

Technology, Organizational and Environmental Determinants of Business Intelligence Systems Adoption in Croatian SME: A Case Study of Medium-Sized Enterprise

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Abstract—In the last few years, examples from scientific literature and business practices show that the adoption of technological innovations increases enterprises' performance. Recently, when it comes to the field of information technology innovation, business intelligence systems (BISs) have drawn a significant amount of attention of the scientific circles. BISs can be understood as a form of technological innovation which can bring certain benefits to the organizations that are adopting it. Therefore, the aim of this paper is twofold: (1) to define determinants of successful BISs adoption in small and medium enterprises and thus contribute to this neglected research area and (2) to present the current state of BISs adoption in small and medium-sized companies. In order to do so, determinants are defined and classified into three dimensions, according to the Technology – Organization – Environment (TOE) theoretical framework that describes the impact of each dimension on technological innovations adoption. Moreover, paper brings a case study presenting the adoption of BISs in practice within an organization from tertiary (service) industry sector. Based on the results of the study, guidelines for more efficient, faster and easier BISs adoption are presented.

Keywords—Adoption, business intelligence, business intelligence systems, case study, TOE framework.

I. INTRODUCTION

TODAY, almost every company strives to be supplied with quality information. From today's competitive market with highlighted, personalized sense for tracking and satisfying each customer need, it arises that successful companies need to have as much detailed insight into their business information [16], [24]. Each successfully conducted business process is generating documents that bestow important or less important information. As a result, companies have huge amounts of different data that have to be wisely filtered, saved, analyzed, hatched and distributed [16], [24]. Therefore, for such purpose, some sort of information technology (IT) application is needed.

In the context of technological solutions for analyzing data and providing companies with quality business information, the BIS has arisen [16], [18], [24], [30]. BIS represents the technology view of the business intelligence (BI) concept,

since BI is a much broader term when considering terminology, than BIS.

Since, each company, interested in such technology needs to go through the adoption process, it is important to simultaneously have in mind determinants for successful adoption of such technology [10], [30]. For the purpose of this paper, several determinants within the TOE framework have been chosen and analyzed aiming to demonstrate ongoing state in a Croatian company when it comes to the BIS adoption in SMEs. Therefore, this paper is assembled in a following way. In the second section, the theoretical part of this paper is presented. Descriptions of BIS, the TOE framework and BIS adoption are deliberated. The third section presents the methodological part of this paper. In the fourth section, a case study conducted within one chosen middle-sized Croatian company within tertiary sector is given. Also, together with the case study analysis part, results of the case study have been discussed in the fourth part of this paper. Finally, in the fifth section, this paper is closing with the concluding remarks, proposals for future research in this field and the limitations of the study.

II. BUSINESS INTELLIGENCE

A. BIS

While searching for answers in achieving successful business operating, various benefits of different technological innovation adoption have come across. Many authors of scientific papers specifically accentuate business success with adoption of new technological solutions, i.e. technological innovation (e.g. [1], [5], [7], [26]). For today's successful companies one of the key resources is information. Access to the important and crucial business data that would provide appropriate information for better decision-making processes is one of the main occupations of every company wanting to be successful and competitive in a market [13]. Having all of the above in mind, nowadays, companies are more willing to implement the concept of BI that will supply company with tools, methods, processes, technologies, applications, etc. for detailed in-depth data analysis [16], [23], [34]. According to Gartner research reports from 2007, 2008, 2009, BI applications are one of the most crucial technologies that are being bought by many companies [11]. Results of BI analysis mostly pertain on gathered and unified data that are

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simultaneously relevant and aimed for decision making processes that are being carried out on different levels within the organizations' hierarchy, such as strategic or middle management levels [4], [27], [25], [36]. Except on the better decision-making process within the company, successfully implemented BI concept is also having significant influence on detailed defining and achieving strategy and strategic goals that are planned within a company [4], [21], [32], [36]. Accordingly, for achieving any benefits (long or short term) of BI concept implementation, it is important to have strong support for using it from both management levels, strategic and middle, which will also be the main users of its features [4].

The technological part of the BI concept is one of the key features providing final users with important information, through offering different technologies, software, applications, etc. for use, in the purpose of detail data analysis. BISs' key functions are based on answers that need to be found and defined for five crucial questions about companies' business: (1) What is happening in the environment? (2) Why is something happening? (3) what needs to be done, (4) and in which way something has to be done? (5) What will be the next business move that has to be taken [28], [29]? BIS can be defined as system that will provide a company with quality data analysis and consequent reports with detailed, precise, timely and correct insight into business operations within the company that is especially useful for managers on different levels of deciding processes in the company [17]. Also, when considering different views on BIS, it can be defined from three different perspectives within the company. According to [24], from the perspective of the customer relationship management expert, BIS encompasses front-end applications and back-end applications for different business operations, while experts for data warehouse (DWH) explain BIS as a new technology platform with applications which are designed for better decision-making processes. Additionally, for statisticians dealing with data mining, BIS represents improved algorithms for data mining techniques. Essential parts of BIS are data sources that can be external or from operational databases, data integration, DWH, data mining and applications for visualization [9], [24].

B. BIS Adoption in Companies

Nowadays, companies are constantly producing immense amounts of business data and consequently, struggle with the intricacy in storing and maintaining such volumes of data [24]. Also, companies are dealing with ever stronger competition on the market that has been more progressing in conducting business with the help of various IT solutions [24]. Those are reasons that are mostly influencing BIS adoption and implementation in companies [24].

According to [8] and [18], from BI concept emergence, IT has been focused on establishing and advancing system and applications that will accomplish established goals of the BI concept. BIS are such technological solution which gather various software tools and solutions, specialized databases or DWH, tools for creating queries and data analyzing, reporting

tools (OLAP tools), tools for conducting data mining techniques, statistical analysis and forecasting, monitoring business activities, etc. [15]. All of these BI features can guide companies to various business advantage e.g., increased profitability and business efficiency as well as curtailed costs of doing business [18]. Therefore, because of BISs' many benefits that provide a company with a competitive advantage and better profitability, today, BISs are considered as one of the most valuable resources of the company [9], [20], [22], [24].

Large-sized companies are mostly companies that decide to adopt and implement technology, such as BIS, in a contrast to small and medium sized companies which are mostly in situations of having lower budgets for such investments [24]. According to [3], the cost of the complete BI project implementation varies between \$50,000 and billions of dollars, which can represent a high price for some small or medium sized companies. However, nowadays, researchers dealing with BIS in small and medium sized companies, as well as business experts, developed new technology solutions of BI concept, affordable for such companies and their needs.

According to [11], every company can be confronted with various problems within the adoption and implementation process of BIS. Problems can be related to already mentioned huge amount of business data, integration of various sources and technologies, the necessary time for the whole project, and sufficient amount of money to cover all costs that arise during the whole adoption and implementation project, etc. [24], [34]. Also, difficulties in BIS adoption and implementation project can be aroused by the absence of skilled and motivated employees, deficiency of volition for business analysis, paucity of top management support for such initiatives, scarcity for the understanding and use of meta-data etc. [11], [12].

Despite all of the challenges that follow the adoption and implementation processes of BISs, many companies successfully adopt and use this kind of technology and effectively achieve all of its advantages. According to the case study presented by [24], an insurance company can achieve various benefits of implementing and using BIS, such as: making progress in a decision-making processes, establishing new favorable circumstances for business, increased profit (the observed insurance company saw a 30% profit increase by planning and defining new main strategies, improving estimates and forecasts in the sale process, making advancements in claim analysis, etc.), and greater availability of cost and revenue information etc. Also, the study conducted by [6] shows how BIS adoption can have a strong effect on some parts of the organizational performance within the measures of a balanced scorecard. Their study was based on small and medium sized companies located in Thailand [6]. The presented results pointed at positive impact of BIS adoption on improving internal processes within companies and better skills and knowledge of employees [6]. On the other hand, the study showed adoption of BIS did not indicate a positive impact on the expected increased revenues of investment or higher customer satisfaction and better

promotion of the company [6].

C. TOE Framework

Since each company has its own specific internal characteristics, by which it performs its business in different market environments, using different technologies, it is important to keep in mind every internal or external factor of a company that may have an impact on the adoption process of BIS.

According to previous studies of many authors, factors that may influence the BIS project of adoption and implementation in the organization is theme which has been occupying interest in scientific circles in the last couple of years [6], [10], [18], [30]. Therefore, one of the theoretical frameworks for such determinants has been chosen and used with the purpose of meeting one of the main objectives of this paper.

For investigating the internal and external determinants of adopting and implementing technological innovations in the company, researchers in this area differ to several theoretical frameworks such as:

- Diffusion of Innovations (DOI) [31],
- Unified Theory of Acceptance and Use of Technology (UTAUT) [35],
- Technology Acceptance Model (TAM) [14],
- Technology - Organization - Environment (TOE) framework [33],
- Theory of Planned Behaviors (TPB) [2], and
- Iacovou model [19].

For the purpose of this paper, TOE framework has been chosen and its determinants have been observed and analyzed within the conducted case study. According to [33], this theoretical framework comprises three different dimensions with several success determinants in each. Determinants that may have potential impact on the project of BIS adoption and implementation have been observed in three dimensions: Technological organizational and environmental dimension. In Fig. 1, all three dimensions are shown with their defined determinants according to [33].

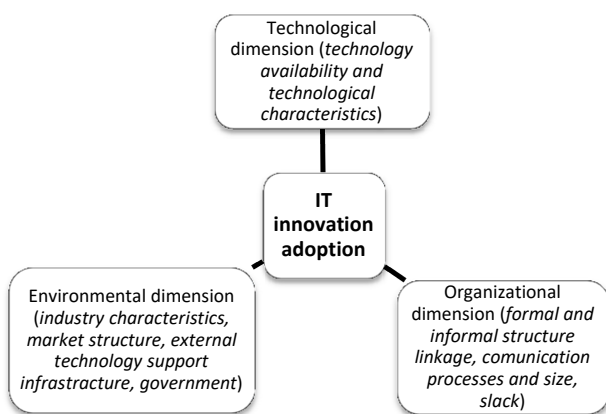


Fig. 1 TOE framework [33]

III. METHODOLOGY

The case study has been conducted in a Croatian medium-sized company that deals with various vehicle services including technical inspection services, vehicle registration and homologation services along with all other related services. The elected company is a 20-year-old medium-sized private company. Although it is a part of a larger international group, it operates exclusively in the Croatian market.

The selected company is going to be referred to as "Company X" in the further text to maintain its anonymity. It has been selected for this research due to its initial adoption of BIS 10 years ago and its long-term usage along with recent BIS experience in the form of functional software upgrades.

For the purpose of this research, an in-depth interview has been conducted in March 2019 with the head of the Finance and Accounting Department. The interviewee's tasks and responsibilities include reporting to the top management and taking part in making all the important decisions in Company X in relation to BIS. In addition, the interviewee participated as an in-charge person of recent software technological and functional upgrades. Therefore, the interviewee explained and commented on the process of BIS adoption in Company X through some key determinants of the TOE framework, so that certain relevant conclusions could be made.

IV. CASE STUDY RESULTS AND DISCUSSION

A. BIS Adoption in the Context of the Technology Dimension

Considering the technology dimension and its determinants within the adoption process, the BI system was integrated and compatible with existing systems in the company. Therefore, Company X adopted BIS as an extension of an existing Enterprise Resource Planning (ERP) system that already consolidated all the data in the firm. Technical resources in the form of infrastructural and hardware requirements have been provided by the IT department of the mother company. Hence, additional technological resources were not required, as the software operates on the same IT infrastructure which has been sufficient. BIS was completely adopted in relation to the company's values, principles and business practice. Having clear strategic and operational goals in mind, changes that BIS have brought to the organization have made a strong positive impact on the entire organization.

Defining reports by combining data presented the greatest challenge in the initial phase. Certain problems in the adoption process were posed by getting familiarized with BIS functionalities especially in the human resources department due its employees' problems with computer literacy. Also, a slight level of resistance existed among the other employees due to the fear of technology and generally a fear of the unknown, but it was minimized after several hours of education. After the education, employees developed an interest in BIS use, which had a positive impact on its successful adoption. The key to this success was in the created awareness of the BIS benefits that have contributed to the employee's willingness to adopt the system faster. The

suggestion to adopt BIS had originated from top management at that time, but the main initiative came from the interviewee who had the need for additional information in the form of personally created and customized reports.

The main benefits Company X gained from BIS adoption were visible through the time saved in executing business operations as well as reduced costs and shorter time of performing of reporting tasks for top management. In addition, the task of financial statements preparation has been greatly advanced by the help of additional, detailed information provided by BIS. Also, existing periodical reports have been replaced with real time reports. The previous manual way of creating reports through exporting and forming data has been automated. Mainly, improvements have been evident in the analysis of core business activities e.g., detailed analysis of sales results has revealed several improvement capabilities of direct sales. Prior to BIS adoption, Company X had a possibility to obtain information only in the form of a report from the ERP system. However, these reports were inadequate and their processing was time consuming, resulting in less quality decisions which were based on outdated information and intuition, so BIS adoption was a logical step forward. Comparing to other IT solutions in Company X, investment in BIS promptly became worthwhile.

According to the interviewee's answers, technology availability and its characteristics such as compatibility of BIS with other IT systems, low level of complexity in using BIS, employee's positive perception about BIS's use and possibility to evaluate benefits of adopting BIS, were presented as relevant factors for the BIS adoption project.

B. BIS Adoption in the Context of Organization Dimension

The case of Company X has shown that top management support has been very helpful success factor in the adoption of BIS. Top management extensively supported adoption of BIS, knowing all the benefits that the system will bring forth. Tremendous initiative of the entire company alleviated the risk of not completing the project. Only the risk of the supplier's inability to deliver what had been arranged, had been present to certain extent. Apart from top management, middle management has had an important role in BIS adoption, as well as coordinators at the lower management level, which also had demands, expecting to be satisfied by the system.

Considering the company's readiness for the BIS adoption project, Company X has had all the resources to successfully adopt BIS including, technical, financial, and computer-literate and devoted human resources. The financial aspect of the project has not been an issue, due to the fact that supplier for BIS has been the same one as for the ERP system. Human resources, as well as their knowledge and willingness to accomplish their aspirations were presented as an essential factor for the project of BIS adoption.

Within Company X, the decision-making process has been supported by business analysis based on quantitative data. Namely, BIS has enabled quick and easy access to the required information, so that management can rely on the information obtained from the system. Therefore, it has been

proven that the reliable, clearly defined, comprehensive and timely data, obtained from BIS are extremely valuable for making the right business decisions.

Taking into the consideration all the mentioned facts, it is easy to conclude that Company X was fully prepared to adopt BIS since it had good communication processes and linkages among its employees, as well as sufficient resources and well-defined data that were necessary for BIS adoption project success.

C. BIS Adoption in the Context of the Environment Dimension

As a market follower, Company X has been strikingly smaller than the market leaders in its market. Hence, when considering the influence of the competition on the BIS adoption, the interviewee had assumptions that competitors were using BIS before it was adopted in Company X, but that was not the reason why the firm decided to adopt the system. The key was in the aspiration for knowledge and information about their own business. For Company X, the BIS adoption process has been of strategic importance, since the company was conscious that it would be unable to operate on a regular basis in its market without the important business information that BIS provide.

The reputation of the supplier was important for Company X in the supplier selection process. Therefore, the BIS adoption project was conducted by the same supplier that executed the ERP adoption and implementation project. The whole adoption project of BIS lasted for 4 months, which was considerably faster, having in mind the much longer period that was required for completing the ERP adoption project. After the BIS adoption project was completed, the supplier made all the necessary adjustments to the software shortly after the requirements were communicated. Also, the chosen supplier has been available to respond to any questions or problems in using BIS. However, till now, Company X needed its supplier only to conduct routine software maintenance.

According to the interviewee's answers, the suppliers' reputation, technological competencies, responsiveness and ability to successfully carry out the project had been relevant for BIS adoption in Company X.

V. CONCLUSION

Rapid development of the ICT industry and its solutions based on digital transformation enables companies nowadays to access more cost affordable and more project feasible implementation of BIS. As a result, the increasing numbers of BIS adoption projects have been initiated in the Croatian market, especially in small and medium-sized companies.

The case study conducted for the purpose of this research has shown determinants which describe the adoption of BIS in Company X. BIS adoption has been a huge necessity in Company X due to its uncontrolled business conditions and surrounding market blindness. BIS has fulfilled its potential in the case of Company X by providing so much needed analysis in the form of required reports. It can be concluded from the

results that the organizational dimension, due to organization support and readiness, determines the BIS adoption in Company X the most. Complete awareness and devotion of the entire organization have led to fast and successful BIS adoption. Nevertheless, the technological dimension had its role in the adoption as well. Perception of the comparative advantage and all the benefits that BIS brings had an impact on the project of BIS implementation. Along with compatibility of BIS with existing organization processes, values, and other systems, and because of cooperative suppliers' support, BIS has been the backbone of the organizations' decision-making process. The environment dimension of the TOE framework had the least implications on BIS adoption in Company X, while competition has not had any impact on the implementation project whatsoever. In the end, BIS adoption has paid off numerous times in Company X, and so, it can be classified as successful.

The limitations of this paper are within the limited collected data of the conducted research on only one medium-sized company. Therefore, a multi-case study analysis that will include more small and medium-sized companies in Croatia is a recommendation for further research in this field.

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