to deal with the requirement to render their actions visible in order to attain efficiency (Berente & Yoo, 2012; Bernstein, 2012) or to manage impressions (Cunha, 2013).

The study at TelCo adds to those latter studies on transparency, by suggesting that the material enactments of the transparency practices are performative. More specifically, it suggests that the sociomaterial practices through which organizational members make their actions visible reconfigure the world and thus they are consequential for how those practices will be enacted in the future. In other words, the ways in which organizational members interact with digital technologies and generate specific data in order to render their actions transparent or obscure, actively perform specific inclusions and exclusions that reconfigure reality, and direct the attention to specific actors and outcomes. These reconfigurations further influence the way people will interact with the same technologies in the future. These insights contribute to the literature on transparency, by suggesting that it is performative and thus influences the way people try to make their actions visible.

In addition, the insights from chapter 3 are more generally relevant to the recent tendency towards taking a performative perspective to study technology in organizations (Orlikowski & Scott, 2014, 2015). Performativity has been recently taken up by

organizational scholars in the study of organizational routines (Feldman & Pentland, 2003), financial markets (Mackenzie, 2006), material-discursive practices of valuation (Orlikowski & Scott, 2014), the use of narratives in entrepreneurial innovation (Garud, Gehman, & Giuliani, 2014), rational decision making (Cabantous & Gond, 2011), and so on. In the context of studying technology in organizations, performativity can be viewed from the perspective of “sociomateriality mattering” (Gond et al., 2015), which draws on gender studies and post-humanism (Barad, 2003, 2007), and Actor-Network Theory (Latour, 2005), and views reality as a practical accomplishment. From this view, reality is enacted, and constantly reconfigured in ongoing sociomaterial practices (Barad, 2007). The study at TelCo helps further understand the notion of performativity by highlighting the temporality that is inherent in this process. More specifically, the reality that is reconfigured has a temporal dimension, and the enactments of sociomaterial practices can draw the attention towards the past, present, or future while performing different consequentialities. For example, the interaction of an account manager with the weekly blind spots report draws the attention to the pressure that is experienced in the present, and triggers further interaction with the system, in which the account manager stores fake leads in the system to avoid having blind spots in next week's report.

### **5.3.3 Future research on analytics and performativity**

In the study at TelCo, the CRM system allowed for the account managers to change data entries without leaving any trace. This feature was important in reinforcing the freedom with which they would often be opaque while storing data about sales opportunities, as they could change the data entries at a later stage without showing the previously stored data somewhere. Future research could be performed with a digital technology with features that increase its disciplinary power, in order to study how this would influence the practices through which people try to conceal information.

In addition, the study at TelCo alluded to the fact that to some extent opaqueness was tolerated by higher management, as it allowed them to have interpretative flexibility not only during performance evaluation (specifically in the estimation of targets), but also in their actions of accountability towards TelCo's shareholders. Although we could illustrate how the materialized practices of performance evaluation influenced the employees' practices of visibility, we could not explain why those performance management practices were formed in this way in the first place. This triggers further research to investigate the way digital technologies materialize practices of performance management and accountability. Also, this indication suggests that information from the CRM system had symbolic value (Feldman & March, 1981), not only in terms of how it was produced by the account managers, but also in the way it was used by higher management. It would be

interesting to study what would happen if the materialization of practices of visibility and performance evaluation increased the substantive production and use of this information.

Furthermore, the developments on Big Data (McAfee & Brynjolfsson, 2012), with which vast amounts of data collected from very different sources can be collected, aggregated and analyzed, bring new insights for the field of transparency, as they produce representations that are mobile and often publicly available (Hansen & Flyverbom, 2015; Zuboff, 2015). Further research could take this direction and study how the material enactment of transparency changes in the Big Data era, and how this reconfigures practices of accountability and performance evaluation.

Another interesting direction would be towards the introduction of algorithmic ways of working (Hansen & Flyverbom, 2015; Kallinikos & Constantiou, 2015; Orlikowski & Scott, 2015), which are assumed to leave less space for freedom and creativity in acting for individuals, and often generate automated digital traces of the actions. Taking a performativity perspective, it would be interesting to study how sociomaterial practices of transparency and accountability are performed in such contexts.

Finally, this study invites organizational scholars to follow the “performative turn in organization studies” (Gond et al., 2015: 20), and to take into consideration the ontological assumptions of sociomateriality. Studying how entities are constituted while they are performed in sociomaterial practices might help us gain a richer understanding of complex phenomena in organizations and organizing.

#### **5.3.4 Practical implications**

The findings of chapter 3 regarding the performativity of transparency are relevant to managers who rely on digital artifacts to evaluate their employees, as well as to the developers of those digital artifacts. The features of digital technologies, combined with the way organizational members are evaluated, will have a significant impact on how the technology will be enacted and may reinforce opaqueness rather than transparency. The digital technology should be designed while taking into consideration the practices of performance evaluation in the organization, as these will influence the way people use the technology. For example, in the case of TelCo, producing a digital trace every time the account managers edit the sales opportunities stored in the CRM system could prevent some of the “numbers games”, as the account managers would be aware that they cannot hide their practices of making some things opaque.

However, more generally, managers should be aware that the evaluation of employees' performance based on quantifications could trigger employees' efforts to influence those quantifications, e.g. by using the digital technologies accordingly. The “numbers games” that we discussed in chapter 3 are common in organizational settings where employees are evaluated based on rankings and other quantifications, such as in professional

services firms. Those findings require further reflection on the future issues that may arise from the practices of datafication, quantification, and algorithmic decision making (Newell & Marabelli, 2015) in the management of human resources, and suggest that managers should perform such practices with caution. But also, the findings trigger managers to reconsider their evaluation practices, such as using rankings and target-oriented evaluations, as those can cause perverse effects on their employees' practices.

## **5.4 Insights from chapter 4: The unintended consequences of symbolic adoption**

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### **5.4.1 Key findings and response to the overall research question**

Chapter 4 analyzed the symbolic actions through which the account managers tried to conceal their non-conformity with using the analytics artifact (the CLM model). The study at TelCo showed that these symbolic actions had unintended consequences for the account managers. First, they contributed to the institutionalization of the CLM model in the Sales department, while later they also started influencing the actual practices of the account managers. In order to make sense of this phenomenon, chapter 4 turns to institutional theory (Barley & Tolbert, 1997; Meyer & Rowan, 1977; Tolbert & Zucker, 1983) and specifically to micro-institutional foundations (Elsbach, 2002; Kellogg, 2009; Lok & De Rond, 2013) and tries to unpack the process of symbolic adoption, which has been black-boxed so far by institutional theorists (Bromley & Powell, 2012; Collings & Dick, 2011; Kostova & Roth, 2002). More specifically, the study follows a process research approach (Langley, 1999) to investigate how actions of symbolic adoption influence the process of institutionalization, and what unintended consequences arise for the actors who perform them.

In the analysis we distinguished the pragmatic actions of the actors, which were performed for substantive reasons, from their symbolic actions, which were performed in order to attribute different meaning than their substantive one, to direct attention away from certain facts and towards others, in order to serve specific interests (Brown, 1994). The account managers performed symbolic actions (such as registering the CLM code symbolically when storing leads in the CRM system) with the goal to conceal their non-conformity with the CRM system. However, their symbolic actions triggered other symbolic actions from the analysts (e.g. showing the registration numbers to higher management to prove that the CLM model was effective). It was this interplay of symbolic actions that had impact on the institutional level, such as establishing the rule that the CLM model should be a standard way of working. While the symbolic actions unintendedly (for the account managers) influenced the institutional level, they also reinforced more

symbolic actions of concealment, as there was higher pressure for the account managers to appear as if they used the model. Later, as the CLM model was becoming institutionalized, the changes on the institutional level started having stronger impact on the actual practices, as for example the account managers that lost their jobs felt that the model was replacing them.

In response to the main research question of the doctoral thesis, this chapter suggests that actors may use the technology of analytics only symbolically, in order to conceal their resistance, and to appear as if they comply with the pressure to use analytics to act more rationally. However, the study shows that these symbolic actions can have unintended consequences, such as making the technology more and more embedded in the organization, and influencing the organizational practices in the realm of pragmatic action.

#### **5.4.2 Theoretical implications for the role of symbolic adoption in institutionalization processes**

Chapter 4 contributes to the field of institutional theory (Barley & Tolbert, 1997) and specifically to micro-institutional foundations (Elsbach, 2002; Kellogg, 2009; Lok & De Rond, 2013), by investigating the role of symbolic adoption (Collings & Dick, 2011; Kostova & Roth, 2002) in the process of institutionalization (Barley & Tolbert, 1997). The study shows that not only pragmatic actions (Lawrence et al., 2013; Lok & De Rond, 2013; Sminia, 2011), but also symbolic actions (Brown, 1994) can influence the creation of institutions. This can happen when symbolic actions of concealment interplay with other symbolic actions, such as the ones performed for impression management. This interplay can influence the institutional order, but it can also cause changes on actor's practices on the realm of pragmatic actions.

In addition, the study unpacks the process of symbolic adoption, through which actors conceal their non-conformity with the institutional pressures (Oliver, 1991). This process has often been black-boxed in the large organizational sector studies on institutional theory (Boxenbaum & Jonsson, 2008; Scheid-Cook, 1992). The study suggests that an endogenous process emerges through which the actions of symbolic adoption (unintendedly) influence the institutional order, while they are also reinforced by the unintended consequences that they induce –as the symbolic adopters have to continue appearing as if they have actually adopted the new practice.

Finally, the study contributes to theories of institutional change (Dacin et al., 2002; Kellogg, 2009) by illustrating how the new epistemic practices of acting based on data and analytics can influence the emergence of institutions. In the case of TelCo, the decision of higher management to establish the CLM model as the standard way of working was based on the registration data from the CRM system that the analysts had presented, which

however did not represent the way the account managers had actually worked to generate the leads stored in the CRM system with the CLM code. Thus, such new epistemic ways may foster a myopic process for the emergence of institutions.

### **5.4.3 Future research on institutional theory**

An interesting direction for future research based on the insights of chapter 4 would be investigating further the role of digital technologies and the epistemic practices that they afford, in the emergence of institutions. The field of institutional theory and specifically the research on institutional work (Battilana & D'Aunno, 2009; Lawrence et al., 2013; Lawrence, Suddaby, Clegg, Hardy, & Nord, 2006) have been interested in better understanding the role of materiality in the creation of institutions (Raviola & Norback, 2013). Studying how the enactment of analytics and big data practices can influence the institutionalization process could offer interesting insights to that conversation.

Furthermore, the study at TelCo shows that symbolic actions can unintentionally make the technology more and more embedded in the organization, and can influence the organizational practices in the realm of pragmatic action. More research could be performed to study what happens after the analytics approach becomes substantive in the organization, and how organizational members change their practices for knowledge creation as well as the way they make decisions.

In addition, it would be interesting to emphasize more the power dynamics (Fleming & Spicer, 2014) between the symbolic adopters and the actors who try to institutionalize the new practice. A power lens could highlight how the interest struggles evolve, while influencing and being influenced by the symbolic actions.

Finally, this study turns scholars' attention back to the literature on symbolic actions (Brown, 1994), and to the field of symbolic management in general (Alvesson & Berg, 1992; Pfeffer, 1981), which had evolved in the past decades. The study discusses the unintended consequences of symbolic actions in relation to the process of institutionalization. Future research could consider other types of unintended consequences, such as how those symbolic actions may influence the culture of the organization.

### **5.4.4 Practical implications**

The findings from chapter 4 in the context of introducing a new technology within an organization are relevant to managers who are in the position of taking the related decisions. The study at TelCo shows that employees may perform symbolic actions to appear as if they use the technology, whereas in practice they refuse to embed it in their practices. The decisions of TelCo's higher management to enforce the rule for using the

CLM model and to continue using it after the reorganization of Sales were based upon the leads that had been stored in the CRM system with the CLM code by the account managers, in their effort to conceal their non-conformity. This myopic process could lead to severe losses in the future, as the effectiveness of the CLM model hadn't been actually tested yet. Consequently, managers should be aware that exerting too much pressure on the employees could lead them to perform symbolic actions, in order to direct the attention away from their actual resistance. Furthermore, they should realize that they should not rely solely on data to decide whether the new technology should be used by their employees. Spending some time on the work floor next to the employees, to understand how they actually work, could lead to better decisions regarding the applicability of the new technology.

## **5.5 Boundary conditions of the findings**

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In sections 5.2-5.4 I have presented the key findings of my research, organized in three sub-topics: the emergence of epistemological clashes with the introduction of analytics in an organizational setting; the performativity of transparency as this is sociomaterially constructed in the interaction of organizational members with digital technologies and their analytical features; and the unintended consequences of symbolically adopting analytics. Together, the findings of my study help better understand how the technology of analytics is enacted in sociomaterial practices, in the organizational quest for rationality, under certain boundary conditions. The findings trigger implications for theory and practice, and inform directions for future research. In this section I discuss the boundary conditions of those findings.

This study was performed under certain limitations, which need to be discussed in order to consider the boundary conditions of the findings. First of all, the data regarding the first 14 months of introducing the CLM model in TelCo Sales was collected retrospectively, and thus lacked the real time observation of the account managers' first encounters with the CLM model, and their tensions with the analysts. I tried to overcome this limitation by triangulating the information between multiple respondents (from different roles and different teams) and between multiple sources (documentation was used next to the interview data). Also, due to confidentiality reasons it was not possible to follow the account managers in their visits to the customers. In order to better understand this part of their practice, I had to rely on their descriptions and compare the descriptions amongst multiple respondents.

Furthermore, I had limited encounters with the directors of TelCo (two interviews in total), which limited the richness of the data regarding their involvement in the tensions between the account managers and the analysts. This was the main reason for which the

power struggle was not thoroughly analyzed in this thesis. In addition, this was one of the main reasons for which it was difficult to prove that to some extent opaqueness was tolerated by higher management, although it was often implied by multiple respondents, including one of the directors. This also limited the analysis of the interplay between the performance management system and the CRM system, since we were able to investigate how the materialized practices of performance evaluation (specifically the estimation of targets) influenced the employees' practices of visibility, but we could not give a detailed account of why those performance management practices were formed in this way in the first place.

Finally, the second reorganization that was announced in TelCo in December 2014 led to the layoff of my main contact person from TelCo a few months later. This event, combined with the time limitations of my doctoral thesis, led to concluding my data collection in March 2015. Therefore, my insights miss the long-term perspective of what happened to TelCo Sales after outsourcing all Sales Medium activities to the business partner organizations. In addition, due to confidentiality reasons it was not possible to get access to the business partner organizations, in order to study how their employees used the insights of the CLM model. This prevented us from investigating whether the employees at the business partner organizations embraced the epistemology of analytics in their practices, or whether they adopted it only symbolically, like the account managers.

One boundary condition of the findings concerns the rapid developments that happened in the organizational structure of TelCo at the time of the study. TelCo was in a very dynamic state due to the several reorganizations taking place, thus it was hard to identify causality between the layoffs of the employees and the expansion of the CLM model. Whereas it would be probably naive and very technological-deterministic to suggest that the CLM model caused the layoffs in the Sales Medium, the analysis illustrates how the necessary organizational changes (related to costs reduction and simplification of processes) offered a prosperous ground for the analysts to expand analytics to other sales channels.

Another boundary condition is related to the setting in which analytics was introduced. In the sales department, the different epistemologies between the account managers and the analysts were easier to compare, since the knowing practices between the two groups were very different. I would expect to observe similar differences in epistemologies in other settings in which the knowing practices of employees are different from the algorithmic way of generating knowledge that analytics entails, e.g. in education or design. However, the generalizability of these findings to other settings in which the differences between epistemologies are expected to be less distinct, cannot yet be answered. It would be interesting to perform future research in such a different setting, e.g. in a technological startup company, in which the employees may have more related

background on the use of digital technologies, and less recognizable differences in their knowing practices from those of analytics.

Finally, the bureaucratic structure and the culture of TelCo constitute another boundary condition of the findings here. More specifically, the findings of chapter 3 regarding the numbers games might have been different in a smaller organization with a flat structure, in which the higher management may be situated closer to the employees and evaluate them more by observing them in their work rather than by using quantifications. Likewise, the findings of chapter 4 regarding the influence of the actions of symbolic adoption on the institutionalization of the CLM model could have been different if the study had been performed in a smaller organization, in which the higher management would have a better idea of how their employees work on a daily basis.

## **5.6 Theoretical implications for the field of rationality and directions for future research**

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### **5.6.1 Implications for the field of rationality**

In the introductory chapter of this thesis I presented how organization theorists have approached rationality since the field of organization theory started developing. Pure rational choice theories suggest that choices are made based on perfect knowledge of all alternatives, consequences and preferences following the rule of maximizing (March, 1994). Theorists have critiqued this notion from different perspectives. In table 1.3 I reviewed critiques of rationality that are both inherent in theories of rational choice, suggesting that actors are intendedly rational but in practice they do not reach perfect rationality, as well as external critiques from other theories. Despite those critical perspectives, rationality has been established as a normative ideal for action and justification by both organization theorists and practitioners (Cabantous & Gond, 2011; Jarzabkowski & Kaplan, 2015; March, 2006). Several tools, known as technologies of rationality (March, 2006), have been developed to help reach favorable outcomes, by providing a model-based estimation of the anticipated consequences and their likelihoods for occurring. I suggested taking a sociomaterial practice perspective (Feldman & Orlikowski, 2011; Nicolini, 2012; Orlikowski, 2007) in order to study how such tools of model-based rationality are actually used in organizations, and to better understand how organizational actors enact rationality in their practice. In this context, the findings of my thesis become relevant to the field of rationality.

In table 5.2 I review how the findings of my study at TelCo contribute to the academic discourse on rationality, and specifically to the critiques that were summarized in table 1.3. The purpose here is not to provide a response to all those different theoretical

perspectives, but rather to suggest how the different conversations around rationality could be further informed by taking a sociomaterial practice perspective on rationality.

**Table 5.2 Contribution of the doctoral research to the critical perspectives on rationality**

	Theoretical perspectives	Critiques on rationality	Relevance of the theory to technologies of model-based rationality	Insights from the sociomaterial practice lens	Contribution of chapters 2, 3, 4 of this thesis
Inherent critiques in theories of rational choice	Bounded rationality (March & Simon, 1958; Simon, 1947)	While individuals are intendedly rational, their choices are based upon incomplete information due to limited cognitive capabilities and information constraints.	The tools help organizations reach favorable outcomes, by providing a model-based estimation of the anticipated consequences and their likelihoods for occurring, based on past experiences. The preferences are associated with the best interests of the firm. The tools are inappropriate for complex situations. They could reinforce a myopic adaptive process. (March, 2006)	Preferences and criteria are situated in the sociomaterial practices.	<i>Chapter 2 illustrates how the preferences and criteria are situated in the sociomaterial practices.</i>
	Political models (Cyert & March, 1963)	Individuals are intendedly rational, but because they have conflicting goals organizational choices are the results from negotiating between self-interested individuals and represent the interests of the most powerful actors.	The preferences in the model-based assessment are associated with the best interests of the powerful actors. (Jarzabkowski & Kaplan, 2015)	Practices and their temporal and spatial configuration produce and reproduce power differences, conflicts, and inequalities (Nicolini, 2012), which may be manifested when organizational choices need to be made.	<i>Chapter 2 shows that people involved in different practices will have different views of what is the most rational way of acting, and that can lead to tensions and clashes. Chapter 3 illustrates how the different interests of the actors influence the information that is analyzed by the analytics artifacts, thus influencing the course of further actions.</i>
Critiques in theories that criticize the normative ideal of	Organized anarchy/garbage can model (Cohen et al., 1972)	Choices are made independently of any individual rationality. Choice opportunities, decision makers, problems and solutions are matched depending on the times that these arrive on the scene and the possibilities available at those times.	The actors may choose the first tool that they know how to use and that seems to fit the situation at hand, instead of searching for the most appropriate tool to use. (Jarzabkowski & Kaplan, 2015)	The performativity of tools of model-based rationality will also influence the way choice opportunities are matched to problems.	<i>Chapter 4 shows how the analytics insights are part of the sociomaterial configuration of the garbage can model. Solutions are matched to problems during the interaction of human actors with analytics artifacts.</i>
	Action rationality (Brunsson, 1982, 1990) / Organizations as action generators (Mintzberg & Waters, 1985; Starbuck, 1983)	Irrationality, which entails the analysis of few alternatives, the consideration of only positive consequences of the chosen actions and the retrospective formulation of objectives, is often necessary to mobilize organizational action or to allocate responsibility to organizational actors. Decisions are often taken	While these theories do not refer to technologies of rationality explicitly, based on their perspective we would assume that actors might choose to use tools of model-based rationality only when these indicate positive consequences for the action they want to perform. Alternatively, actors might choose the tools that indicate as best	The actors are not separated from the tools of model-based rationality. Instead, they shape their patterns of actions while they are entangled with different tools of model-based rationality that are part of their practices.	<i>Chapter 3 illustrates the entanglement of actors with tools of model-based rationality and how actors shape their actions through a recursive relationship with those tools.</i>

	after the actions are performed, to justify the corresponding actions.	choice the action that they already performed.		
Interpretative perspective on rationality (Chia, 1994; Laroche, 1995; Weick, 1995)	Rationality is understood as a social construct: decision making does not constitute a rational choice between alternatives, but rather a post-hoc rationalization of actions that were already performed, necessary for individual and collective sensemaking.	Tools of model-based rationality can be used by actors to solve issues of pluralism of viewpoints or to make controversial decisions acceptable by all actors. (Denis et al., 2011; Jarzabkowski & Kaplan, 2015)	Because cognition and knowledge are situated in the practices, tools of model-based rationality and their insights may not be understood in the same way by actors involved in different practices.	<i>Chapter 2 shows that tools of model-based rationality and their insights are interpreted differently by actors involved in different practices, thus they cannot be used for collective sensemaking.</i>
Rationality as a symbolic construct (Feldman & March, 1981; Langley, 1989)	Organizations try to appear as if they are rational to acquire legitimacy for their activities. Because information symbolizes a commitment to rational choice (Feldman & March, 1981), they engage in conspicuous consumption of information and formal analysis.	Organizational actors adopt tools that support the technology of rationality to appear as if they are rational.	The ideal of rationality is performed by sociomaterial practices in which actors produce and reproduce what is considered to be rational.	<i>Chapter 4 shows the process through which the symbolic use of analytics results in establishing it as the normative ideal for rational action in the organization, influencing the organizational practices.</i>
Technology of foolishness (March, 1988)	Rational choice is counterintuitive when it comes to innovating. Sometimes organizations need to take actions without having a good reason, in order to unleash creativity and innovation.	Technologies of model-based rationality in complex situations could be seen as sources of exploration. But when actors attend to feedback from experience because of the low returns it will often bring, they will refrain from using the technology. (March, 2006)	Opportunities for exploration may emerge even when the intention is not to use such tools to innovate, through the interaction of people with tools of model-based rationality that are part of their organizational practices.	--

More specifically, chapter 2 contributes to the inherent critiques on rationality, namely bounded rationality (March & Simon, 1958; Simon, 1947) and political models of organizational action (Cyert & March, 1963), which assume that actors are intendedly rational. Indeed, both groups of analysts and account managers were following means-ends rationality in their actions. Although they employed different epistemologies, one cannot conclude that one group acted more rationally than the other. However, the two groups had different preferences and criteria that influenced their actions. Those preferences and criteria were situated in their practices, which were quite different. Thus, there was controversy over what was needed to act rationally: the analysts believed that sophisticated analytical models were important in order to be rational, while the account managers believed that the interaction with the client was fundamental in informing their course of action. The study illustrates how these differences over what is the most rational way of acting led to tensions between the two groups, which made their collaboration problematic. Furthermore, chapter 2 also contributes to the discussion on the interpretative perspective on rationality (Chia, 1994; Laroche, 1995; Weick, 1995),

which conceives of rationality as a social construct, formulated as a post-hoc rationalization of actions that were already performed, necessary for individual and collective sensemaking. Chapter 2 shows that actors involved in different practices understand analytics tools and their insights differently. Thus, analytics is not always applicable for reinforcing collective sensemaking, but it depends on the practices of the people involved and whether these afford a similar understanding of the insights.

Chapter 3 also contributes to the discussion on political models of organizational action (Cyert & March, 1963), by illustrating how the different interests of the actors influence the information that is imported into and analyzed by the analytics artifacts, thus influencing the course of further actions. The study illustrates how account managers, in their interaction with the CRM system, would store different information depending on the temporal orientations and the ends they were directed to. This information would later be analyzed and would influence future choices and actions, e.g. how the targets of the following year would be assigned to the account managers. In addition, chapter 3 also contributes to the discussion on action rationality (Brunsson, 1982, 1990), which assumes that decisions are taken after the actions are performed, with the goal to justify the corresponding actions. From the perspective of action rationality, one would expect that tools of model-based rationality would be used only to justify actions that were already performed. In chapter 3 we see that actors are entangled with tools of model-based rationality and that they shape their actions through a recursive relationship with those tools. More specifically, the account managers would shape their actions (being transparent or opaque) in their recursive relationship with the CRM system, and specifically with the analytical features of the system, such as the automated performance reports. The technology of rationality was not separate from their actions but it would shape –and it would be shaped by– them.

Chapter 4 contributes to the view of rationality as a symbolic construct (Feldman & March, 1981; Langley, 1989), according to which organizations engage in conspicuous use of information and formal analysis, in order to appear as if they are rational, in their attempt to acquire legitimacy. Chapter 4 shows the process through which the symbolic use of analytics results in establishing analytics as the normative ideal for rational action in the organization. The symbolic actions that the account managers performed to conceal their non-conformity with using the CLM model, triggered some of the symbolic actions of the analysts, who tried to create the impression that the CLM model was effective. This resulted in institutionalizing the CLM model, and establishing it as the most rational way for doing customer management. Moreover, chapter 4 contributes to the theory of organized anarchy (Cohen et al., 1972), according to which choice opportunities, decision makers, problems and solutions are matched depending on the possibilities available at those times. The process through which the higher management decided that the CLM model should be established as the standard way of working for the account managers

resembles a garbage can model. Higher management needed to bring more structure in the way work was done in the Sales Medium, in order to increase efficiency. When the analysts presented the analysis of the leads registered in the CRM system with the CLM code, the CLM model appeared to be an effective solution for efficiency. Without having exhausted the list of alternatives, the CLM model was matched to a problem that was looking for a solution. Hence, chapter 4 shows that the analytics insights are part of the sociomaterial configuration of the garbage can model. Solutions are matched to problems during the interaction of human actors with analytics artifacts.

In sum, my research illustrates how rationality is constructed in a world comprised of sociomaterial practices. Taking a sociomaterial practice perspective on rationality indicates that what is considered to be a rational way of acting emerges in the sociomaterial practices of actors. My analysis of the study at TelCo shows that the material enactment of rationality is performative: rationality (and specifically its constitutive elements such as which goals matter most, and which decision rules will be used) is configured while the actors are performing a practice, and this act of configuring is consequential for how the practice will be reconfigured and how it will be performed in the future. In other words, rationality is both shaped by as well as shapes sociomaterial practices. Taking that into consideration, one can better understand why tools of model-based rationality are enacted differently in different practices and influence people's choices and actions in various ways. This can be added to the challenges identified by March (2006) on the technologies of model-based rationality, as it is not straightforward how technologies of model-based rationality support organizations' exploitation processes (March, 1991), but it depends on the practices in which they are enacted.

## **5.6.2 Future research on rationality**

The study at TelCo has several theoretical implications for the field of rationality, as I explained in the previous sub-section. However, it also provides directions for future research in the academic discourses on rationality. In chapters 2 and 4 we saw that eventually the CLM model and the way of working that it entailed took over the practice of customer management in the Sales Medium. The way that the account managers considered necessary to employ rationality in customer management, i.e. the relationship with the customers, had to disappear. It is questionable how this will influence customer management in the future. As March (2006) has suggested, it could lead to a myopic adaptive process. More research could be performed to study how analytics, which is said to increase rationality by providing an exhaustive search for information, influences adaptation processes in practice (Levitt & March, 1988).

Furthermore, more research is needed to further understand the entanglement (Orlikowski, 2010) of humans with analytics artifacts and how this shapes the way

rationality is enacted. While chapter 3 illustrated the entanglement of account managers with the CRM system and its analytical features in the practices of registering information, it did not fully capture practices of decision making, e.g. how the top managers were entangled with the CRM system in their decisions for targets allocation. Future ethnographic research could be performed to study phenomena in which actors are entangled with analytics models and other tools of model-based rationality (Jarzabkowski & Kaplan, 2015) in practices that involve decision making, such as in the field of strategy.

In addition, future research could investigate how the notion of rationality in practice may inform the field of behavioral decision making (Ariely, 2008; Kahneman, 2003; Simon, 1959). Chapter 2 illustrates how the preferences and criteria for making choices are situated in the sociomaterial practices. This is in line with the theory of situated action (Suchman, 2007), which emphasizes the interrelation between an action and its social, cultural and physical environment. Whereas traditionally behavioral sciences such as behavioral decision making and behavioral finance view action as the result of actors' intelligible operation and processing of environmental stimuli, i.e. a cognitive process that could be abstracted and modeled, the theory of situated action views situated action as "tied in essential ways not to individual predispositions or conventional rules but to local interactions contingent on the actor's particular circumstances"(Suchman, 2007: 52) . Chapter 3 also shows how the actions of visibility performed by the account managers were tied to the phenomena (Scott & Orlikowski, 2014) experienced in the interaction with the CRM system at a specific moment. Those findings constitute indications of how account managers performed their actions, however they need to be extended in order to reach conclusions on how they may inform theories of behavioral decision making and particularly how they may be bridged with the perspectives of situated cognition (Lave, 1988) and situated action (Suchman, 2007).

Finally, one aspect that was not covered by the research at TelCo concerned the technology of foolishness (March, 1988). March (2006) suggests that technologies of model-based rationality are often ineffective in complex situations, yet they could be seen as sources of exploration. Future research could be performed to study how this could emerge in the case of analytics. This becomes interesting if we consider the automation that analytics entails in several organizational processes, making it challenging to understand how organizations can find innovative ideas and solutions while working with analytics (Brynjolfsson & McAfee, 2014). At the same time, the data mining techniques included in analytics do not require the analysis to be goal-directed, or have any pre-established goals in mind. In particular, big data analytics (Agarwal & Dhar, 2014) entails an inductive approach that can yield several unexpected patterns from the data. Big data analytics can provide opportunities for people to play with novel, unanticipated insights and engage in the technology of foolishness. This would be interesting to research, in

order to investigate how a technological artifact can be enacted to serve both the technology of rationality and the technology of foolishness in an organizational setting.

## **5.7 Practical implications for the pursuers of rationality**

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The findings of this thesis, in the context of technologies of model-based rationality (Jarzabkowski & Kaplan, 2015; March, 2006) and how they are enacted in sociomaterial practices, have several implications for practitioners who pursue rationality in their organizations. More specifically, the findings are relevant to analysts and other actors who are involved in the development of analytics, as well as to managers who decide to introduce analytics in their organizations.

Chapter 2 illustrates how the preferences and criteria are situated in the sociomaterial practices. Taking this into consideration, analysts should try to get a deep understanding of the practices for which they are designing the analytics models, and take into consideration the preferences and criteria of the users when designing those models. In addition, chapter 2 suggests that people involved in different practices will have different views of what is the most rational way of acting, and they may understand the analytics tools and their insights differently. Managers need to be aware of this, and expect that there might be a contestation over the different analytical models and how people view them in light of a choice that needs to be made. Although the different views of the models might cause tensions in the organizational setting, they could also trigger people to explicate their views of the analytics insights and help them better understand each other's practices. Thus, managers could use the analytics models as boundary objects (Carlile, 2002; Star & Griesemer, 1989) in cross-disciplinary meetings where decisions need to be made, by encouraging people to discuss their situated understandings of the analytics insights.

Moreover, chapter 3 illustrates how the different interests of the actors influence the information that is analyzed by the analytics artifacts, and in this way influence the course of further actions. Analysts and managers could find themselves in the pitfall of treating all data that is analyzed by the models as “hard facts”, and thus might consider the insights of the analysis as accurate information that should inform organizational actions. In practice however, a lot of data is sociomaterially constructed, e.g. when people have to estimate a value before they store it in the system. Similarly, in the case of TelCo, the account managers would often distort the “truth” by storing different values in the CRM system depending on the situation they were in. Even when the data is stored automatically (e.g. by producing a digital trace), there is a code behind the automatic generation of the data that determines what will be generated and stored for further analysis. This code has been constructed by humans involved in sociomaterial practices.

People often fall into the trap to consider data stored in the databases, data representations, analytics insights and so forth as “real facts”, without considering how these data were generated. Managers should be aware of the subjectivity of information that appears to be objective just because it has been produced by the analysis of data. While making a decision solely based on analytics may appear to be a rational decision, it could be irrational in practice. Developers and analysts should think of ways to triangulate the data sources, if they want to consider the data analysis results as objective.

Another point that managers should take into consideration is that analytics could lead to a myopic process of learning (Levinthal & March, 1993; March, 2006), as it focuses a lot on data that has already been collected by the organization, and it omits information that might exist “out there” but has not been captured in a database. This bias could lead to competency traps and might decrease the chances for exploration, while it makes organizational life too predictable. Managers need to be aware that they have to find ways to involve the technology of foolishness in the organization. Creating opportunities to trigger the playfulness needed to face the unknown is necessary, in order to explore new ideas and solutions.

## **5.8 Concluding remarks**

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In this doctoral thesis I studied what happens when analytics is introduced in the organization. I approached analytics as a technology of rationality, which is usually introduced in order to reach favorable outcomes following the normative ideal of rationality. In order to better understand the role of analytics in work and organizing, I took a sociomaterial practice perspective on rationality that helped me study how organizational members enact the technology of analytics in sociomaterial practices, in their quest for rationality.

I performed an inductive longitudinal qualitative study at TelCo, where I studied the introduction of analytics in the Sales department of the business market division. With this study I shed light on three phenomena related to the enactment of analytics: First, I investigated the epistemological clash that emerged between the analysts and the account managers, and found that it was difficult for the two groups to reconcile their different epistemologies. Second, I explored the sociomaterial practices through which account managers were rendering their actions visible while interacting with digital technologies and their analytics features. I found that those sociomaterial practices were performative, as they reconfigured people's further interactions with the digital technologies. Finally, I analyzed how the process of symbolically adopting the analytics artifact at TelCo triggered a series of unintended consequences for the account managers.

My findings shed light on how technologies of rationality are enacted in sociomaterial practices. Overall, this thesis suggests that more data and analytics do not necessarily entail more rational actions, because there can be different conceptions of rationality situated in the sociomaterial practices; because producing data for visibility can also have other performative consequences; and finally because information may often be used symbolically. The findings could help organizations that adopt the technology of analytics in their efforts to increase rationality, by highlighting how this is more complicated than merely adopting the technology.

The research performed in this thesis foregrounds the social and organizational aspects related to the technology of analytics, which have been overlooked thus far, as both scholars and practitioners get excited with the advantages of crunching the numbers. This thesis sets the stage for other studies to perform more research on how organizations deal with new epistemic ways such as analytics, big data and artificial intelligence. “Crunching the numbers” in order to understand their effects is necessary, before we put all our stakes on the computational power of those number crunching technologies.

Overall, I hope that the academic readers of this thesis will take away some theoretical insights to enhance and continue the scholarly conversations on the intersection of technology, work and organizing. Furthermore, I hope that the practitioners who read my analysis will feel better informed about how our actions configure and are reconfigured by the use of technologies of rationality, and specifically the technology of analytics.