Crunching the numbers Studying the enactment of analytics in an organization

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Introduction

"Data! Data! Data!" he cried impatiently. "I can't make bricks without clay!"

This famous quote by Sherlock Holmes in The Adventure in the Copper Beaches (Doyle, 1892) has been highly influential to data enthusiasts (Dykes, 2012), who maintain that analyzing data is essential for organizations to thrive in the 21st century. We have come to live in a world where almost everything (individual everyday actions, business actions and transactions, environmental events, and so forth) can be quantified and stored in archives, databases or even large data grids. Our interactions with ubiquitous digital technologies (such as making a query in the Google search engine or writing a review of a hotel in TripAdvisor) leave digital traces. Sensors can track any kind of information one could imagine: physical activities, mental and cognitive states, environmental variables, social variables, and other (Pantzar & Ruckenstein, 2015; Swan, 2013). The tremendous production of data has come hand in hand with the development of sophisticated techniques for analyzing it, such as predictive modeling and optimization (Bhimani, 2015; Davenport & Harris, 2007). Buzzwords like "analytics", "big data", and "data science" have deluged academic journals, tech conferences and media, and have reached the boardroom, as they appear to be necessary to achieve competitive advantage. As Sherlock Holmes suggested in the quote above, data –and the information produced by analyzing the data– is considered to be indispensable in order to make sense of the world, create theories, and make decisions. Our everyday and organizational practices are blended with data, quantifications, and insights from data analysis: We use recommendations when we shop online at various e-commerce applications. We make decisions on which hotel to book for our holidays based on ranking algorithms. In the universities, tenure and promotion decisions are taken based on rankings and quantitative impact factors that evaluate scholars' publications. In sports, players are selected based on optimization models. Organizations analyze transactional data to predict their logistics needs. *Analytics*, the

technology that includes practices, skills and techniques, such as predictive modeling and optimization, to extract actionable insights from data (Bose, 2009; Davenport & Harris, 2007), has attracted a lot of attention as the way to make faster and better informed choices (Davenport, Harris, & Morison, 2010).

This eagerness of organizations to ground their actions on analytics insights can be explained by the fact that *rationality*, i.e. choosing the optimal means to reach pre-established ends (March & Simon, 1958), has been established as a normative ideal for making choices in organizations (Cabantous & Gond, 2011; Jarzabkowski & Kaplan, 2015). Organizational members acknowledge the fact that it is difficult to achieve perfect means-ends rationality, and often see the advantages of other ways of acting such as making decisions based on emotions and gut-feeling (Kahneman, 2011), employing irrationality to mobilize organizational action (Brunsson, 1982), or following the technology of foolishness to unleash creativity and innovation (March, 1988). Nevertheless, they consider means-ends rationality as the reference point for decision making, and thus attempt to accomplish it, or to appear as if they accomplish it (Cabantous & Gond, 2011).

Taking rationality into consideration, the recent enthusiasm over analytics (LaValle, Hopkins, Lesser, & Action, 2010; McAfee & Brynjolfsson, 2012) can be explained in different ways. For example, one could say that people use analytics insights to enhance their cognitive capabilities and to make better-informed choices (March & Simon, 1958), or to reduce risk and uncertainty in their decisions through the prediction modeling and optimization techniques offered by analytics (March, 1994). A more critical approach would suggest that people use the information to appear more rational and legitimize their actions (Feldman & March, 1981). Numerous tools have been developed for helping organizations reach favorable outcomes and several procedures (such as planning, budgeting, strategic analysis, and operations research) have evolved following rationality as the fundamental way for guiding, justifying and interpreting actions (March, 2006). More specifically, such tools and procedures are designed with the notion that "action is or should be derived from a model-based anticipation of consequences evaluated by prior preferences" (March, 2006: 202). This notion has been conventionalized into the *technologies of rationality* (March, 2006), which help make choices based on model-based assessment of the likelihoods of possible future ends and of pre-established preferences among those ends.

Analytics, a technology of model-based rationality that has flourished recently, is presumed to optimize the selection of alternatives and to help increase rationality in organizational actions and procedures. *"Data is the new oil. Data is just like crude. It's valuable, but if unrefined it cannot really be used. It has to be changed into gas, plastic, chemicals, etc. to create a valuable entity that drives profitable activity; so must data be broken down, analyzed for it to have value."* Those words by Clive Humby in 2006 during a talk to the US Association of National Advertisers became quoted thousands of times in

articles and talks advocating analytics as the new trend that all businesses should follow (Thorp, 2012). Clive Humby is the founder of dunnhumby, the customer science company that became famous in mid-nineties for helping Tesco become the market leader in UK by launching the Clubcard loyalty program, which used analytics to gain data-driven insight into customer loyalty and behavior (Davenport & Harris, 2007; Schrage, 2014). Tesco's success radically transformed the retail industry and became the most popular example of the potential of analytics to create competitive advantage. More organizations jumped on the bandwagon of analytics, believing that this would help them gain more information to make better-informed choices and automate their business processes. However, Tesco's profits have been declining dramatically since late 2000's, while its reputation for competitiveness and creativity has collapsed. An article (Schrage, 2014) that was published in Harvard Business Review in October 2014, discussed Tesco's downfall and questioned the efficacy of predictive analytics to serve as competitive weaponry, provoking several reactions from big data and analytics evangelists.

While the availability of data and the techniques to process it and analyze it are sophisticated enough to reach the ideal of rationality in organizational actions, it is intriguing to study what actually happens when a technology like analytics comes into use in organizations. This is what I intend to do in this dissertation, where I am studying how organizations enact analytics in their quest for rationality. In order to reach theoretical insights from this phenomenon, I break open the black box of analytics, which thus far has been treated as a technological juggernaut (Zuboff, 2015). I take a practice-based perspective (Feldman & Orlikowski, 2011; Nicolini, 2012) that helps me divert from dualisms of cognition and action, material and social, and so on. I look at the sociomaterial practices (Orlikowski, 2007) in which people enact analytics, performing and shaping the notion of rationality at the same time. Through a longitudinal qualitative study in a telecommunications organization, I analyze the clash of different epistemologies of knowledge workers that emerges with the introduction of analytics; I look at how transparency is afforded by the technology and how it is reshaped through the interaction of organizational members with it; finally, I look at how producing information, as well as relying on information, for symbolic reasons can yield perverse effects for the organization and its members.

In this first chapter I set the focus of my dissertation on analytics as a technology of model-based rationality. I start with illustrating how the field of organization theory has been concerned with the notion of rationality since its infancy. Subsequently, I look at critical perspectives on rationality and reach the conclusion that despite such perspectives, rationality is still approached as a normative ideal for acting in organizations. I continue with looking at technologies of rationality and how they embed rationality for organizational search and choice. Then, I introduce the practice lens as a useful lens to study how rationality is enacted in practice, during the interaction of

humans with tools of model-based rationality. Afterwards, I delve into analytics, as the technology of model-based rationality that constitutes the phenomenon under investigation in my doctoral research. Thereupon, I introduce the research question of the dissertation, and specific topics of research that are addressed in the subsequent chapters. Finally, I end this chapter by explaining briefly my research approach, presenting the outline of the dissertation and estimating the implications of this research for theory and practice.

1.1 The quest for rationality

'Rationality is a lot like ancient Rome – all roads lead to it' (Argote & Greve, 2007: 337). Indeed, since its infancy, the field of organization theory has been concerned with the concept of rationality, i.e. making the optimal choice of means to reach pre-established ends (Cyert & March, 1963; Simon, 1947). In the field of scientific management, Taylor (1911) and his successors studied how human beings could be used in industrial organizations in the most efficient and productive way. Rationality was defined in engineering terms and represented the most efficient use of specific means to accomplish given ends (Clegg, Kornberger, & Pitsis, 2005). This notion continues to exist in contemporary organizations, through "best practices" that prescribe the most efficient ways for organizing, such as methods for total quality management, lean production, big data and analytics, and others.

In his study of bureaucratic organizations, Weber (1947) suggests that bureaucracy depends on the application of rational means to achieve pre-defined ends. Techniques are rational as long as they are designed purely to fit their purpose. The better they fit their purpose, the more rational they are. However, this instrumental perspective of rationality is merely one of the different types of being rational, according to Weber (1978). Different analysts of Weber's work have identified several types of rationalities in his work (Townley, 2002). Kalberg (1980) identifies four types of rationality: practical rationality (performing activity guided by the individual's purely pragmatic and egoistic interests); theoretical rationality (denoted in cognitive processes that master reality through the construction of increasingly precise abstract concepts); formal rationality (performing a means-ends rational calculation by referring to universally applied rules and regulations); and substantive rationality (performing action towards a substantive direction, guided by a "value postulate", which manifests a radical perspectivism). The formal and substantive types of rationality inform the rational action that has concerned organization theorists (Townley, 2002). Whereas Weber (1978) identifies that modern bureaucratic organizations are governed by both formal rationality and substantive rationality, he maintains that ideal bureaucracies and administrative systems are the ones governed by purely formal

rationality. He suggests that because individuals are committed to certain beliefs and values and thus often employ substantive rationality, the ways in which they evaluate rational action could conflict, because their beliefs and values may conflict. Such value conflicts cannot be resolved in a rational way, which can make substantive rationality problematic (Cecez-Kecmanovic, Janson, & Brown, 2002). For Weber (1947), in an ideal bureaucratic system people act in accordance with rules and regulations that are formally codified and provide the standards for organizational action. However, his successors, including Merton (1936), Selznick (1949) and Gouldner (1954), suggest that the "machine" model –advocated by scientific management and by Weber's view of bureaucracy– entails several organizational dysfunctions. Their research shows that because organizational members act driven by different motives and have complex learning behavior, strict adherence to rules could lead to psychological maladjustment of people, displacement of goals, and other unanticipated consequences.

At about the same time as the aforementioned successors of Weber, another group of researchers set up an interdisciplinary team at Carnegie Institute of Technology (Scott, 2003), who later got to develop the "Behavioral Theory of the Firm" (Cyert & March, 1963). Led by Herbert Simon, they investigated the notion of rationality in the context of decision making and choice within organizations. In his book "Administrative Behavior", Simon (1947) criticizes the "classical" theory of organization that regards the employee as an instrument (March & Simon, 1958) and suggests that organizational members behave rationally, in the sense that they have wills and motives. He defines rational decision making as the choice of the appropriate means/action in order to achieve a specific end. As these ends are often instrumental to more final objectives, he conceives of a hierarchical chain of means and ends, and he defines rationality as the construction of such means-ends chains (Simon, 1976). Simon (1947) defines the "economic man" to describe the perfectly rational all-knowing decision maker, as viewed by economic models of the firm; and the "administrative man", who represents an intendedly rational but cognitively limited actor. While the economic man describes the normative ideal of decision making, the administrative man represents how decision making is performed in reality. In their highly influential book "Organizations", March and Simon (1958) elaborate on the concept of *bounded rationality*, which means that although individuals are intendedly rational, they are limited by their cognitive skills and reflexes; by their values, which may deviate from the organizational goals, and by the amount of information they have available. Information constraints may be attributed to problems of attention, memory, comprehension, or communication (March, 1994). Thus, in the theory of rational choice, March and Simon (1958) explain that choice is always made within a simplified (limited, approximate) model of the actual situation, and that the definition of the situation is in itself an outcome of psychological and sociological processes. In table 1.1 I provide a systematic comparison of the pure rational choice theory (which assumes

perfect rationality in making choices) to the bounded rationality perspective that is advocated by March and Simon (1958). In a rational procedure, the choice is conditional upon: a) the set of alternatives, i.e. the actions that are possible; b) the expectations, i.e. the future consequences attached to each alternative and how likely each possible consequence is; c) the preferences, i.e. how valuable the consequences of the alternatives are to the decision makers; and d) the decision rule, i.e. the criterion for choosing among the alternatives in terms of the values of their consequences (March, 1994). According to pure theories of rational choice, all alternatives of the choice are known, as well as the consequences attached to each alternative and the probability and risks of each consequence. All decision makers share a common set of preferences, so that they value the consequences of alternatives in a consistent way. The choice is made based on the criterion of optimizing, i.e. the decision maker selects the action with the consequences that will maximize the value. The theory of bounded rationality assumes that all individuals try to be rational, but they are restricted by their cognitive capabilities and the information constraints. Not all alternatives are known and not all consequences are considered. Some consequences might be known but ignored. Preferences are incomplete or inconsistent, and not all preferences are considered at the same time. The selection of choice is simplified by that of optimizing to that of satisficing, i.e. selecting an alternative that is good enough.

Table 1.1 Comparing bounded rationality to pure rational choice theory (March, 1994)

Framework of a rational procedure	Pure rational choice theory	Bounded rationality
Alternatives	Perfect knowledge of all alternatives of choice.	Not all alternatives are known.
Expectations	Perfect knowledge of all future consequences and the probability of each consequence. Knowledge of the risk involved in each alternative.	Not all consequences are considered. Some consequences can be known but ignored. Uncertainty about the likelihood of each possible consequence.
Preferences	Preferences (i.e. values of the expected consequences) are known, precise, consistent and stable.	Incomplete and inconsistent goals. Not all goals are considered at the same time.
Decision rule	Maximizing: selecting the best possible action based on the expected values and risk.	Satisficing: searching for an action that is good enough. Instead of considering expected values or risk, other criteria are invented.

The rational choice theory developed by March and Simon (1958), with its analysis of bounded rationality, is further extended by Cyert and March (1963) in their book "The Behavioral Theory of the Firm". They view organizations as coalitions of individuals who have different individual goals and suggest that organizations manage to exist and thrive with inherent conflict of the members' individual goals. Organizational goals are a series of independent aspiration-level constraints that the coalition members impose. This has led to the development of *political models of organizational action* (Cabantous & Gond,

2011: 574), which recognize that individuals are intendedly rational, nevertheless they view organizational choices as the results from bargaining between self-interested individuals, which usually represent the interests of the most powerful actors (Allison, 1971; March & Olsen, 1976). Thus, while driven by a political rationale, organizational actions are considered to be results of attempts at rational choices (Cabantous & Gond, 2011).

The ideas developed in the behavioral theory of the firm regarding bounded rationality and political models of decision making are critical towards the pure theory of rational choice, suggesting that in practice individual and organizational choices are not perfectly rational. Nevertheless, those theoretical perspectives assume that individuals are intendedly rational and perform search for satisficing. This assumption has been held by many organizational researchers in various fields, including decision making (Dean & Sharfman, 1996; Puranam, Stieglitz, Osman, & Pillutla, 2015), strategy (Eisenhardt & Zbaracki, 1992; Elbanna & Child, 2007; Fredrickson, 1984), organizational search (Cohen, 1984; Winter, Cattani, & Dorsch, 2007), and so on. For example, in the field of strategy formulation, Fredrickson and Mitchell (1984) study the comprehensiveness of organizational decision-making processes as the measure of rationality, i.e. "the extent to which organizations attempt to be exhaustive or inclusive in making and integrating strategic decisions" (Fredrickson, 1984: 445), and investigate its relationship with firm performance. To a large extent, rationality continues being thought of as a normative ideal in organizations (Cabantous & Gond, 2011; Jarzabkowski & Kaplan, 2015).

1.2   Critical perspectives on rationality

Certain perspectives in organization theory and the social sciences have emerged that criticize the idea that individuals are intendedly rational (Cabantous & Gond, 2011; Hendry, 2000; Langley, Mintzberg, Pitcher, Posada, & Saint-Macary, 1995). The theory of *organized anarchy* (Cohen, March, & Olsen, 1972) views decision making emerging in an organized chaos and suggests that choices are made independently of any individual rationality (Cabantous & Gond, 2011). More specifically, the *garbage can model* depicts organizations as collections of choices in search for issues and goals, solutions looking for problems that they could solve, feelings looking for situations in which they could be expressed, and decision makers searching for work (Clegg et al., 2005). The "garbage cans" are choice opportunities (e.g. contract meetings or budgeting committees) which collect decision makers, problems and solutions, depending on the times that these arrive on the scene and the possibilities available at those times (March, 1994). This theory challenges the notion of bounded rationality and provides some understanding over the conspicuous

disorder often experienced in organizational decision-making processes (Langley et al., 1995).

Brunsson (1990) also challenges the normative ideal of rationality by investigating how the degree of rationality changes depending on the role of decision processes. Whereas rationality is desired when decisions are taken to serve the purpose of choice, this is not the case when decisions are taken to mobilize organizational action or to allocate responsibility to organizational actors. For example, Brunsson (1982) explains that decisions are often made by managers to initiate actions in organizations, as decisions often encapsulate expectation, motivation and commitment that are needed to carry out the action. In such cases, in order for the decision processes to be effective, they cannot adhere to the rules of rational decision making. *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 bias the actors towards performing the specific action. Thus, Brunsson (1982) suggests that decision makers often engage in a rational use of irrationality, which he calls *action rationality*. Similarly, more researchers reject the idea that organizational actions undoubtedly result from rational choice (Hendry, 2000), and suggest that decisions are often taken after the actions are performed, with the goal to justify the corresponding actions (Hendry, 2000). For example, Starbuck (1982, 1983) views organizations as action generators, i.e. they perform actions and then create problems to justify them. Starbuck (1983) distinguishes the intentions (named as mental decisions) from the decisive acts (called actual decisions), in order to explain that although individuals make 'decisions' in their minds, they often do not perform the actions they have decided, either due to lack of motivation, or because the circumstances change. In the same vein, Mintzberg and Waters (1985) define strategy as 'a pattern in the stream of actions', rather than decisions.

The idea that actions precede choices is also shared by interpretative researchers (Chia, 1994; Laroche, 1995), who suggest that decisions that appear to be intentional are often post-hoc rationalizations of actions that have already been performed (Chia, 1994; Hendry, 2000). For interpretative researchers, decisions represent statements that result from cognitive processes, performed to make sense of the environment (Weick, 1995) or to create socially shared meanings (Laroche, 1995). Thus, from an *interpretative perspective*, rationality is understood as a social construct: decision making does not constitute a rational choice between alternatives, but rather the "imposition of a rational order upon a previously enacted world" (Hendry, 2000: 956).

Similarly, rationality is viewed *as a symbolic construct* (Feldman & March, 1981; Langley, 1989). Feldman and March (1981) suggest that organizations often perform decisions differently from what rational choice theory suggests, yet they often collect and ask for more information than what they use to inform their choices. The use of information in organizational choices makes decision making appear as an intelligent,

effective act, since rational choice has become a symbol of good decision-making (Meyer & Rowan, 1977). As information use symbolizes a commitment to rational choice (Feldman & March, 1981), organizations may engage in conspicuous consumption of information and formal analysis in order to acquire legitimacy for their activities (Feldman & March, 1981; Langley, 1989).

Finally, another critical perspective on rationality suggests that the norm for rational choice and the obsession with order and control is counterintuitive when it comes to exploring interesting goals and innovating (Clegg et al., 2005; March, 1988). March (1988) uses the term *technology of foolishness* to describe the idea of playfulness, trial and error, improvisation, and being open to new alternatives (Clegg et al., 2005). He suggests that the technology of foolishness should complement managerial rationality –which assumes that choices are made having a set of stable preexisting goals– in order to be able to unleash creativity and innovation and to find new goals that could lead to great outcomes. "Individuals and organizations need ways of doing things for which they have no good reason. Not always. Not usually. But sometimes. They need to act before they think." (March, 1988: 259)

In sum, the critical perspectives on rationality (listed later in table 1.3) provide a different approach to view how individuals and organizations act; rather than driven by rationality, they often act irrationally, e.g. driven by feelings or political interests (Langley et al., 1995; March, 1997). However, while this more "realistic" view of acting and decision making has been accepted in the field of organization theory (Cabantous & Gond, 2011), organization theorists and management scholars still consider rationality as the normative ideal for organizational choices and actions. Acting based on means-ends rationality is still a taken-for-granted ideal for justifications of action, managing organizations, planning, strategizing, decision making, policy making, and even managing personal and social life (Cabantous & Gond, 2011; Jarzabkowski & Kaplan, 2015; March, 2006).

1.3   Technologies of rationality

With rationality thought of as a normative ideal for action and justification by both organization theorists and practitioners (Cabantous & Gond, 2011; Jarzabkowski & Kaplan, 2015; March, 2006), several organizational procedures have emerged –such as strategic planning and management, economic analysis, budgeting, and decision analysis– that are considered to be appropriate for pursuing intelligence and for professionalizing policy formation and decision making (March, 2006). In this context, several tools have been developed to help organizations arrive to favorable outcomes, by providing a model-based estimation of the anticipated consequences and their likelihoods for occurring, based on

past experiences. These tools are called *technologies[1] of rationality* (March, 2006: 202) and inscribe a model-based rational logic, which suggests that "action is or should be derived from a model-based anticipation of consequences evaluated by prior preferences" (March, 2006: 202), whereas models are abstract representations of situations that identify variables and alternatives. While such technologies for performing rational analysis and choice have often been criticized by researchers for ignoring that people act based on bounded rationality, emotions, and other logics of action (Elster, 1999, 2000; March & Olsen, 2005; March, 2006), they are commonly viewed as valid bases for making choices on the organizational (e.g. strategic planning), social (e.g. policy formation), and individual level (e.g. choosing a job or a product). Technologies of rationality assume that organizational members are intendedly rational, they attempt to collect the necessary information about alternatives and consequences, and they base their actions upon this information. For example, strategizing traditionally involves a model-based rational logic to choose between alternative plans and strategies, through the use of tools such as Porter's Five Forces model, strategic group maps, and others (Jarzabkowski & Kaplan, 2015).

March (2006) defines three components as constitutive of technologies of rationality: a) abstractions, which are models of situations that include variables, causal relationships between those variables and sets of alternative actions; b) data collections, which encapsulate past experiences, the history of the organization and its environment; and c) decision rules, which capture the values and preferences of the organization in order to select the best option amongst a set of expected consequences. The model-based rational logic that is inscribed in such tools manifests the normative ideal of perfect rationality: action is driven by a choice made through model-based assessment of the likelihoods of a set of carefully considered possible outcomes and consequences. It is not performed because of habit, customs, intuition, tradition, emotions, rules following, routines, or other logics. Model-based rationality is extracted by creating abstract models from the historical data (March, 2006).

Several challenges and tensions arise for technologies of model-based rationality (March, 2006): First of all, whereas technologies of rationality are considered to be effective for solving simple problems, they have been considered to be inappropriate for making choices in complex situations (Vaughan, 1996) due to the level of uncertainty, causal complexity, ambiguity of preference, interpersonal trade-offs, strategic interaction, and the different extent of measurability which makes the variables that can be measured appear as more important than others that are not measureable. Furthermore, while model-based rationality is considered to support well exploitation processes in

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[1] In both terms 'technology of foolishness' and 'technology of rationality', March uses the term 'technology' in its broader sense, meaning the way work is done in organizations. Technology can be embedded in machines, mechanical equipment, digital artifacts, etc. but it also comprises technical knowledge, skills of organizational members and the logic of how things are done or gained.

organizations, (March, 1991), it also risks at reinforcing a myopic adaptive process, as it could exaggerate the likelihood of historical events and it could underestimate the likelihood of things that have not happened (March, 2006). On another note, while rationality has been previously thought of as too conventional and prohibitory of creativity and imagination (March, 1988), March (2006) believes that the evidence of failure of rationality in complex situations may indicate that rationality can also yield novel ideas, thus it provides high exploratory value. In table 1.3 (which can be found later in this chapter) I suggest how the tools of model-based rationality relate to the different critical perspectives on rationality.

1.4 Rationality in practice

In the previous sections I illustrated that rationality is still considered by organization theorists to be the normative ideal for choice and action (Cabantous & Gond, 2011; Jarzabkowski & Kaplan, 2015), despite the tensions put forward by its critics (Hendry, 2000; Langley, 1989; March, 2006). However, although in theory rationality is constantly considered to be a "reference point" in organization studies, it is not easy to capture empirically and it remains an "elusive concept" (Cabantous & Gond, 2011). Furthermore, although we know in theory how tools of model-based rationality should be used (March, 2006), we still need to explore how they are actually used in organizations (Jarzabkowski & Kaplan, 2015). At the same time, the advances in information technology appear to promise the development of sophisticated tools that can support very effective technologies of model-based rationality (March, 2006). In an era when intelligent tools and techniques can help address the issues of bounded rationality that were presented in table 1.1 and help reach at least an approximation of perfect rationality, it becomes relevant to study how organizational actors deal with the normative pressure to act rationally (Cabantous & Gond, 2011). In order to achieve this, I suggest taking a *practice-based approach* (Feldman & Orlikowski, 2011; Nicolini, 2012) to study how rationality is enacted in practice.

By taking a practice lens, researchers focus on activities, performance, and work, as these are considered to be fundamental in creating and maintaining all aspects of social life (Feldman & Orlikowski, 2011; Nicolini, 2012; Reckwitz, 2002; Schatzki, 2002). They conceive of social life as an ongoing production, emerging through people's ongoing and routinized actions (Feldman & Orlikowski, 2011; Nicolini, 2012). For example, according to Giddens (1984), practices are the recursive social actions that produce, reproduce, change or ignore the structures –institutions, traditions, established ways of doing things– which enable or constrain actions. Practice-based perspectives reject dualisms and recognize the inherent relationship between elements such as mind and body, structure and agency, or cognition and action (Feldman & Orlikowski, 2011). Thus, a practice-based perspective

helps us conceive of rationality as emergent, realized as a pattern of behavior (Hendry, 2000). A practice-based perspective emphasizes the dynamics involved in using technologies of rationality (Jarzabkowski & Kaplan, 2015). From a practice lens, actors form and reshape their preferences, decision rules and search processes while they are embedded in a specific context, performing a specific practice. The logic of practice allows researchers to study how actors enact their practice (Bourdieu, 1990; Sandberg & Tsoukas, 2011) and triggers us to study the actions of people. It is through the focus on the actual doing (Cabantous & Gond, 2011; Hendry, 2000; Langley, 1989) that we can actually study how organizational members actually perceive and use, or more appropriately enact, rationality in their actions. From a practice-based perspective, what is considered rational (based on preferences, decision rules, and so forth) is shaped as actors navigate in the context of their situated actions, exercise their judgment based on the specific situation (Emirbayer & Mische, 1998), and negotiate what is rational to them.

The practice lens addresses the role of agency differently from the traditional sociological approach of the 'homo economicus' that views the individual as a disengaged, calculative, formally rational entity; or the 'homo sociologicus' approach that addresses the individual as a duty-obeying, norm-following agent. The practice lens views the agents as "body/minds who 'carry' and 'carry out' social practices" (Reckwitz, 2002: 256). As carriers of practice, agents understand the world and themselves and use knowledge according to the practice that they carry, but at the same time there is space for individual performance and creativity (Nicolini, 2012; Reckwitz, 2002). While the intelligibility of a practice (Schatzki, 2002) implies certain ways of acting, knowing, and wanting, situated actions are consequential and thus reproduce and/or change those ways each time they are performed (Feldman & Orlikowski, 2011). This view emphasizes the contextualization of social experience (Emirbayer & Mische, 1998) and thus helps us conceptualize rationality not as a general notion that exists out there, but as situated in the practices, enacted while actors form the path of their situated actions. Actors enact rationality as they exercise the practical evaluative element of their agency, i.e. their "capacity [...] to make practical and normative judgments among alternative possible trajectories of action, in response to the emerging demands, dilemmas, and ambiguities of presently evolving situations" (Emirbayer & Mische, 1998: 971). What is considered rational within a specific practice is encapsulated in the intelligibility of the practice (Schatzki, 2002) and guides the individuals in their actions, but is also reproduced and reshaped by those actions.

The practice-based perspective has helped organization scientists reformulate the notions of knowledge and meaning from the ones that have been traditionally used in management studies (Feldman & Orlikowski, 2011; Nicolini, 2012). Lave (1988) studies how people perform mathematical calculations and shows that while some people may perform poorly in standardized math tests, they can still employ significant mathematic skills in their daily practices, such as while doing grocery shopping at the supermarket.

She uses the notion of cognition in practice, to suggest that social conduct and phenomena do not just stem from the minds of individuals, but they result from the ongoing actions that are always situated in a specific context and practice. Similarly, Suchman (2007) emphasizes situated cognition and suggests that plans are a resource for situated action usually invoked after the activity to provide accountability. Thus, plans do not determine or control the actions that they project. Rather, they are the artifacts of situated activity (planning activity) that "results in projections that bear some interesting, yet unexplained, relation to the actions they project" (Suchman, 1993: 72). These theoretical insights have deeply influenced the practice perspective, which for example views knowing as a consequential activity embedded in the practice (Feldman & Orlikowski, 2011). Knowledge, in the form of mastery in carrying out a social and material activity (Nicolini, 2012), emerges through situated activity and is constantly enacted as the actors perform the practice (Orlikowski, 2002). Haraway (1988) criticizes that there is not one established, universal understanding of objectivity. Instead, she calls for a partial perspective, one that views objectivity drawn from "particular and specific embodiment" and grounded in situated knowledges (Haraway, 1988: 582). From a practice perspective, we can view rationality as emerging from the doing of actors (Cabantous & Gond, 2011; Jarzabkowski, 2003) who are embodied in specific contexts and have situated knowledge. In other words, the variables, preferences, decision rules etc. that matter are shaped by the actions of actors, as they are performing a specific practice.

Practices are seen as consequential in the sense that they form identities, make meanings, and produce social order (Feldman & Orlikowski, 2011; Nicolini, 2009, 2012). For practice researchers, behind all features of our world there is always the effort and work of someone. Family, organization, institutions, and so on exist as long as there are recurrent material practices that reproduce them. For example, democracy exists because of the practices of voting, debating, campaigning, etc. and the work done to assemble these practices together (Nicolini, 2012). This would lead us to understanding rationality not as one notion that exists out there and guides individual and organizational actions, but as a way of acting that is constantly performated in the praxis, i.e. the flow of activity by which actors make choices and perform their actions (Cabantous & Gond, 2011; Jarzabkowski, 2003). In other words, just as practices are "meaning-making, identity-forming, and order-producing activities" (Nicolini, 2012: 7), they are also consequential for how rationality is constructed and understood by both organizational actors and theorists (Cabantous & Gond, 2011).

Several practice theorists (Callon, 1986; Latour, 1987; Pickering, 1995; Suchman, 2007) have recognized the consequential role played by non-human actors such as natural objects and technological artifacts in producing social life (Feldman & Orlikowski, 2011). The practice lens acknowledges the heterogeneous nature of the world we live in (Nicolini, 2012) and foregrounds the importance of objects and materials, which often resist our

actions, bite us back and shape our social world. Objects are resources for practices to occur, and their arrangements actively participate in producing, reproducing, and shaping the practices (Nicolini, 2012). For example, the classroom, tables, chairs, and blackboard are resources for the practice of teaching to occur; while the way the tables are arranged shapes the way teaching will be performed. Taking a practice-based perspective to study rationality puts emphasis on tools and techniques of model-based rationality (March, 2006), which can be seen as "rationality carriers", because they embed (intended) rationality as they are used to organize individual and organizational activities (Cabantous & Gond, 2011). This brings to the fore technological artifacts intended to extend actors' cognitive capability and to make them feel or appear more rational when used in a rationality-seeking process (Cabantous & Gond, 2011; Feldman & March, 1981; Jarzabkowski & Kaplan, 2015). The practice lens recognizes that people will use tools of model-based rationality in multiple ways (Boudreau & Robey, 2005; Orlikowski, 2000), as different action possibilities and opportunities emerge while actors engage with a technology (Faraj & Azad, 2012). Technologies-in-practice, i.e. structures of technology use (Orlikowski, 2000), are not given or established; but they are constituted and reconstituted in the situated practices of the users. The way in which technological artifacts are used will emerge and change depending on the particular circumstances in which they will be used. This means that tools of model-based rationality do not stand alone, but their material features and capabilities are only relevant in relation to the specific practices in which they are used (Feldman & Orlikowski, 2011).

In order to better understand the role of tools of model-based rationality in the practices of individuals and organizations, I adopt a *sociomateriality perspective* (Orlikowski, 2010), which is well aligned with the practice lens (Jones, 2014). The notion of sociomateriality has been recently developed (Orlikowski, 2010) by organizational scholars who draw on the field of Science and Technology Studies in general and Actor-Network Theory in particular (Latour, 2005; Mol, 2002), in order to address the dualism between the material and the social. This dualism has dominated the study of technology in management research, and views technology either as an exogenous force that determines organizational life, or as a product of social definition and production, relevant only in relation to the people who engage with it. Instead, sociomateriality suggests that the relations between social and material are not given, but they are enacted in practice (Jones, 2014), and focuses on how both social meanings and materialities are together enacted in everyday practices (Orlikowski, 2010). Sociomateriality establishes materiality as central to our understanding of contemporary organizations (Jones, 2014) and recognizes that both human and non-human actors have agency, without privileging any of the two. While the perspectives on sociomateriality may differ (Cecez-kecmanovic, Galliers, Henfridsson, Newell, & Vidgen, 2014), I specifically draw on the view of strong sociomateriality (Jones, 2014), which follows an agential realist ontology, as this has been

developed by Barad (2003, 2007) and followed by Orlikowski (2010, 2007). Agential realism[2] is a relational ontology that rejects the idea that human and non-human entities have inherent properties and exist independently, and suggests that the social and the material are ontologically inseparable from the start (Barad, 2003; Introna, 2009; Orlikowski, 2010; Suchman, 2007). They are "considered to be inextricably related — there is no social that is not also material, and no material that is not also social" (Orlikowski, 2007: 1437). Barad (2007) and Orlikowski (2010, 2007) view the social and the material as constitutively entangled in everyday life. The sociomateriality lens follows the notion of performativity, as this has been developed by Pickering (1994, 1995), Barad (2003), Law (2004) and others, which conceives of reality as a dynamic, practical accomplishment, and suggests that the world is enacted in practice. Practices are performative, in the sense that they have productive consequences, and thus produce the world (Scott & Orlikowski, 2014). This comes in line with the consequentiality of practices that I previously described, according to which e.g. identity is not static, but it is enacted in organizational practices. Thus, the constitutive entanglement of the social with the material emerges in the ongoing, situated practice (Orlikowski, 2007). In other words, the social and the material are both aspects of the same phenomenon, which is produced and is made contextually relevant by situated practices (Barad, 2003; Nicolini, 2012). From this perspective, organizational practices are viewed as sociomaterial (Orlikowski, 2007; Orlikowski & Scott, 2014; Scott & Orlikowski, 2014; Suchman, 2007), as they involve the recursive and temporally emergent entanglement of social and material entities, and co-constitute the organizational phenomena. For example, the "push e-mail" feature of smartphones (with which smartphone users receive e-mail messages automatically from the e-mail servers as soon as the messages are sent), together with the material configurations of the phone (e.g. wireless network and software) have become entangled with people's choices to always carry their smartphones anywhere, to check them repeatedly, and to answer the e-mail messages as soon as they receive them (Orlikowski, 2007).

From a sociomaterial lens, rationality is enacted in sociomaterial practices, in which tools of model-based rationality are entangled with the humans that design and construct them as well as with the individuals who use them in their situated actions. What is considered to be a rational way of acting and making choices is shaped by the sociomaterial reconfigurations that emerge in a specific context and at a specific moment in time. For example, when travellers book a hotel in the TripAdvisor site, they are entangled with the computer, the software, the network, the ranking algorithm and the

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[2] Agential realism regards phenomena as the primary ontological units, rather than separate entities and agencies such as subject and object, human and material, or matter and meaning (Scott & Orlikowski, 2014). Phenomena constitute the entanglements between agentially intra-acting components that emerge in practice (Barad, 2007). Intra-action is a notion that signifies the mutual constitution of entangled agencies. In contrast with interaction, which assumes that entities are separable and that their agencies pre-exist before those entities come together, the notion of intra-action recognizes that the entities and their agencies emerge through their encounters, i.e. through their inta-action (Barad, 2007).

analytics used by the TripAdvisor application, the reviews that have been generated by other users, and so on. Which hotel is considered to be the best choice is the product of an emergent reconfiguration: the search criteria used by the user, together with the data stored in the database, the ranking algorithm, and other aspects, influence the results of the search as well as how they will appear on the screen. At the same time, while the user might initiate the search with an initial set of preferences and a specified decision rule, the results from the search such as the ratings, the textual reviews of other users, as well as other material elements, could trigger different or additional search criteria, or could even change the user's preferences, and could influence the final choice. In this case, rationality is not simply inscribed in the ranking algorithm of TripAdvisor (which could be thought of as a tool for model-based rationality), neither does it exist solely in the mind of the traveller. It is produced, and reshaped, during the search action that the traveller performs when using the TripAdvisor application.

In conclusion, I suggest taking a practice lens to study how rationality emerges and is enacted in organizations. This implies looking at the "doings" of organizational members, acknowledging the situated nature of their cognition, knowledge and rationality, and studying their interaction with tools of model-based rationality. In table 1.2 I am summarizing the main principles of the practice lens and how this informs us to study rationality in practice:

Table 1.2 How the principles of the practice lens inform us to study rationality in practice

Principles of the practice lens	Elements of rationality in practice
Focus on the actual doing	What is considered rational (in terms of which variables, preferences, and decision rules matter) is shaped as actors navigate in the context of their situated actions.
Agents carry but also carry out practices	Rationality is encapsulated in the intelligibility of the practice and guides the individuals in their actions, but is also reproduced and reshaped by those actions.
Cognition and knowledge are situated in the practices	Rationality (and specifically which variables, preferences, and decision rules matter) emerges from the doing of actors who are embodied in specific contexts, and have situated knowledge.
Situated actions are consequential in the production of social life	Practices are consequential for how rationality is constructed and understood by both organizational actors and theorists.
Emphasis on material artifacts which help produce, shape and perpetuate the practices	Tools of model-based rationality are seen as carriers of rationality. Their features are only relevant to the specific practices in which they are used.
Practices are sociomaterial	What is considered rational is shaped by sociomaterial practices, in which humans are entangled with the tools of model-based rationality.

In the previous sections I introduced critical perspectives that have been posed in relation to rationality in the field of organization and management theory. Some of those critiques are inherent in theories of rational choice (bounded rationality, political models of decision making), while other external critiques (garbage can model, action rationality, organizations as generators of action, interpretative perspective on rationality, rationality as a symbolic construct, technology of foolishness) can be traced in other theories that criticize the idea that people are intendedly rational. In table 1.3 I present those critical perspectives and suggest how each perspective is relevant to technologies of model-based rationality. Furthermore, I provide my own projection of how the practice lens can help us further investigate the critiques posed by each theoretical perspective.

Table 1.3 Inherent and external critical perspectives on rationality

	Theoretical perspectives	Critiques on rationality	Relevance of the theory to technologies of model-based rationality	Insights from the sociomaterial practice perspective
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.
	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.
Critiques in theories that criticize the normative ideal of rationality	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.
	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 after the actions are performed, with the goal to justify the corresponding actions.	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 choice the action that they already performed.	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.
	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	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, Dompierre, Langley, & Rouleau, 2011;	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

		individual and collective sensemaking.	Jarzabkowski & Kaplan, 2015)	in different practices.
	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 sybolizes 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 performated by sociomaterial practices in which actors produce and reproduce what is considered to be rational.
	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.

1.5   Analytics: A technology of model-based rationality

While the technologies of model-based rationality may include a wide range of concepts, procedures, frameworks, models, methods and technological artifacts (Jarzabkowski & Kaplan, 2015), in this thesis I focus specifically on one subset of tools, which constitute the technology of analytics. As I mentioned in the introduction of this chapter, lately there has been a lot of excitement about analytics (LaValle et al., 2010; McAfee & Brynjolfsson, 2012). Analytics is considered to be an efficient and effective way of acting based on data, as it includes sophisticated techniques that are presumed to help make perfectly rational choices. Due to its assumed effectiveness, it makes an interesting case to study how the issues with rationality discussed in sections 1.1 and 1.2 play out when analytics is introduced in the organizations.

With the term *analytics* I am referring to the set of practices, skills, techniques and technologies, such as statistical analysis and predictive modeling, which are employed by organizations to steer decisions and actions (Bose, 2009; Davenport & Harris, 2007). A common example of using analytics is the employment of market basket analysis (Kumar & Rao, 2006) by Walmart, with the goal to understand the purchase behavior of customers and to improve their sales promotions, store design, and so forth.

Many scholars and practitioners use the terms analytics and business intelligence interchangeably (Chen, Chiang, & Storey, 2012). However, Davenport and Harris (2007), as well as Sharma et al. (2010), suggest that analytics is different from business intelligence, because it includes more than identifying the problem, answering questions about what happened, where, how often, and so on with the use of access, reporting and monitoring

techniques. Analytics is mostly used to analyze the problem, to answer questions about why things are happening, what will happen next and what is the best solution to the problem, with the use of statistical analysis, forecasting, predictive modeling and optimization techniques (Davenport & Harris, 2007). The field of analytics is also closely related to the field of decision support systems, which has been researched for decades (Arnott & Pervan, 2008, 2014; Sharma et al., 2010). Both disciplines have been developed with the same philosophy: to provide a data-based approach to decision making (Davenport & Harris, 2007; McAfee & Brynjolfsson, 2012). Whereas a decision support system usually provides an automated solution to a certain problem with a specified set of data and a specific model, analytics may use various analytical methods to analyze several problems and opportunities. It relies a lot on business intelligence capabilities such as reporting and data warehousing, while it often requires the user's interpretation over which particular problem needs more attention (Negash, 2004).

Looking at the close relation with business intelligence and decision support systems, one might say that analytics is just a fad term for the same type of technologies that are aimed to process information in order to automate and support decisions. However, several researchers (Agarwal & Dhar, 2014; George, Haas, & Pentland, 2014; Markus, 2015) recognize "analytics", "big data", and "data science" as one of the biggest disruptions in business and academic ecosystems and view several directions for new research in the field of information systems (IS) and organizing –and specifically automation of business processes, knowledge work and decision making– that will inevitably stay around even if the fashion of analytics fades away.

With constantly better machines, bigger data, and smarter algorithms, analytics provides significant advances for automating decision making and business processes (Agarwal & Dhar, 2014). Due to the tremendous rise of computing power and the availability of open source (e.g. R, Weka and RapidMiner) and commercial (SAS, IBM, QlikView, etc.) software solutions, analytical techniques like predictive modeling and optimization are now easily accessible to organizations. Also, the rapid development of web, mobile and network technologies in the past two decades has fostered the continuous and fast-paced growth of data that organizations need to process, bringing us to the "Big Data" era (Chen et al., 2012; George et al., 2014; McAfee & Brynjolfsson, 2012). Analytics has enabled sophisticated analysis of several types of data (text, web, network, mobile, visual data, and other types) with the use of machine learning, data mining and other techniques. These techniques can be so complex that they even necessitate a new role in the organization, that of the "data scientist" (Davenport & Patil, 2012), who has highly analytical skills and is capable of extracting the correct datasets and applying the appropriate techniques with the goal to find patterns in the data. The "datafication" of everything (Lycett, 2013) appears to bring new opportunities for organizational members,

who can make better sense of the world by understanding the phenomena represented by significant data patterns extracted through analytics.

Recent academic literature (Bhimani, 2015; Brynjolfsson, Hitt, & Kim, 2011; Markus, 2015; Sharma, Mithas, & Kankanhalli, 2014; Woerner & Wixom, 2015) and practitioner-oriented literature (Davenport et al., 2010; Kiron & Shockley, 2012; LaValle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011; McAfee & Brynjolfsson, 2012) suggests that analytics can support decision making and increase rationality in business processes, therefore it can create value and competitive advantage. Analytics appears to be the holy grail of perfect information (Davenport & Harris, 2007), and organizations jump on the bandwagon to make significant investments to adopt it (LaValle et al., 2011). However, most IS researchers and practitioners take the effect of analytics on decision making for granted. They follow mostly a "prescriptive" (Clark, 2010) view on decision making, which reinforces the "normative" theories of decision making advocating the ideal of fully rational choice (Cabantous & Gond, 2011; Clark, 2010). Data-driven decision making is now presented as the ideal way for making decisions (Davenport & Harris, 2007; McAfee & Brynjolfsson, 2012; Sharma et al., 2014; Woerner & Wixom, 2015).

Furthermore, analytics appears to rationalize and to automate knowledge work (Newell, 2015), and the datafication of everything is assumed to yield patterns for action that can be taken by knowledge workers without having to comprehend the causal connections behind those patterns. The proponents of the technology (Brynjolfsson & McAfee, 2014) suggest that notions of knowing and expertise are changing as humans interact with the smart technologies. For example in the field of journalism, big data is expected to change the professional logic and industrial production of journalism (Lewis & Westlund, 2014).

Few researchers have been concerned thus far with the challenges that analytics and big data may bring to organizations. For example, big data practices may entail challenges for the field of strategy making, by introducing inductive, bottom-up approaches for information search which could be transformed from purposeful to an agonistic, haphazard activity (Constantiou & Kallinikos, 2014). Also, the technology of analytics and big data could create information asymmetries and raise ethical considerations regarding control and power relations (Hansen & Flyverbom, 2015; Zuboff, 2015). In addition, analytics appears to shift paradigms and ways of thinking and to disrupt existing approaches for acting and organizing (Whyte, Stasis, & Lindkvist, 2015). Finally, Newell (2014) questions what type of knowledge work can be automated with algorithms and with analysis of big data; she suggests that part of knowledge work will always require human judgment.

The rapid development of machine capabilities and sophisticated algorithms has established analytics as a powerful tool for model-based rationality (Agarwal & Dhar, 2014). However, little is known so far about how organizational members enact analytics

in their every day practices (Maas, van Fenema, & Schakel, 2014). While nowadays analytics is presumed to be smart enough to reach the normative ideal of rationality, we do not know how organizational members really use it in their practices. The critical perspectives on rationality, as those discussed in section 1.2, would suggest that analytics is used in different ways, e.g. a posteriori to justify an action that has already been done. Therefore, I suggest that analytics provides fruitful ground to expand the research agenda on rationality.

1.6   Research question

In the start of this chapter I illustrated how the technology of rationality has been established as a normative ideal for making choices and taking actions in organizations (Cabantous & Gond, 2011; Jarzabkowski & Kaplan, 2015), despite the tensions put forward by critical perspectives (Hendry, 2000; Langley, 1989; March, 2006). Afterwards, I suggested taking a practice lens (Nicolini, 2012) on rationality in order to better understand how it emerges and is enacted in organizations. The practice-based perspective emphasizes the situated nature of rationality, and directs my attention to the "doings" of organizational members and their interaction with tools of model-based rationality. In this dissertation I am focusing on one specific technology of model-based rationality, namely the technology of analytics (Davenport & Harris, 2007). Due to the technological advancements on machine power, data aggregation and algorithms, the technology of analytics is assumed to support perfectly rational decision making (Brynjolfsson et al., 2011; Sharma et al., 2014), to improve business processes (Agarwal & Dhar, 2014; Woerner & Wixom, 2015) and to rationalize knowledge work (Brynjolfsson & McAfee, 2014). However, certain researchers have started raising concerns about the advocated advantages of analytics (Constantiou & Kallinikos, 2014; Kallinikos & Constantiou, 2015; Markus, 2015; Newell, 2015). This tension indicates that by looking at the interaction of organizational members with analytics tools, we may understand better how people enact technologies of model-based rationality in general, and the technology of analytics in particular. Consequently, in this thesis I address the following research question:

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

I investigate this question by focusing on three specific areas of the phenomenon of introducing analytics: First of all, being informed by the practice lens, I acknowledge the fact that rationality (in terms of which variables should be considered and which preferences and decision rules matter) emerges while a practice is performed (Jarzabkowski & Kaplan, 2015; Nicolini, 2012). This triggers me to believe that the rationality embedded in the technology of analytics may not always fit with the rationality

that is situated in the practice that analytics is aimed to transform. Whyte et al. (2015) observed that analytics may shift paradigms and ways of thinking and may disrupt existing approaches for acting and organizing. In the era of Big Data, when analytics is expected to automate knowledge work with algorithms, clashes may emerge when the technology of analytics is introduced, because it might embed a different type of rationality from that of the existing practice. Thus, the first sub-topic that I study in my thesis includes possible clashes that may emerge when the technology of analytics is introduced in one organizational practice.

Furthermore, as analytics increases transparency in the organization through the production and visibility of information, it appears to help increase rationality in organizing e.g. by making processes of coordination, control, and performance evaluation more efficient (Zuboff, 2015). However, this rationality does not necessarily fit with the differing interests and intentions of all different actors within the organization (Nicolini, 2012). The sociomaterial practice perspective recognizes that agents enact tools in multiple ways (Boudreau & Robey, 2005; Orlikowski, 2000). Therefore, it becomes interesting to study how people deal with the information asymmetries and control issues that may be afforded by analytics tools. Therefore, a second sub-topic that I have investigated concerns how actors with different interests enact analytics in their practices, which often affords increased transparency and control in the organizational setting.

Finally, as analytics appears to help reach the normative ideal of rationality (Cabantous & Gond, 2011; Jarzabkowski & Kaplan, 2015), it may become a symbol of rationality, and it may influence organizational members toward the conspicuous use of analytical information in their effort to act rationally, or to appear as if they act rationally for legitimacy reasons (Feldman & March, 1981; Jarzabkowski & Kaplan, 2015). Thus, a third sub-topic of this thesis investigates what happens when analytics is used in the organizational setting for symbolic reasons.

1.7   Research approach

In order to answer my research question, I performed an inductive longitudinal qualitative study. An inductive, qualitative approach is well suited with my main goal to elaborate theory (Vaughan, 1992), since it allows for interpretation of social reality and it helps understand and analyze complex phenomena as they occur, embedded in their natural setting. The insights of each empirical chapter draw from a subset of the extensive set of data collected at TelCo.

TelCo is a large telecommunications provider offering telecom services to both end-consumers and businesses. I collected data from March 2013 until February 2015, in the Marketing & Sales department of the business division. As most applications of analytics

are in larger organizations, often in marketing and sales, this constitutes a typical case for studying how organizational members enact the analytics technology (Gerring, 2007). My main interest lied on how the account managers coped with the introduction of an analytics tool for model-based customer management, namely, the Customer Lifecycle Management (CLM) model. Being informed by the practice lens (Feldman & Orlikowski, 2011; Nicolini, 2012), I studied the practices of account managers from multiple sales channels, and the practices of analysts who analyzed data for customer intelligence.

I collected data mainly via interviews (Weiss, 1995) with analysts, account managers, middle managers, marketers and higher management. In order to get a better insight into the practices of the informants, I complemented the interview data with ethnographic observations collected by shadowing analysts and account managers at TelCo's offices, and by observing meetings and presentations. Documentation was also used to triangulate the sources of evidence.

I analyze the data following a process research approach (Van de Ven & Poole, 1995), which departs from the variance logic and instead focuses on how issues emerge and develop over time (Langley, 1999; Van de Ven, 2007). The processual approach recognizes the ontological assumptions of the practice perspective (Nicolini, 2012; Tsoukas & Chia, 2002) and allows me to study how the changes induced by the introduction of analytics unfolded over time, and why they unfolded this way. In order to make sense of the complex data that I have collected, I employ a multitude of strategies for analyzing and theorizing processes, such as the use of narrative, temporal bracketing, visual mapping and grounded theory (Langley, 1999).

In the next chapters I introduce the research methodology that was employed for each empirical study separately and in detail.

1.8   Dissertation outline

In order to answer the main research question of this thesis, I focus on three separate sub-topics that I elaborated earlier in this chapter. Each of these sub-topics was researched empirically in my field study. The insights for each sub-question are reported in the subsequent chapters of this thesis:

In chapter 2, I investigate what happens when the rationality advocated by analytics entails different variables, preferences and decision rules from the ones embedded in the practice in which analytics is introduced. The study suggests that clashes can emerge in such situations, between the actors who perform the existing practice and the actors who advocate the rationality embedded in analytics. More specifically, it investigates the problematic collaboration between the account managers and the analysts –who developed the CLM model to automate customer management in TelCo. Taking a practice perspective, the study investigates the clash between the two groups, who not only

employed different knowing practices, but also had different epistemologies and thus had a different view of what constitutes valid knowledge.

In chapter 3, I study how actors with different interests enact analytics in their practices, as it often affords increased transparency and control in the organizational setting. I focus on the analytics technology embedded in the CRM system (automated reports about customer information, performance reports, and other features) at TelCo, which affords transparency in the Marketing & Sales department. Transparency is presumed to increase rationality in organizing, as it can increase efficiency in coordinating customer management activities, evaluating sales performance, assigning workload, deciding on incentives, and so on. While this appears to be a rational way of organizing, I see that in practice the different actors (higher management, middle managers, sales employees, and others) have different goals and values and thus use the CRM system in unexpected ways. I see that transparency is constantly reformulated through the interactions of different actors with the CRM system, while they act upon the rationality embedded in their different practices.

In chapter 4, I investigate what happens when analytics is used in the organization for symbolic reasons. More specifically, I study the process through which the technology of analytics became institutionalized in the Sales department of TelCo. The account managers concealed their non-conformity with the analytics tool by producing information that indicated that they used the tool. However, the analysts and higher management acted upon this information and superstitiously concluded that the analytics tool was effective, and thus decided to institutionalize it. The study suggests that the symbolic adoption of the technology of rationality comes back to bite the actors who enact it, with perverse effects that not only affect the institutions, but also bring about substantive outcomes for those actors as well as for the organization.

Finally, in chapter 5 I view holistically the insights from the three studies. I discuss their theoretical and practical implications, and I introduce directions for future research. Table 1.4 provides the outline of this dissertation and the outlets in which each study has been peer-reviewed and presented.

Table 1.4 Outline of the dissertation

Chapter	Purpose	Related output	Co-authors
1. Introduction	Set the scene, introduce the problem under study, research objectives, research approach, expected contribution, outline of the thesis	Parts of the introduction will be further developed in an academic paper.	-
2. Epistemologies in clash: What happens when analytics lands in the organization?	Empirical study to examine what happens when the rationality advocated by analytics does not fit with the rationality embedded in the practice in which analytics is introduced.	Chapter 2 was peer-reviewed and presented at: the Academy of Management Meeting 2014 - OCIS Division; OLKC 2014 International Conference on Organizational Learning, Knowledge and Capabilities; Third European Theory Development Workshop in OMT and Strategy 2014. The chapter will be submitted for publication to a journal in the field of organization science.	This paper has been written in collaboration with Hans Berends, Samer Faraj, and Marleen Huysman
3. Playing the numbers game: Dealing with transparency	Empirical study to investigate how actors with different interests enact analytics in their practices, as it often affords increased transparency and control in the organizational setting.	Chapter 3 was peer-reviewed and presented at the Academy of Management Meeting 2015 - OCIS Division. The chapter will be submitted for publication to a journal in the field of information systems.	This paper has been written in collaboration with Hans Berends and Marleen Huysman
4. It comes back to bite you: The unintended consequences of symbolic adoption	Empirical study to examine what happens when analytics is used in the organizational setting for symbolic reasons.	Chapter 4 was presented at PROS 2015 - Seventh International Symposium on Process Organization Studies. The chapter will be submitted for publication to a journal in the field of organization studies.	This paper has been written in collaboration with Inge van de Weerd and Marleen Huysman
5. Discussion and Conclusions	Summarize the findings and discuss final conclusions, present the limitations of the dissertation, discuss the implications for theory and practice and	-	-

As can be seen in the table above, chapters 2, 3 and 4 were written as independent academic articles in collaboration with co-authors. Therefore, in these chapters "we" is used to refer to myself and to my co-authors on the corresponding articles.

1.9   Contribution of this dissertation

This dissertation as a whole contributes to the discussion on rationality that has preoccupied the field of organization theory since its infancy. By taking a practice lens, it investigates how rationality emerges in practice as organizational members enact technologies of model-based rationality (Jarzabkowski & Kaplan, 2015). In this way, the thesis contributes to the conceptualization of rationality in organizations as an effortful accomplishment, situated in people's practices (Cabantous & Gond, 2011). At the same time, the thesis speaks to the field of information systems, which –to a large extent– has been overly enthusiastic over the possibilities that analytics and big data technologies offer, and extends the challenges that the technology of analytics entails for organizations (Constantiou & Kallinikos, 2014; Markus, 2015; Zuboff, 2015).

Next to the theoretical implications of this thesis as a whole, each study also contributes to other theoretical conversations. Chapter 2 contributes to the ongoing discussion on knowledge at work (Bechky, 2003; Carlile, 2004; Orlikowski, 2002) by suggesting that people reflect on their own epistemologies for understanding what constitutes valid knowledge and how it is produced, and that pragmatic boundaries on knowledge collaboration may entail epistemological differences between different occupational communities, which are difficult to reconcile. Chapter 3 contributes to the theoretical conceptualization of transparency (Bernstein, 2012; Hansen & Flyverbom, 2015), by suggesting that transparency is performative, in the sense that it often mutates that which it is aimed to make visible. Also, chapter 3 contributes to the ongoing discussion in the field of information systems regarding the use of digital technologies to increase surveillance and control in organizations (Elmes, Strong, & Volkoff, 2005; Zuboff, 1988, 2015) by suggesting that the interaction with digital technologies can make things opaque as much as it can make them visible. Finally, chapter 4 contributes to the literature on institutionalization (Barley & Tolbert, 1997) and institutional change (Dacin, Goodstein, & Scott, 2002; Kellogg, 2009) by suggesting that symbolic actions performed to conceal non-conformity can also influence the institutional order, and can have perverse substantive effects for the organization and its members.

Finally, the thesis also has implications for practice: First of all, it focuses managers' attention on the use of tools for model-based rationality, and suggests that the way these tools are used influences how rationality will be enacted. This means that one cannot expect organizational members to use analytics tools in the same way, and that rationality is shaped while a practice is performed. Thus, efforts to increase rationality in the organization need careful consideration of how they suit the different practices; otherwise they may lead to clashes and other perverse effects.