Business Intelligence Adoption and Implementation Risk in SMEs:
Insights From an Empirical Study in Tunisia

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ABSTRACT

Business Intelligence (BI) systems are increasingly accessible to small and medium-sized enterprises (SMEs). Like all information systems (IS), their implementation is very risky by nature. Several scholars underscore that IS risk management is more effective when initiated earlier in the system life cycle, as early as at the adoption. The objective of this research is to describe and understand the process of BI adoption in SMEs focusing on the management of implementation risk of from the adoption stage using an interpretive holistic single-case study of a small manufacturing firm in Tunisia in Africa that successfully adopted a BI system. Consistent with previous research, the study shows that in order to manage the implementation risk during the adoption stage, SMEs can proceed in a way that is more efficient for them that is rather intuitive, informal, and unstructured, which is, however, explicitly based on an architecture of principles, policies, and practices. The main limitation of the study is related to the qualitative single case study design.

KEYWORDS

INTRODUCTION

Business Intelligence (BI) systems have been dominating the technological priority list of many Chief Information Officers (CIO's) since 2009 (Luftman & Ben-Zvi, 2010). Likewise, the worldwide expenditure of BI tools by IT companies was expected to grow from nearly $122 billion in 2015 to more than $187 billion in 2019, an increase of more than 50% over the five-year forecast period (IDC, 2016). The integration of BI systems with the business process is seen as important to monitor

business value at both operational and strategic level in dynamic business environments (Chen, Chiang, & Storey, 2012).

Even though, as for most information technology tools, the majority of BI systems are mainly adopted by large enterprises, their advantages are mostly the same for both large and small and medium-sized enterprises (SMEs) (Popovič, Puklavec, & Oliveira, 2019). Indeed, in order to survive, SMEs are seeking to adopt and implement information systems (IS) particularly BI systems now considered as an important component of competitiveness in the current *data-driven* economy (Howson et al., 2019; Poba-Nzaou, Uwizeyemungu, & Saada, 2019).

As a matter of fact, SMEs found themselves faced with the increasing demand for business information with voluminous data and limited time for decision-making (Muryjas, 2014). Furthermore, the socio-economic environment, characterized by strong competition and data availability, encourages companies to adopt systems such as BI, that facilitate efficient processing and analysis of data from different sources (Poba-Nzaou et al., 2019). However, the implementation of BI tools, like any other enterprise system, is often characterized by a high level of complexity and entails greater risk of implementation failure (Dresner, 2019).

Notwithstanding the importance of BI systems, SMEs are still lagging behind in terms of implementing and leveraging the advantages stemming from the use of the BI systems. In this regard, it is essential that research focus on ways to improve implementation of BI tools project (Deng & Chi, 2012; Popovič, 2017). This is most important in resource-limited context that characterizes SMEs.

In addition, research on BI systems in the context of SMEs is particularly limited. A quick search on Scopus database (in February 2020) using "Business Intelligence" AND "Small Business" as key words returned only 7 journal articles. In a recent systematic literature review conducted in eight databases including Google Scholar, Llave (2017) found only 26 journal articles investigating on BI in the context of SMEs. Moreover, in the existing literature on BI systems, to the best of our knowledge, no study has yet explicitly addressed the possibility of reducing the risk of implementing a BI system at the adoption stage in the SME context. Here it is important to emphasize that results obtained from IS studies realized in the context of large firms cannot necessarily be generalized and transferred to the context of SMEs (Sarkar, Wingreen, & Cragg, 2017). Hence, following Poba-Nzaou and Raymond (2011), this study addresses the above-mentioned gaps in the literature by attempting to answer the following research question: *How does the process of adopting a BI system affect the level of risk of its implementation in the context of SMEs*?

To generate rich insights on this question, we investigate a single interpretive field study (Walsham, 1995, 2006) of a small firm that has successfully implemented a BI system in Tunisia, in Africa. At this stage, it is important to remember three facts: (1) as in most industrialized and developing countries, SMEs are numerically and economically important for Tunisia. In fact, according to IMG-Médias (2015), Tunisia had about 11,000 SMEs contributing to 65% of the employment and two thirds of the country's economic activity. In Tunisia, the Institut National de la Statistique defines an SME as an enterprise employing 6 to 199 employees (2) a recent systematic review of BI literature conducted by Ain, Vaia, Delone, and Waheed (2019) reveals that, of the 111 studies analyzed, the majority (56%) adopted a quantitative as opposed to qualitative approach (19%) of which only 10% used a case study (3) and only 8% of the sample were studies conducted in the context of an African country. The objective of this study is to analyze the management of BI implementation risk during the adoption stage in the context of SME in a developing country using combined business intelligence systems adoption framework and Diffusion of Innovation Theory. Following the introduction, the empirical and theoretical foundations are presented. The subsequent section is devoted to the discussion of the research results. Lastly, the study concludes with stating implications for practice as well as directions for future research.

EMPIRICAL AND THEORETICAL FOUNDATIONS

The empirical and theoretical foundations of this inquiry is composed of two parts: (1) a theoretical background that combines studies on IS risk management, and (2) a theoretical foreground based upon Diffusion of Innovation Theory.

Theoretical Background

Defining Business Intelligence Systems and their Key Functionalities

There are various definitions of BI system with various features and functionalities (Aruldoss, Travis, & Venkatesan, 2014; Baars & Kemper, 2008; Chaudhuri, Dayal, & Narasayya, 2011; Popovič, Hackney, Coelho, & Jaklič, 2012) and the concept encompasses both the concept of a product as well as that of a process (Vedder & Guynes, 2001). Broadly speaking, as a product, Business Intelligence (BI) could be referred to as the architecture and the integrated collection of decision support and database applications. In this vein, it can also be defined as "a broad category of applications, technologies, and processes for gathering, storing, accessing, and analyzing data to help business users make better decisions" (Watson, 2009, p. 491). However, as a process, it is mainly one of collecting, processing and disseminating information within an organization. It is designed to deliver data to the decision makers involving technology and the application of data to derive insights by combining data gathering, data storage and with analysis to provide input.

Business Intelligence Systems and Risk

Although the concept of risk is widely accepted and important amongst IS researchers and practitioners, there is no clear consensus on its definitions, and for this study, risk refers to the uncertainty that can have a negative or positive effect on an organization's ability to achieve its objectives (Shin, 2002). The IT risk is defined by the Information Systems Audit and Control Associations – ISACA (2009, p. 11) as a "business risk associated with the use, ownership, operation, involvement, influence and adoption of IT within an enterprise". ISACA underscores that IT risk is composed of IT-related events and conditions that can probably impact the business; it can arise with both uncertainty frequency and magnitude, and it generates threats in attaining strategic goals and objectives.

Despite the litany of problems cited in the literature over the past four decades of software development projects failure rates are stil a concern as they always result in significant financial losses (Dwivedi et al., 2015; Hughes, Dwivedi, Rana, & Simintiras, 2016), as evidenced by Standish Group CHAOS report which is frequently cited in the literature. The 2015 report indicated that only 36% of software projects were considered successful, 45% exceeded their initial cost estimate and 19% failed (The Standish Group, 2015). In short, the software projects have proved expensive, difficult to implement and often have a high failure rate. Business Intelligence systems are no exception. Recently Gartner (2019) predicted that, even though by 2022, about 90% of corporate strategies will especially recognize *information* as a critical enterprise asset and analytics, including BI as an essential competency, by then, only 20% of analytic and BI insights will generate business outcomes, thus underscoring the risky nature of BI projects.

According to Dresner (2019) the percentage of organizations reporting successful implementation of BI systems was only 31% in 2018 and 29% in 2019 . A study by Messaoudi (2014) found that the failure rate of BI system implementations is estimated at more than 50%. Actually, the implementation of a BI system can cause organizational as well as technical disruptions (Ang & Teo, 2000). The problems that are considered the most frequent and difficult to overcome are non-technical in nature (these includes management issues, lack of skills or resources, managers IT knowledge and other organizational factors (El-Adaileh & Foster, 2019; Salisu, Bin Mohd Sappri, & Bin Omar, 2021)) with a percentage of 70% compared to 20% for technical problems (Adamala & Cidrin, 2011).

## Business Intelligence Systems Adoption Framework

We adopted a framework based on Poba-Nzaou and Raymond (2011) whose conceptualization is composed of six key concepts, underpin the concept of risk management at the adoption stage: context of the adoption process, steps of the adoption process, risk factors, risk exposure, risk management profile, and *fit* (see Figure 1).

According to the framework, BI implantation risk management at the adoption phase can be conceptualized as the process of searching for the *fit* between implementation risk exposure and risk management profile. In addition, the framework suggests that this process is influenced by a general context (TOE-Technology-Organization-Environment) of the implementation as well as a specific context and it can be broken down into seven sub-processes: decision, planification, information search, selection, evaluation, choice and negotiation. The organization movement throughout the adoption process is made possible thanks to the presence of one ore several motors of change (Van de Ven & Poole, 1995). The last authors identify four motors of change: life cycle, teleology, dialectics, and evolution.

In this framework, risk exposure is estimated based on risk factors and risk factors refer to factors whose presence increases the likelihood of negative results (Alter & Sherer, 2004). Given the lack of consensus on the nature of information systems risk factors and key components for those factors (Alter & Sherer, 2004; O'Callaghan, 2007), this study adapts the risk exposure categories identified by Poba-Nzaou and Raymond (2011); these are technological, business, organizational, contractual, legal, entrepreneurial or managerial and financial.

The organizational risk derives from the characteristics of the organization in which the BI system is implemented and used (Wu, Chen, & Olson, 2014). The business risk stems from internal and external consistency of the business model and processes after BI implementation (Sadok & Lesca, 2009), whereas the technological risk arises from information processing technology needed to operate the BI system (Kytle & Ruggie, 2005; Shin, 2002). The entrepreneurial or managerial risk is related to the attitude of owner managers or the management team towards IT/IS in general and BI systems

Figure 1. Framework of BI adoption process and implementation risk management
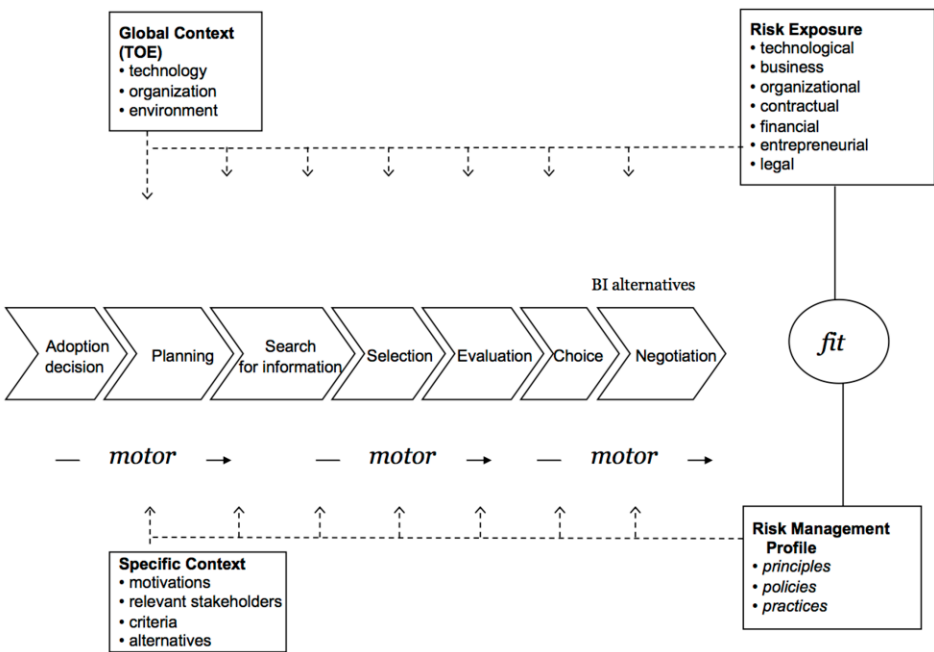
in particular (Olszak & Ziemba, 2012; Wu et al., 2014). The financial risk emanates from cash-flow problems limiting SME ability to cover all expenses related to the adoption, implementation and use including software licensing and upgrading fees (Ariss, Raghunathan, & Kunnathar, 2000; Ranjan, 2009; Wu et al., 2014). Broadly speaking, packaged software is generally licensed as opposed to sell outright. The legal risk is related to product intellectual property.

Risk management profile includes the mechanisms for mitigating risk and reducing the degree of exposure (Poba-Nzaou & Raymond, 2011; Poba-Nzaou, Raymond, & Fabi, 2008).

In a general sense, *fit* is anything about an element P that *works* with E in order to facilitate an outcome Y (Harrison, 2007) . The concept of *fit* is used to refer to the extent to which a project's risk management profile *works* its risk exposure. More specifically, according to Poba-Nzaou and Raymond (2011, p. 172), "project risk management can be understood through the fit between the organization's level of exposure to risk and its risk management profile".

General Context of BI Adoption

Based on the TOE (Technology, Organization, Environment) framework (Depietro, Wiarda, & Fleischer, 1990), the general context of BI adoption is conceptualized as threefold: Technological (existing and new technologies already implemented by the firm), Organizational (firm size, resources, including managerial and entrepreneurial (in the case of SME) structure and their roles in the implementation process), and Environmental (industry competitors and industry size). Furthermore, the TOE framework is a relatively broad framework that has been demonstrated to be easily adaptable to a specific domain within IS. For instance, it has been widely used in prior studies to understand technology adoption and implementation including cloud computing, ERP (Enterprise Resource Planning), e-business and BIM (Building Information Modeling) to name but a few (Alshamaila, Papagiannidis, & Li, 2013; Bosch-Sijtsema, Isaksson, Lennartsson, & Linderoth, 2017; Low, Chen, & Wu, 2011; Masrek, Jamaludin, & Hashim, 2009; Oliveira & Martins, 2011; Poba-Nzaou & Raymond, 2011; Zhu, Kraemer, & Xu, 2006). The TOE framework has also been used to understand BI systems implementation and adoption (Bijker & Hart, 2013; Malladi & Krishnan, 2013).

Specific Context of BI Adoption

The influence of the specific context of the adoption is more direct and immediate than the general context presented in the previous section. Following Poba-Nzaou and Raymond (2011), we contend that the adoption process can be influenced by four elements pertaining to the specific context of the adoption: (1) the motivations to adopt the BI system, which motivations can be operational, technical or strategic in nature (2) the different stakeholder actors implicated in the adoption process such as software vendors, owner managers, integrators, business analysts, BI executives, BI architects, developers and data management experts (3) the selection criteria for the BI system, applied not only to the systems itself, but also to the software vendor and the integrator (4) the alternatives which refer to BI tools available options that can be either of open source or proprietary type.

Theoretical Foreground

Theories Applicable to BI Systems Adoption

Several theories have been used in past studies to understand IT adoption and implementation at the organizational level. In our study, we focus on Rogers' (1995) Diffusion of Innovation Theory (DOIT) which is a non-domain specific theory and the most widely applied theory in technology adoption research (Cruz-Jesus, Oliveira, & Naranjo, 2018; El-Adaileh & Foster, 2019; Ewe, Yap, & Lee, 2015; Gaardboe & Jonasen, 2018; Salisu et al., 2021). The spreading out of innovation is a process by which an innovation is communicated and shared, through certain channels, over time, among members in a social system (Rogers, 1995). Innovation can be an idea, practice or tool that is seen to be new to potential users. According to the DOIT, five attributes of an innovation are relevant in explaining

various levels of its adoption and diffusion: a) the relative economic and social advantage which is the extent to which a particular group of users perceive innovation as better than the idea it replaces; b) compatibility with the values and practices which refer to the degree to which an innovation is perceived to be consistent with existing values and practices, past experiences and needs of potential adopters; any innovation incompatible with the values and norms of their practices will not be adopted as fast if it is compatible; c) complexity which is the extent to which innovation is perceived to be difficult to understand and use; the simpler the innovation, the sooner it will be adopted; d) trialability that is the extent to which an innovation can be tested on limited evidence before convincing most of the potential adopters; if the innovation is not tested, it cannot be expected to be successful; e) the observability of the results which is the degree to which the results of an innovation are visible; if the results of an innovation are easily visible by users, it is more likely for them to adopt it.

Rogers (1995) also describes five categories of innovation adopters along the continuum of innovativeness: i) innovators who represent about 2.5% of the population; these are the first adopters of the innovation who usually decide the adoption without consulting the opinions of others; ii) the early adopters represent about 13.5%; this cohort is composed of adopters who quickly embrace the innovation and share their opinions. These are considered as references to be consulted before the innovation is adopted; iii) the early majority represents about 34% of the population; it brings together adopters who take their time before adopting the innovation; they tend to always use previous experience when adopting the innovation; iv) represents about 34% of the population; this cohort is composed of adopters who expect the product to be used by a large number of users before deciding to move forward with the adoption. Hence, they will be asking for proof of success from previous adopters; v) late adopters represent about 16% of adopters; these are the most rational adopters who expect the innovation to be tested and validated by all previous adopters.

Although the first focus of DOIT was at the individual level, Rogers' (1995) theory has since been extended to the organizational level. At the organizational level, attributes such as "individual (leader) characteristics, internal organizational structural characteristics, and external characteristics of the organization" (Oliveira & Martins, 2011) may also influence an organization's innovativeness. Further, owner-manager's characteristics were also found to have direct influence to adopt BI systems (Mohammad Kasem, Ahmad Samed, Amro, & Mohammad Hamdi Al, 2020).

RESEARCH METHODS

Given the research question, we adopted a qualitative approach with an interpretive stance to understand the reality by focusing on subjective meanings that informant assigns to the social phenomenon under study as it is lived by them (Butler, 1998; Klein & Myers, 1999). In addition, the choice of interpretative field study helps to understand the context of an information system and the dynamics of reciprocal influence between the system and its context (Walsham, 1995). We conducted an in-depth holistic single case (Yin, 2003) in order to generate initial "rich insights" (Walsham, 1995) on the adoption of the BI system and the management of implementation risk, in the context of small firms. The unit of analysis selected for the research is the small firm or the organization. The only criterion used to select a case was to have adopted and implemented a BI system in Tunisia less than five years ago. Several firms were contacted through the personal network of one of the research team members and Omega was the first organization to have agreed to participate in the research project.

We relied on three main sources of data collection: semi-structured interviews, Omega enterprise and project documentation, and researcher field notes. In total, four key informants were selected on the ground that they played an active role during the adoption and the implementation of the BI system: the information system manager, the administrative director and controlling manager, the sales administrator and the information system assistant. This approach was adopted by similar study by Olexová (2014) as well as Poba-Nzaou, Raymond and Fabi (2014). Each individual interview lasted for about an hour. All interviews were audio taped and transcribed verbatim.

It is important to underscore that an adequate level of saturation was reached after the third interview (Guba & Lincoln, 2004). In fact, achieving saturation with such a small number of key informants is not surprising for several reasons (Guest, Bunce, & Johnson, 2006; Morse, 1994, 2000; Poba-Nzaou, Raymond, & Fabi, 2014): (1) the small and very well-limited and clearly circumscribed perimeter of the study in the context of a small firm (2) the clear nature of the research question requesting information that is easy to obtain for key informants as they played active roles in the adoption and implementation processes of the BI system (3) the phenomenological nature of the investigation (4) the high quality of the data obtained from key informants given that they all were inspired and excited to reflect on their experience and express themselves cheerfully.

The data analysis process started during the procedure of data collection. We first identified sequences in time as well as focal actors, desirable outcomes and relevant contextual clues allowing us to explicitly incorporate time dimension in our analysis (Pentland, 1999). Following an iterative approach, we applied the principle of "hermeneutical cycle" which is the primary principle of interpretive research (Klein & Myers, 1999). Finally, we employed the principle of abstraction and generalization which allowed us to link and generalize our empirical findings to theoretical concepts. More specifically, we drew on the concepts defined in our theoretical background as vehicles to infer abstraction and generalization from our findings. Once again, this was completed in the process of moving back and forth, not only between the data and the selected concepts, but also within the data and the concepts in the manner of the hermeneutic cycle (Klein & Myers, 1999).

Following previous scholars (Flyvbjerg, 2006; Gomm, Hammersley, & Foster, 2000; Walsham, 1995), we argue that the question of generalization is relevant in a single interpretive case study albeit being different and requiring very different actions to be enhanced. The last author identified four types of generalization from IS interpretive case study including "contribution of rich insights" which applies to this research. In addition, we provided 'thick description' (Geertz, 1973) in order to facilitate transferability in allowing managers and other researchers to assess the extent of analogy between our case and those to which our findings are to be applied (Guba & Lincoln, 1989).

Created in 2000 by a father and his three sons, Omega is an SME specialized in the refining and packaging of edible oils. Omega is one of the leaders in its niche market in the food industry in Tunisia and continues to expand its operation beyond its original market. It is a subsidiary of a large international European company that is its main business partner. As is shown in Figure 2, Omega adopted a BI system at the end of a process that lasted about a year and one month.

Figure 2. Timeline of the Adoption of BI system at Omega
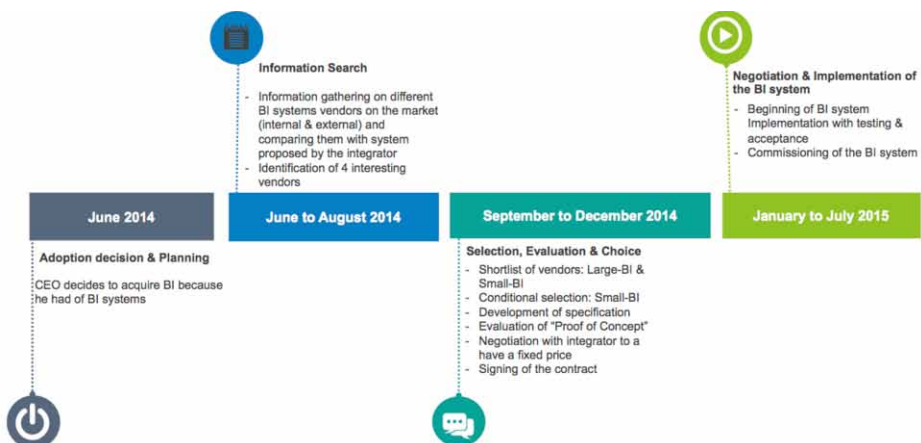
RESULTS

Following our research framework, the subsequent paragraphs present the general and specific context of the dynamics of the adoption of a BI system at Omega, including the steps in the adoption process as well as the practices mobilized by Omega to minimize implementation risks from the adoption stage (Figure 3).

The Global Context of BI Adoption at Omega

- **The environmental context:** Omega is characterized by a high dependence on its customers and suppliers. In 2015, it achieved 80% of its turnover with 26 customers and 10% of its turnover with its largest customers. Omega's commercial dependency is fairly distributed where the main supplier accounts for only 12.5% and the rest is supplied by several firms. This situation is the result of purposeful managerial choice based on a strong willingness to decrease the risk of shortages or potential conflict of interest with some of the suppliers.

- **The organizational context:** Omega is a wholly owned family group SME in the food industry with 150 staff members. In 2015, the organization had an annual turnover of $40 million and share capital of $3,500,000. The objective of the organization is to develop organizational competence and innovation capabilities in order to achieve high performance by introducing modern technologies applicable in its sector. Omega relies on either produce to stock or produce to order types of production by specializing in the production and export of oils. Omega hopes to maintain its "niche" with stable production of vegetable oils such as olive oil, sunflower oil, corn oil, grapeseed oil and palm oil. To give value to its production strategy, Omega is incorporating other types of edible vegetable oils to making frying oils as well as packaging olive oils. The organization has a production unit with three production lines and three packaging lines. These include a line for vegetable oils in cans, one for PET bottles and another one for the packaging of olive oil in glass bottles in addition to a line for packaging olive oil in gallons of 3 to 10 liters.

Figure 3. Dynamics of the adoption process and implementation of BI System and Risk management at Omega
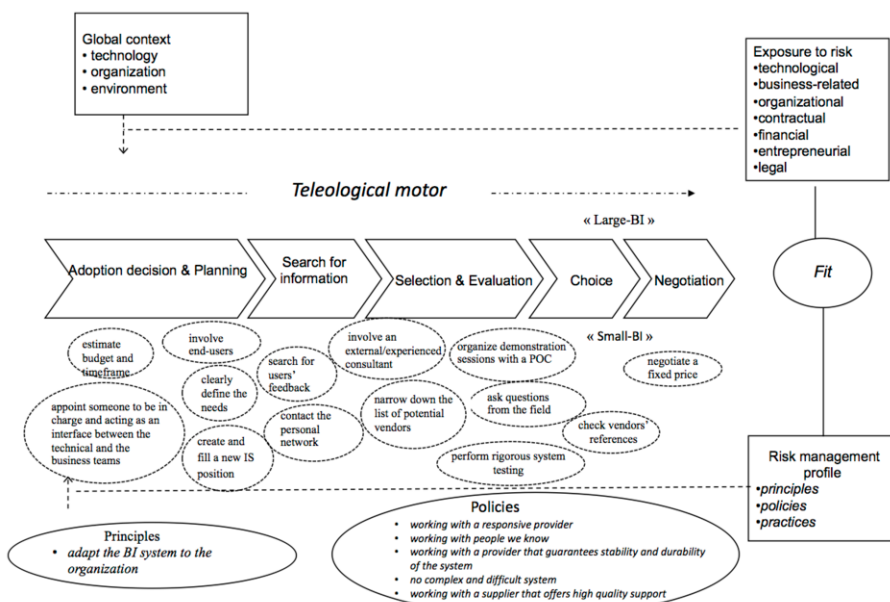
Omega's strategic aim is to expand in neighboring regional (Africa) and international markets (especially Europe). The organization has the ability to compete and contract with foreign partners through the tendering process. This gives Omega a significant competitive advantage founded on its responsiveness, reputation to offer quality products and services that meet international standards at competitive prices. The selling price policy of its products depends on three factors: (1) the cost price of the raw materials (2) the benchmarking of different prices for similar products in both the local and the international markets (3) the volume of the orders, as well as the duration of the contract when applicable. Omega pursues "flexibility-based" strategies (Armstrong, 2013) that allow its teams to set prices when the export order is placed.

- **The technological context:** Prior to the BI system implementation, Omega application portfolio was already sophisticated and based on a proprietary ERP system, Microsoft Office suite and other specific production software. The information extracted from these systems was often scattered, erroneous, and redundant. This kind of information system is often characterized by inflexibility, inefficiency and disintegration (Poba-Nzaou, 2008). However, Omega wanted to analyze its commercial and production activities in order to improve associated processes, that is to manage inventory and sales in real time. It is for this reason that Omega decided to adopt the BI system and hired an Information Systems Manager to manage the implementation of the project.
- **The entrepreneurial or managerial context:** The majority of the management team, including the CEO and operational team were quite familiar with computers and open to IT and new technologies. In fact, most of them are passionate about computers and have several years of experience in the agri-food industry.

The Specific Context and Process of BI Adoption at Omega

- **Motivation:** Omega management indicated that the motivation to adopt BI systems coincided with the organization's intention to modernize its business processes so as to allow the management team to have a high level of visibility on its activities and real-time capability of analyzing data in order to enhance its decision-making processes in order to improve its organizational performance. More specifically, Omega wanted to have a better knowledge of its transactions with suppliers and its market activities. Thus, the primary motivations for adopting a BI system at Omega could be considered not only strategic but also operational and technological.
- **Stakeholders:** In total about 10 main internal stakeholders were involved in the adoption process, including the CEO and various employees within the organization. This ensured internal stakeholders participated throughout the BI adoption led by the integrator and an external consultant that was hired specifically by Omega as indicated by the Information System Manager:

The CEO, the administrative director and head of management controls and I involved users, of course, by assisting in the demonstration to validate the solution proposed by the service provider and a consultant [Information Systems Manager]

- **The criteria:** Omega mainly based its BI system selection on the criterion of the degree of congruence of the system with its existing business processes and systems. The underlying principle followed by Omega was "the system must meet the local needs" along with policies such as the acquisition of the system should be "within the planned budget" (see Table 3 Example of a chain of evidence in the Appendix). Other criteria included the quality of services and support provided by the integrator and the software vendor, and the quality and extent of functional coverage of the BI system and the ease of interfacing with the existing ERP system.

The key informants reported that the implementation outcomes met their needs and expectations, hence the implementation of the BI system was considered a success from their point of view. The data analysis revealed that the adoption process at Omega consisted of five out of the seven steps suggested by Poba-Nzaou and Raymond (2011) as the adoption decision and the planning as well as the selection and the evaluation were hard to separate: the adoption decision & planning, information search, selection & evaluation, choice and negotiation.

The BI Adoption Process Steps at Omega

- **The adoption decision and Planning:** As stated before, the motivation for Omega to seek a BI system was of strategic, operational and technological nature and was also related to the willingness to mitigate risks associated with its day-to-day operations and transactions. The organization was already generating a huge volume of complex data. The data provided to the management team was particularly tedious to process using the legacy system as stressed by both the administrative and the sales directors:

The CEO pushed us to adopt a BI system, we had a lot of historical data and were overwhelmed with tasks that required a lot of time and manpower … to be able to project, avoid and manage risk by using data from providers or market data. We wanted to automate the process, improve our productivity and performance and relieve our employees of tasks that can be automated so they will have more of a supervisory role [Administrative Director and Controller]

The BI system helps to document and modelize our data so as to see clearly what is going on in the company operations and finances. We need to document in order to be able to analyze and act accordingly to our reality… The idea was born from the ERP we had. We were in operational mode, but to go a little higher and then able to make reliable decisions and exploit data was the first decision of the CEO [that triggered the adoption process] [Sales Director]

The management of Omega did not have a formalized plan to adopt the BI system nor a budget or a formally defined schedule. However, they had an idea of the amount of money or budget they were prepared to invest as well as the commitment in terms of amount of time that they were willing to spend on the project.

- **The search for information:** Once the management specified the needs, Omega carried out information searches in the following three steps:
  - **Internet searches:** The management team collated information about different tools and feedback from different users from the internet.
  - **Information gathering via the network:** The CEO shared the knowledge gathered from the BI systems community (experts) who have implemented similar systems.
  - **Request for information from the ERP integrator:** Omega also consulted a well-known integrator for advice as indicated by the Administrative Director.

On discussion between us, the selection was not in fact made overnight, it took a long time between our CEO and the business managers, we talked to each other, we discussed together, we did some research on the internet, the CEO also brought back ideas from his acquaintances on what is done on the market. We have seen on the Internet the different software on the market and received feedback from others using BI systems. [Administrative Director and Head of Management Controls]

- **Selection and evaluation:** With those informal references regarding the costs and the timeframe in the head, the management of Omega compared quotations for the license, implementation and integration services of the BI systems from various suppliers as underscored by the IS Assistant and the Administrative Director.

We had requested quotes for the license (annual license), as well as for setup and integration. [Information System Assistant]

At the beginning, based on the specification document prepared by Omega with the help of an external consultant, four providers were initially selected. At the end of the demonstrations, one large vendor (Large-BI) and one small specialized BI system vendor (Small-BI) were shortlisted based on the organization's principle stating that "*the system should fit the enterprise*" and not the other way around. Other activities carried out by Omega during this step are described by the Administrative director:

We had an analysis phase. In the beginning, we selected 4 providers, we made a comparison between them, but honestly, the solution presented by our integrator gave us the confidence and reassured us by showing us concretely how the system works. He made us a POC "Proof of Concept" and showed us what the system will give us using historical data and the results were satisfactory to us. Since the integrator had a very good command of the BI system and our ERP, he interfaced it [easily] with the BI system. [Administrative Director and Head of Management Controls]

Thereafter:

The integrator gave us a demonstration. He presented us with the solution, explaining what the system will offer us and how to integrate it. We tried to see the screens and play with them to find out how the system works. We asked a lot of questions about how it works and how it can be administered, so the POC was conclusive for us. We didn't want to test it for a month, which wasn't the goal; we were looking for a solution to be implemented quickly. [Sales Administrator]

- **The choice:** The final demonstration done by the Integrator focused on different functionalities and the management team was impressed. The integrator experience, as well as the possible alignment between the BI system and the business process, significantly influenced Omega choice of Small-BI as highlighted by the IS Assistant, the Sales Administrator, and the Administrator Director:

We had enough confidence in our integrator and we've been working together for a while now and he showed us that it integrated very well with our existing system and it addresses our functional requirements. [Information System Assistant]

Despite the attractiveness of Small-BI, Omega nonetheless critically reviewed Large-BI options as indicated by the Sales administrator:

We have studied Large-BI options; they've proven themselves, but we were wondering ... is it going to be easy to implement ? Is it going to be complicated ? So we preferred this solution. Even on the price level, it gives us a preferential rate as we are already a customer with them via our integrator and we were satisfied with our integrator. [Sales Administrator]

We have been working with our integrator [for years]. He is a leader in his field and had a good reputation in the market. [Sales Administrator]

In addition, the support to be provided post-implementation was crucial to Omega. In this regard, the existing relationships with the integrator played in its favor and especially their experience of having been supported at all times by a dedicated team. A statement by the Administrative Director and Controller:

Another important factor in choosing this partner is their ability to offer support post-implementation and their reaction time to address the problem is crucial. [Administration and Control Officer]

- **Negotiation:** The formal negotiations on the pricing of the license, implementation and integration schedule of the BI systems were essential to the signing of the contract. Further, there was another round of negotiation on a module that was not initial including in the functional scope of the project from the beginning but was afterward needed as highlighted by the Administrative Director:

There were price negotiations. There was one module we needed, but it was over budget. We tried to negotiate a little with the integrator to get him to give us a price, and it worked. Of course, there was a negotiation phase where we tried to optimize the price, trying to have a price that did not exceed our budget. [Administrative Director and Head of Management Controls]

It is important to note that, overall, Omega is satisfied with the functionality, the reliability and the relevance of the system. Other sources of satisfaction include the ease of use of the BI system, the quality of the diverse training offered by the integrator, the support as well as its guidance. A statement by the Administration and Control Officier illustrates this point:

The results are in line with our expectations and needs defined at the beginning of the process. It made us discover aspects that we did not know in our company, a correlation of everyday data that is reliable for decision-making and the creation of new information more relevant. [Administration and Control Officer]

DISCUSSION

It is important to remember that, because of their specific characteristics, including limited resources, SMEs tend to adopt different tools and methods when compared to their larger counterparts (de Araújo Lima, Crema, & Verbano, 2020). Again, because of their particular characteristics, small firms will have a harder time to recover from the failure of the implementation of an IT system and implementing a BI system is a costly, resource-intensive, complex and risky undertaking (Thong, 1999; Yeoh & Popovič, 2016). Despite both the "numerical and economical" (Jenkins, 2004) importance of SMEs in most countries, our understanding of risk management and especially IT risk management in the context of SME is still limited.

This study reports on a case study of the management of BI implementation risk by a small firm at the outset of the adoption stage. Interestingly, consistent with previous studies (Bannerman, 2008; Ciborra, 2004; Falkner & Hiebl, 2015; March & Shapira, 1987; O'Connor & Kelly, 2017; Poba-Nzaou & Raymond, 2011; Simmons, Armstrong, & Durkin, 2008), we found that overall, Omega's approach to BI implementation risk was rather reactive, informal and intuitive mainly based on informal and semi-informal activities. More specifically, from the risk management perspective, one may infer that the management of BI system implementation risk at Omega was an informal and

step-by-step approach based on a 3-tier architecture of principles, policies and practices as reported by Poba-Nzaou and Raymond (2011).

Our data analysis revealed one principle, five policies and fourteen practices mobilized by Omega to manage the implementation risk at the outset of the adoption process (see Tables 1 and 2). Actually, the application of the principle, policies and practices have impacted the adopting process as well as the BI systems alternatives considered, and the exposure to implementation risk (Poba-Nzaou & Raymond, 2011).

Our data analysis reveals that Omega BI system implementation risk management was initiated at the adoption stage albeit in an informal way. It is worth noting that, despite the informal nature of the approach adopted by Omega, their undertaking contributed to the effective minimization of implementation risk exposure and the implementation is considered a success by the informants as they are satisfied by the systems and its impacts.

For instance, Omega's exposure to organizational risk was found to be high (see Tables 1 and 2). Some of the contributing factors to this level of exposure were: employee reluctance to adopt a BI system, low level of task automation and lack of project management expertise. In order to decrease the exposure to this risk, Omega implemented one principle, three policies and three practices that contributed to decreasing the exposure to organizational risk. The three practices are: "*involve users*" and "*organize demonstration sessions with a 'POC'*" and "*search for users' feedback*". These practices

Table 1. BI risk exposure and management principles, policies and practices of Omega

The dimensions of risk exposure and risk factors	Level of exposure to risk
Organizational Risk • Employee reluctance to adopt BI systems • Low level of task automation • Lack of project management expertise	High-risk exposure • Number of principles = 1 • Number of policies = 3 • Number of practices = 6
Technological Risk • Need to interface the BI system with the existing IS including the ERP system • What's new in the BI system • Risk related to the relevance of the information resulting from the numerous manipulations and the BI-ERP interface	High-risk exposure • Number of principles = 0 • Number of policies = 3 • Number of practices = 8
Business Risk • Transformation of manual business processes to align them with the BI system • Maintaining consistency of target processes	High-risk exposure • Number of principles = 1 • Number of policies = 3 • Number of practices = 9
Contractual Risk • Characteristics of the software vendor • Characteristics of the integrator	Low-risk exposure • Number of principles = 0 • Number of policies = 1 • Number of practices = 3
Financial Risk • Financial capacity	Low-risk exposure • Number of principles = 0 • Number of policies = 0 • Number of practices = 2
Entrepreneurial Risk • The attitude of the owner manager	Low-risk exposure • Number of principles = 0 • Number of policies = 0 • Number of practices = 0
Legal Risk • Related to intellectual property	Low-risk exposure • Number of principles = 0 • Number of policies = 0 • Number of practices = 0

Table 2. Principles, policies and practices of implementation risk management and their effects on the adoption process at Omega

	Decision & Planning	Search for Information	Selection	Evaluation & Choice	Negotiation	Large Vendor	A Small Specialized BI Vendor	Organisational Risk (High)	Technology Risk (High)	Business-Related Risk (High)	Financial Risk (Low)	Contractual Risk (Low)	Entrepreneurial Risk (Low)	Legal Risk (Low)
Principle Adapt the BI system to the organisation	■	■	■	■	■	-	+	■		■				
Policies														
Working with a responsive provider	■	■	■	■	■	-	+							
Working with people we know			■				+	■	■	■		■		
Working with a provider that guarantees stability and durability of the BI system	■	■	■	■	■	+	+		■	■				
No complex and difficult system		■	■	■		-	+	■						
Working with a supplier that offers high quality support	■		■	■	■		+	■	■	■				
Practices														
Organize demonstration sessions with a POC			■	■		+/-	+	■	■	■				
Contact the personal network	■	■		■		+/-	+		■			■		
Search for users' feedback			■	■	■	+/-	+	■						
Negotiate a fixed price in several rounds					■	+/-	+					■		
Appoint someone to be in charge and acting as an interface between the technical and the business teams	■								■	■				
Involve end-users	■	■	■	■		+/-	+	■		■				
Perform rigorous system testing				■					■	■				
Ask questions from the field				■				■	■	■				
Clearly specify the needs	■	■		■										
Narrow down the list of potential vendors		■												
Create and fill a new IS position	■	■						■	■	■		■		
Estimate a budget and a timeline	■			■		-	+					■		
Check vendors' references				■					■	■		■		
Involve an external/experienced consultant			■	■	■	■				■	■			

have proven effective in the management of the associated organizational change. By consulting and allowing users participation in the adoption process, Omega provided them with the opportunity to find out how the new system functions under their own working environment. This reduces the probability for the system to be rejected by targeted users. Through management discussion and demonstration sessions, users eventually understood the importance of this new system and its benefits as well as how it will operate in their work environment:

The first phase was to let everyone know that we are setting up a BI system. In fact, we've been communicating internally, with the CEO. We talked, discussed and held regular meetings (every month or two weeks) between all the participants in order to raise awareness to inform people of the benefits, why we are going to adopt a BI system, what it will bring us and what it will change compared to the current process. We've reassured people that there will be training sessions on the

BI system throughout the process and little by little people have become familiar with this new tool that we're going to integrate. [Information System Manager]

In the same manner, the level of exposure to business risk was found to be high. The motivation to adopt the BI system was to improve certain business processes. Hence Omega team has mobilized one guiding principle, three policies nine practices that have reduced the probability of misfits of the BI system with firm processes. The following are four examples of practices that contributed to reducing the exposure to business risk: "*involve end users*", "*check software vendors' references*", "*organize demonstration sessions with a POC*", "*ask question from the field*". A statement from the Administrative director highlights the importance of organizing demonstration:

The POC or the demonstration part is considered critical in our adoption. That's where it all came down to; there were a lot of participants, a lot of questions were asked. I think that this phase was decisive, we could see how well the system meets our needs. [Director of Administration and Controls Officer]

Even though the level of exposure to financial risk was found to be low, the CEO ensured the project aligns with their limited budget and business imperative by adopting the following practices to minimize the exposure financial risk: *"negotiate a fixed price" and "estimate a budget and timeline"*. Again, in the same manner, although the exposure to contractual risk was found to be low, Omega management team mobilized one policy and three practices to reduce the exposure to this risk. Finally, it is interesting to note that no policy and no practice was mobilized to reduce the exposure to managerial and legal risks whose levels of exposure were anyway low, as the project was wholly supported and sponsored by the CEO and Omega adopted a proprietary BI system.

The research framework adopted for this case study suggests that the movement of the organization from one stage to the other through the adoption process is the result of the manifestation of an instance of a motor of change. For Omega, it is the will and the intention of the CEO who *envisioned* the firm as being able to monitor its operation in real time that *moved* the organization throughout the adoption process, hence it can be inferred that the motor in action is of *teleological* nature (Van de Ven & Poole, 1995).

Going back to the diffusion of innovation theory, the study revealed that the characteristics of the innovation as defined by Rogers (1995) and more particularly the compatibility of technology, observability of results, complexity and capacity for experimentation prevailed and influenced Omega BI system adoption process.

In fact, for example, the characteristic "compatibility of the technology" came into play through the following principle: "the system adapts to the company" Whereas the "capacity for experimentation" is manifested by the "POC". Of note is the fact that the compatibility sought by Omega went beyond that of the BI system with existing systems in Omega application portfolio. In fact, through the policy "*Working with a responsive provider*", Omega wanted providers whose characteristics matched its own characteristics; hence the compatibility sought by Omega also applies to the characteristics of the provider. This finding is consistent with the finding by (Poba-Nzaou & Raymond, 2011) and call for an extension of the diffusion of innovation theory. In reference to the adoption diffusion curve and the low rate of BI system adoption in SMEs, Omega is considered being part of the first cohort of adopters that is the *innovators* group representing about 2.5% of the population (Rogers, 1995). Omega seems to portray the characteristics of innovators, that is, having high risk tolerance and being willing to take risk but also having financial capacity to bear eventual failure. In spite of its high-risk tolerance, Omega has implemented several measures that are apparently unstructured, however, based on one principle and five policies and fourteen practices as described above. In this regard, the way Omega's CEO implicated its networks in the apparatus of risk management is revealing. First, the CEO contacted his personal network to collect more information on BI systems when applying the practice "*contact the personal network*". Then the management team decided to favor working with people they knew when applying the policy

of "*working with people we know*". It is important to remember that the use of firm external network as a means for mitigating risk in the context of SMEs has been reported by previous studies (Kim & Vonortas, 2014; Poba-Nzaou, 2008; Poba-Nzaou & Raymond, 2011). The last study found that SMEs tend to use internal risk mitigation strategies to manage technological and operational risk, but they use formal and informal networks to manage financial risk. Interestingly, our case reveals an instance of the use of formal and informal network in managing respectively organizational, technological, business and contractual by applying the policy "*working with people we know*" and business and contractual risk by applying the practice "*contact the personal network*".

As the implementation of the BI system is considered successful by the firm stakeholders, the informal approach followed by Omega is deemed effective. The framework that we used help to gain an in-depth understanding of the way Omega actually manages risk and the effects of the principle, policies and practices carried out. Although Omega's decision to adopt a BI system was based on clear expectations, the experience with the BI system increased the interest of the management team to go beyond what they already know in terms of creating business value, improving certain managerial processes, producing analytical reports to manage risk and optimizing organizational performance.

CONCLUSION

To date, most research on risk associated with the implementation of new technologies has focused on risk management activities occurring during the implementation process in the context of large enterprise in industrialized countries. We recognize that more empirical evidence is undeniably needed to deepen our understanding of new technologies risk management activities in the context of SMEs and especially those occurring before the implementation, in particular in the context of developing countries. However, we consider that this study offers several theoretical and practical contributions. First, from a theoretical perspective the study of BI adoption by a SME in a developing country is by itself a contribution as it answer calls made by Ain et al. (2019). Second, this study extends existing knowledge on risk management in the context of SMEs. By using the framework suggested by Poba-Nzaou and Raymond (2011) for the study of the implementation of a BI tool in the context of a developing country; we have enhanced its transferability because the framework was developed in the context of ERP implementation in an industrialized country. Third, this study confirms the necessity to extend the compatibility suggested by DOIT theory when applied to a SME as a SME sought a compatibility that go beyond the characteristics of the system to include the characteristics of the provider of the innovation.

From practical stand point, this study confirms that, in the context of SMEs, it is not always necessary to resort to cumbersome and highly formalized approaches to manage BI implementation risk and the management of implementation risk at the adoption stage can follow an intuitive approach based on principles, policies and practices. The framework provided in this study can be used by SMEs owner managers or consultants as an effective guide for managing BI implementation risk from the adoption stage. Future research should be directed toward the study of risk management activities occurring throughout the system lifecycle, with particular attention to the collaboration between the adopting organization, the implementation partner and the system vendor.

The main limitation of the study is related to the qualitative nature of the research and the sample limited to a single case.

CONFLICT OF INTEREST

There was no conflict of interest between the researchers and participants.

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APPENDIX

Table 3. Example of a chain of evidence from Omega

Category 4: Risk and Results Sub-category 4.3: Risk management profile		
4.3.1 Principle	4.3.1.1 The system adapts to the organization	Administrative Director and Management Control Manager, p. 16: He gave us a POC "Proof of concept" and he showed us what the system is going to give us using historical data, he showed us graphs, etc., and the results were quite satisfactory for us, it was what we wanted. In addition, since the integrator had a very good command of our information system and our ERP, he interfaced it adequately with the BI system.
4.3.2 Policy	4.3.2.1 Working with a supplier that offers support locally	Administrative Director and Management Controls Manager, p. 20: An important factor in deciding which partner to work with is the support behind it, in particular the reactivity of the partner in case of problems.
4.3.2 Practice	4.3.2.1 Organize demonstration sessions with a "POC" philosophy	The integrator gave us a demonstration. He presented us the solution, explaining what the system will offer us and how to integrate it. We tried to see the screens and play with them to discover the system. We asked a lot of questions about how it works and how it can be administered, so the "POC" was conclusive for us.

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