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The Moderating Role of Human Capital on the Relationship between Business Intelligence Capabilities and Business Intelligence Success

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Abstract
Business intelligence (BI) system is at the heart of the management information system of any organization due to its important role of understanding the environment and support decision-making process. However, BI is meaningless without the users who read and interpret outputs and add knowledge in it. This makes human capital is a vital component of BI process. The aim of this empirical study is to investigate the moderating role of human capital on the relationship between BI capabilities and BI success. A survey was conducted to 196 employees working at different companies and using BI Tools. The findings indicated that BI capabilities had some effect on BI success. Accordingly, organizational BI capabilities have a positive relationship with BI success with respect to risk factor value as well as technological BI capabilities such as internal data sources and internal data reliability. Research results also showed that data types, namely qualitative data and BI success have negative and moderate relationship. Furthermore, partial support was found for the moderating role of human capital on the relationship between BI capabilities and BI success. Managerial implications for practitioners and theory are discussed. Research findings contribute to practice by providing information for users and managers of BI to consider human factors while assessing BI success.
Keywords : Business Intelligence, Business Intelligence Capabilities, Business Intelligence Success, Human Capital

1. Introduction

The phenomena of intense pressure to analyze increasing amounts of data for providing proactive and better responses to their customers has led organizations to use business intelligence (BI) tools for the sake of improving their decision making process. It has become a major challenge for organizations to benefit from BI tools for obtaining a competitive advantage.

Popularity of BI systems has increased in latest years as an approach to retrieve and evaluate data for organization (Watson et al., 2008). According to Koronios and Yeoh (2010) with the help of BI systems decision makers can deliver meaningful data. Organizations main concern is to survive and it is more complex and difficult in today's high competitive world. Attributes and timeliness of a company's BI capabilities may be a huge factor for not only survival but also increasing profits (Liautaud & Hammond, 2000).

Business intelligence system is at the heart of the management information system of any organization that seeks well inform performance, and as indicated by Bounabat (2006). According to Wu & Wang, (2006) BI is very essential to improve the overall company performance and it is designed to support organization-wide processes (El Sheikh & Alnoukari, 2012). This imposes that organizations should employ a central data repository to provide all users with a consolidated view. This will provide them with valuable information as to improve executive decision making process by decreasing time and cost whilst increasing the efficiency of the organization. On the other hand, BI has become a strategic instrument that allows organizations to rise above the restrictions of legacy systems (El Sheikh & Alnoukari, 2012).

Nevertheless, English (2005) sees a problem with the definition of BI: Most of the definitions emphasis software and technological components of BI. However, the importance of BI is to understand the environment of business and support decision-making process. So this makes BI meaningless without the users who read and interpret outputs and add knowledge in it. Therefore, this shows human capital is a vital component of BI process (English L.P., 2005). Hannula & Pirttimäki's study (2003) supports this argument by indicating that "around 75% of interviewees felt content and human factors are the key aspects of BI".

In this paper we examine the relationship between BI capabilities and BI success by emphasizing the moderating effect of human capital on this relationship. Survey data was obtained from BI professionals to understand the effect of BI capabilities on BI success. This study considers theoretical aspects regarding BI capabilities including both organizational and technological capabilities.

The contribution of this research to the literature is on the relationship between BI capabilities and BI Success where unit of analysis is the organization. Human capital is included as a moderator to measure its effect on this relationship.

2. Theoretical Foundation and Hypothesis Formulation

2.1 Business Intelligence (BI)

Although BI is very significant to many organizations, the literature concerning BI success is still limited. According to Forrester, BI can be described as "a set of processes and technologies that transform meaningless and raw data into usable, valuable, and actionable information" (Evelson, McNabb, Karel, & Barnett, 2007).

BI is a poorly defined term and software vendors and consulting organizations are changing the definition of BI to fit their product; some even use the term as entire range of decision support approaches (Arnott, D.G., 2004). BI is not an application, user, area, or single product rather than a set of architecture of integrated systems and methods that provide the organization with information for decision-making. BI is combining historical and operational data with the analyzer tools in the system to reveal valuable and competitive information and historical data to decision makers and business planners (Khan, R. & Quadri, SMK., 2012).

As defined by the Data-Warehousing Institute, BI is "tools, technologies and processes required to turn data into information and information into in to knowledge and plans that optimize business actions" (Eckerson, W. 2007).

Turban et al. (2006) on the other hand has defined BI as " a broad category of applications and techniques for gathering, storing analyzing and providing access to data to help enterprise user make better business and strategic decisions".

Organizations must improve and adjust frequently in order to be successful in constantly changing business environment. This requirement brings a need of information used by employees throughout all levels of the organization to use in decision-making. Business Intelligence provides answers to fundamental questions from data that created throughout the organization, such as how the customers rank, how well the business is doing currently and should the organization stay current path, what clinical trials should be continued, and where should organization stop. Strong BI system can support decisions with more than just feelings. Building a fact-based "decisioning" framework via a powerful computer system provides confidence in any decisions made (Nelson, 2007).

Meaning of business intelligence changes with the use of the term intelligence. If intelligence used as human intelligence, business intelligence means the human intelligence capacity applied in business affairs/activities. However use of intelligence as information makes the definition that broad category of systems for collecting, providing access to, and analyzing data in order to help users to make better business decisions (Ranjan, 2009). In BI, intelligence is generally defined as; "discovery and explanation of hidden, inherent, and decision-relevant context in large amounts of business and economic data" (Herschel & Jones, 2005).

2.2 BI Framework

BI framework offers a wide-ranging overview of different components of BI strategy fitting together to offer an entire BI vision. BI gathers together the forces, which drive business operations: people, processes, and technology in a collaborative environment (Gartner, 2009). "BI framework begins by setting the business context, high-level scope, overall objective, what is intended to be achieved, the intended enterprise-wide coverage of the BI strategy, and the criteria of success" (Gartner, 2009).

It should be understood that a well business intelligence framework links.

> "BI, business process, collaborative applications, and the underlying data stores. The framework further enhances the integration with business planning systems, it supports knowledge management business processes, performance management technologies, and users. BI strategy should have a comprehensive approach in describing the current and future behavior of the processes, technology, people, and other components to ensure that they align with the goals and strategic direction of the enterprise. BI framework helps you in connecting these pieces together" (Gartner, 2009).

Framework must have regular standards, which BI users must stick to. Framework must also give the possibility to associate main components. BI should offer integration of BI framework and BI environment of the organizations (Prashant, P. 2009).

2.3 BI Capabilities

Hostmann et al. 2007 mentioned eight significant BI capabilities classified into organizational and technical features.

As this study includes BI capabilities, each of them is explained briefly below.

2.3.1 Technological Capabilities

2.3.1.1 Data Source

"Data source is where data resides and is retrieved for analytical usage, which could be either internal or external" (Mohammadi & Hajiheydari, 2012). A data source can also be defined as "the place where the data that is used for analysis resides and is retrieved" (Hostmann et al., 2007). BI involves with the collection of data from both internal and external sources (Harding, 2003; Isik, Jones, & Sidorova, 2010). Internal data is integrated and managed within a traditional BI application information management infrastructure, such as data warehouse,

data mart, or online analytical processing cube (Hostmann et al., 2007). External data comprises the data, which is produced by exchange between organizations and customers, suppliers and vendors (Paswan, A. 2010). This type of data hardly added into a data warehouse. Mostly, external data is gathered from web sites, spreadsheets, audio files, and video files (Paswan, A. 2010).

2.3.1.2 Data Type

Data can be either dimensional or non-dimensional and numerical or non-numerical. "Dimensional data is structured and subject oriented and non-dimensional data is unstructured refer to dimensional and numerical data as quantitative and non-dimensional and non-numerical data as qualitative data" (Hostmann, 2006).

"To build a BI decision-support environment, data from different sources has to be merged" (Moss & Atre, 2003). There are three main kinds of data sources: "operational, private, and external" (Moss & Atre, 2003)

2.3.1.3 Data Reliability

Data reliability depends on data source whether it is qualified and controlled. Organizations take into account the data they collect daily when they make serious decisions. Therefore, it is a necessity to have correct and reliable data. Nonetheless, it is a fact that all size companies are negatively influenced by "imperfection, duplication and inaccuracy" of the data, they use (Hostmann, 2006). Gartner Group mentions, "more than 50% of BI projects through 2007 would fail because of data quality issues and TDWI estimates that customer data quality issues alone cost U.S. businesses over $600 billion dollars a year".

Prior researches demonstrate that clean, high quality and reliable data is one of the most significant BI success factors (Eckerson, 2007; Howson, 2007). The research by Howson (2007) states that data sources those organizations gather their data has a vital role of the BI success. Data sources are more important mainly for the organizations, which are using multiple data sources and multiple information systems. Many researches present that integrating with these technologies is critical for avoiding inconsistencies and inaccuracies (Swaminatha, 2006; Becerra-Fernandez & Sabherwal, 2010)

2.3.2 Organizational Capabilities

2.3.2.1 Interaction with Other Systems

Business Intelligence interactions with other systems can be explained as the degree of communicability of business intelligence with other systems. Organizations should create business interaction there for they have IS tools. "This integration can be at the data level, application level, business process level, or user level, yet these four levels are not isolated from each other" (Isik, Jones, & Sidorova, 2010). Data integration offers an integrated look for business data. Application integration unites business tools by management of the event flow (White, 2005). User interaction integration offers a single personalized interface to the user and business process integration offers a united look of organizations' business processes (Isik, Jones, & Sidorova, 2010). This integration can be made by various technologies. To illustrate, enterprise information integration (EII) offer tools to generate dispersed data that exist in a particular database and enterprise application integration (EAI) allows tools to work together with the use of standard interfaces (Swaminatha, 2006).

2.3.2.2 Business Intelligence Flexibility vs. Complexity

Mohammadi & Hajiheydari, (2012) described flexibility as "a BI flexibility indicates the amount of interaction a BI system have with variety of data sources and analytical tools".

An effective information system must be flexible by accommodating a specific amount of differentiation concerning the needs of the related business process. The economics of flexibility are not clearly figured out yet even with many researches on the different flexibility branches. An information system should be flexible to be effective. "Despite many previous studies on the flexibility of organizations, processes, and various organizational technologies, the economics of flexibility are not yet well understood" (Gebauer & Schober, 2006). This paper supports information system approach construction with focusing on the effects of information system flexibility on the cost efficiency. The theoretical model describes economics of two general strategies of Information Systems flexibility. First is "flexibility-to-use", which is concerning the IS attributes, which are given at the time of application, second 'flexibility-to-change' concerning the IS attributes that give an alternative for future in case of system upgrade and also contains the chance of operation performance outside of the Information system (manual procedures).

According to the model, IS flexibility-to-change is economically set up for assisting a business process brings a high uncertainty, though a low uncertainty cooperates well with information system flexibility-to-use. Additionally the model shows us large process differentiation can increase the significance of information system flexibility administration, like it liable to restrain the value of an information system on manual uses, though a "high level of time criticality" of process needs are likely to enhance the importance of an information system on manual uses (Gebauer & Schober, 2006). Complexity is the measurement of the difficulty of a particular job, system, and technology. The term complexity sometimes used to refer usability, but it is not certainly true since a tool can be usable for an engineer but not for an end-user (Sadok & Lesca, 2009).

2.3.3 Intuition Involved in Analysis

Analysis with intuition can be explained as acting by feelings rather than facts. BI analysis types can be divided

into three categories: operational, tactical, and strategic. There are two trends: first, the analyses turn out to be more complex and ad hoc. Consequently, become less repetitive, less foreseeable, in need of various quantities and kinds of data. The other is; the risks and also the returns of the analysis increase. More strategic queries generate value less often on the other hand when they produce the value is extraordinary (Imhoff & Pettit, 2004). Operators of the tools can limit the analysis. Capabilities of the executives are key factors. Intuition, is mostly seen as the "antithesis of this approach", and mostly ignored or disregarded in decision-making. However, recently there has been a booming of interest in involving feeling in BI process, the reason may be displeasure by rationality and its limits (Imhoff & Pettit, 2004).

Intuition and rationality are two capabilities, which mostly considered for decision-making (Sadler-Smith & Shefy, 2004). It is mentioned that 'intuitive decision-making' was mostly disregarded earlier; attention was on the operation tools and systems like decision-making systems (Sadler-Smith & Shefy, 2004). "Intuition means that executives are allowed to pick up on important, but weak signals, whilst rationality enables executives to act on those signals" (Sadler-Smith & Shefy, 2004). According to Khatri and Alvin (2000), the use of "gut-feel" in strategic decision-making was mostly preferred in the computer industry than banking and utilities industries, and senior managers fundamentally admit this factor in decision-making process (Sadler-Smith & Shefy, 2004). Managers 'gut feeling' arises during long years of experience, and the new tools can not be substitution for that. According to Khatri & Alvin (2000) it is significant to make the decision by using both relevant information and the 'gut-feeling' (Sadler-Smith & Shefy, 2004). Cleland & King (1983) say, "Common error made by those who base their decision on intuition is that they fail to see that there are other alternatives" (Sadler-Smith & Shefy, 2004).

Sadler-Smith & Shefy (2004) claim that 'gut feelings' are unavoidable when making a decision though testing its validity is beneficial.

2.3.4 Risk Level

Being a risk taker organization leads to more tolerance for uncertainty and for this type of organizations it is expected BI to help to explore new opportunities. Controversially, non-risk taker organizations have little tolerance for uncertainty, which in return brings particular problems (Hostmann et al., 2007).

Risk and the role of Business Intelligence can be explained with three dimensions: individual, group, and organizational behavior.

• Risk perception affects the desire or motivation to obtain resolution for decision-making. To illustrate, understanding changes in the competitive environment may be the resolution of risks when making decisions.

• May help to measure the risks objectively or subjectively.

• Searching information and processing considered as the natural approach to supporting decision-makers for detecting and determining risks.

These three dimensions are linked to each other a change in one can be resulted in a change in other one. For instance, intelligence about a competitive development is probable to adjust the standing risk perception, triggering to additional information search, risk identification, and measurement. The last parameter regarding risk management is seen as significant aspect of risk and decision making throughout organizations and individuals. Risk management should be organized before the decision for reveal certain risks or after the decision for decreasing the possible occurrences of disagreements between customers and the organizations (Harding, 2003).

2.3.5 BI Success

Given the complexity of most system implementations, no single measure exists for Business Intelligence success. As a result, various measures including tangible and intangible measures are utilized to determine success, including perception-based measures, return on investment, system response time, report generation, among others. Beginning with the initial go-live, identified key metrics was tracked to gauge BI initiative success. Based on industry literature and baselines, many of the metric targets were set higher in an effort to make the most of the information systems investments. BI success can also be measured by return on investment ROI (McKnight, 2004). The 'Competitive Intelligence Measurement Model' calculates the ROI on BI by considering achievement of objectives, satisfaction of managers, and the costs related with the project (Lonnqvist & Pirttimaki, 2006).

Another approach to measure BI success is subjective measurement (Lonnqvist & Pirttimaki, 2006). This approach is based on measuring the satisfaction of BI users by asking them their opinions on the effectiveness of the BI in their companies (Davison, 2001). As result of this approach, one can learn what BI users think about the different aspects such as use, timeliness and usefulness of BI systems. Also it is possible by this approach to understand to what extend BI users have realized the expected benefits of BI. This research uses subjective measurement method to measure the success of BI.

BI project implementation success can be measured through perceived success, whether the project completed timely, completed on budget, and overall satisfaction with the BI (Howson 2007; Wixom & Watson, 2001) which is used in this study while measuring the BI success.

As a result of the discussions stated above, the following hypothesis were formulated:
Hypothesis 1: Organizational BI Capabilities will be positively related to BI
Hypothesis 1 a: The better the quality of data sources, the greater is perceived BI success
Hypothesis 1 b: The better the quality of different types of data, the greater is perceived BI success
Hypothesis 2: Technological BI Capabilities will be positively related to BI Success

2.3.6 Human Capital

Skandia (1994) defined human capital as "the combined knowledge, skill, innovativeness and ability of the company's individual employees to meet the task at hand". Human capital involves company values, culture, and philosophy (Skandia, 1994).

According to Becker (1985) human capital is "skills and knowledge that individuals acquire through investments in schooling, on-the-job training, and other types of experience".

Human capital boost individuals' capabilities of revealing new business opportunities. Additionally it aids owners to obtain other functional assets like physical and financial capital. So, it helps gathering of new knowledge and abilities. Even though there is rooted relation between success and human capital variables, uncertainty is still exists over the level of this relationship (Unger, Rauch, Frese, & Rosenbusch, 2011).

Studies have noted that the main resource of an organization's capabilities is the human capital, which is established by 'employee knowledge and experience' (Unger, Rauch, Frese, & Rosenbusch, 2011). Previous researches show that organizations, which have high level of human capital, have greater firm performance. Human capital theory suggests, "An individual's general or firm-specific human capital is positively related to compensation" (Schulz, Chowdhury, & Van De Voort, 2013).

Researchers mention a large range of variables: "formal education, training, employment experience, start-up experience, owner experience, parent's background, communication skills, knowledge, and others" (Unger, Rauch, Frese, & Rosenbusch, 2011).

Recent studies emphasize the vital role of human factor. When the subject is success of BI, human factor should be taken into account because BI helps to understanding the organization and its environment it also supports decision-making. It is not possible to measure the success without people who understand the meaning and importance of the information and decide with their knowledge (English, 2005). Hannula & Pirttimäki's (2003) research results show that 75% of applicants feel content and humane approaches are the main parts of BI.

"Management today is increasingly about managing intangible resources is beginning to dawn on business managers and academics alike" (Bontis & Girardi, 2000). Human and intellectual capital has been recognized as the key intangible source in organizations. It is significant that managers recognize that the organizational structure and culture, which are intangible recourses, are also important for the survival of the organizations. Thus, organizations require practical methods, which can be used to understand to manage intangible resources (Bontis & Girardi, 2000).

All successful BI applications, without concerning the size and the scope, should know that it is affected by human factors. It does not matter if the project is the best the right people should be in the place.

The existence of IT experts, professionals and knowledgeable workers is the focal point of BI system success achieving the people oriented approach in business and it is a high valuable goal of the organization (Imhoff & Pettit, 2004). The above statement is in line with the views of Luftman, et. al., (2004) where they argued that there are several skills required in a successful IT professionals like understanding the business vision and issues, team working, ability to self-development in addition to their IT skills and ability to learn from the projects and knowledge around, the workers are one of the critical success factor of the organizational projects success. IT human resource contributes to system analysis and design in addition to human resources planning (Imhoff & Pettit, 2004).

Based on this , the following hypothesis were developed:
Hypothesis 3: "The relationship between BI Success and Technological BI capabilities will be moderated by human capital."
Hypothesis 4: "The relationship between BI Success and organizational BI capabilities will be moderated by human capital."

3. Research Model and Methodology

3.1 Research Model of the Study

The foregoing discussion leads to the proposed research model shown in figure 1.

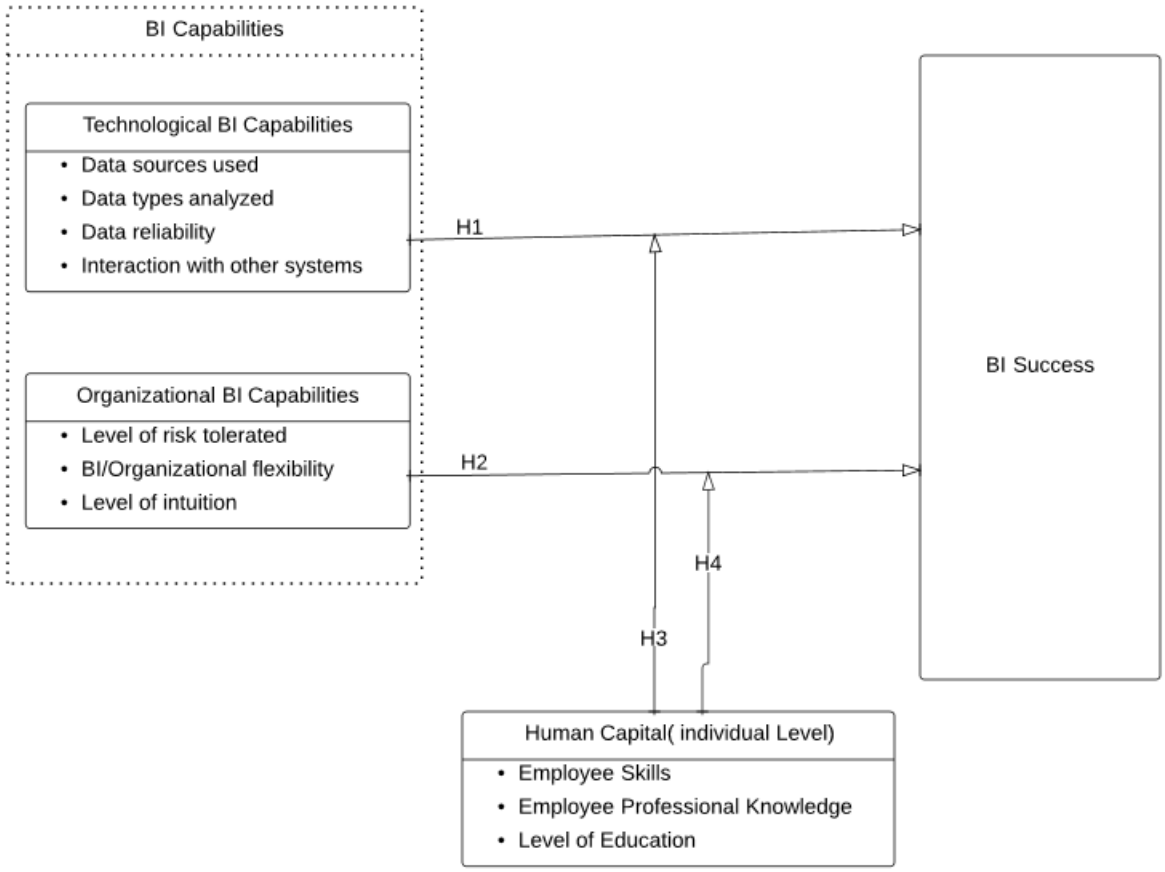

Figure 1: Research Model of the Study

3.2 Methodology

3.2.1 Sample and Data Collection

The sample for this empirical study is comprised of BI users who uses BI at different levels of the decision making process and in different industries in Turkey. The data was collected by a web-based survey between February and May of 2013. A hyperlink to the survey was e-mailed to the participants. There was a cover letter to the survey for explaining the purpose of the study. In total, 162 responses were received.

To assess the moderating role on BI capabilities on BI success, questionnaire of 39 scale items was developed and send out to the participants in the survey. First part of the questionnaire was designed to measure the moderator variable, human capital. In the second part, the independent variables, namely technological BI capabilities and organizational BI capabilities are measured. The third part of the questionnaire measures the dependent variable, i.e. BI success. The items in the questionnaire were adapted from several studies that have measured the same constructs and are listed in table 1.

Table 1. Survey Information

Variable	Scale	Item Count	Adopted from
Technological BI capabilities	5-point likert scale	14	Wixom and Watson's model (2001)
Organizational BI capabilities	5-point likert scale	13	Hostmann (2007), Imhoff (2005), Gonzales (2005),
BI success	5-point likert scale	5	Hortono (2006),
Human capital	5-point likert scale	7	Stewart (2001), Zorlu (2010)

4. Research Findings

4.1 Factor Analyses

Factor analysis using principal components matrix with varimax rotation was used in order to find the factor

structures of technological BI capabilities and organizational BI capabilities . Any item with a factor loading value less than 0.50 or loading to more than just one factor was excluded from the analysis. Also, only factors that had Eigenvalue values of 1.00 or higher were taken into consideration for the total variance explained.

4.1.1 BI Success

Five items were hypothesized in order to load on one factor for the dependent variable, BI Success. The results are given in table 2 below and showed that all items loaded on single factor that is 0.622 or greater than this value. After the factor analysis, internal consistency of BI Success factor was evaluated. Cronbach's alpha for the BI success factor found as 0.872 which is good and that makes the factor considered as internally consistent measure. Kaiser-Meyer-Olkin (KMO) value was extracted as 0.770 means the value is above the accepted level. This outcome marked the homogeneous structure of the variables and the result of Bartlett Test (.000, Chi-Square: 1648.094, df: .90) showed that the variables were suitable for factor analysis.

Table 2. Factor Analysis for BI Success

Factor 1: BI success	Variance %58.913	Factor Loadings
3 - How well the BI that I am using provides information I need in time		.906
1 - How well the BI that I am using supports my decision making		.905
4 - How user friendly the BI that I am using is		.859
2 - How well the BI that I am using provides precise information I need		.810
5 - The BI that I am using overall		.662
Kaiser-Meyer-Olkin Measure of Sampling Adequacy: .770		
Bartlett's Test of Sphericity: .000	Chi-Square :1648.094	df: .90

Table 3. Factor Analysis of Technological BI Capabilites

Factor Analysis for Internal and External Data Sources

Factor 1: Internal Data Sources	Variance %38.913	Factor Loadings
4 - The internal data sources used for my BI are concise		.948
1 - The internal data sources used for my BI are readily available		.902
2 - The internal data sources used for my BI are readily usable		.742
3 - The internal data sources used for my BI are easy to understand		.612
Factor 2: External Data Sources	Variance %23.344	Factor Loadings
1 - The external data sources used for my BI are readily available		.922
3 - The external data sources used for my BI are readily understand		.939
2 - The external data sources used for my BI are easy to usable		.782
Kaiser-Meyer-Olkin Measure of Sampling Adequacy: .795		
Bartlett's Test of Sphericity: .000	Chi-Square : 1023.234	df: .90

Factor Analysis for Qualitative and Quantitative Data Sources

Factor 1: Qualitative Data Types	Variance %41.924	Factor Loadings
7 - My BI provides comprehensive qualitative data		.928
8 - My BI provides consistent qualitative data		.910
5 - My BI provides high quality qualitative data		.905
6 - My BI provides accurate qualitative data		.896
Factor 2: Quantitative Data Sources	Variance %39.241	Factor Loadings
2 - My BI provides comprehensive Quantitative data		.955
1 - My BI provides accurate Quantitative data		.899
4 - My BI provides high quality Quantitative data		.845
3 - My BI provides consistent Quantitative data		.802
Kaiser-Meyer-Olkin Measure of Sampling Adequacy: .765		
Bartlett's Test of Sphericity: .000	Chi-Square: 1317.379	df: .90

Factor Analysis for Data Reliability

Factor 1: Internal Data Reliability	Variance %20.089	Factor Loadings
7 -Internal data for my BI is updated regularly		0.922
3 -Internal data collected for my BI is accurate		0.914
1 -Internal data collected for my BI is reliable		0.901
Factor 2: External Data Reliability	Variance %22.681	Factor Loadings
2 - External data collected for my BI is reliable		0.92
4 - External data collected for my BI is accurate		0.893
8 - External data for my BI is updated regularly		0.815
Factor 3: Inconsistency and conflicts in Data Reliability	Variance %11.072	Factor Loadings
6 - There are inconsistencies and conflicts in the external data for my BI		0.95
5 - There are inconsistencies and conflicts in the internal data for my BI		0.788
Kaiser-Meyer-Olkin Measure of Sampling Adequacy: .779	Bartlett's Test of Sphericity: .000	Chi-Square : 1024.462 df: .90

Factor Analysis for Interaction with other Systems

Factor 1: Interaction with other systems	Variance %42.476	Factor Loadings
4 - BI Provides a unified view of business data and processes		.900
3 - BI Provides links among multiple business applications		.883
2 - BI Provides a comprehensive electronic catalog of the various enterprise information resources in the organization		.857
1 - BI Provides easy and seamless access to data from other applications and systems		.758
Kaiser-Meyer-Olkin Measure of Sampling Adequacy: .759		
Bartlett's Test of Sphericity: .000	Chi-Square : 1345.526	df: .90

Table 4: Factor Analyses Results of Organizational BI Capabilities

Factor Analysis for Level of Risk

Factor 1: Level of Risk	Variance %41.232	Factor Loadings
4 - My BI Provides helps me manage risk by monitoring and regulating the operations		.906
3 - My BI Provides helps me minimize uncertainties in my decision making process		.848
1 - My BI Provides supports decisions associated with high level of risk		.725
2 - My BI Provides supports decisions motivated by exploration and discovery of new opportunities		.619
Kaiser-Meyer-Olkin Measure of Sampling Adequacy: .880		
Bartlett's Test of Sphericity: .000	Chi-Square : 233.308	df: .90

Factor Analysis for Flexibility

Factor 1: Flexibility	Variance %50.590	Factor Loadings
4 - My BI is highly scalable with regards to transactions		.933
3 - My BI makes it easier to deal with exceptional situations		.921
7 - My BI is highly scalable with regards to infrastructure		.871
6 - My BI is highly scalable with regards to users		.855
1 - My BI is compatible with other tools that I use		.567
Kaiser-Meyer-Olkin Measure of Sampling Adequacy: 0.733		
Bartlett's Test of Sphericity: .000	Chi-Square : 64.790	df: .90

Factor Analysis for Level of Intuition

Factor 1: Level Of Intuition	Variance %59.297	Factor Loadings
5 - Although I use my BI for decision making ,I still put emphasis on my past experiences for the decisions I make		.850
4 - The decisions I make require a high level of thought		.842
1 - Using my BI, I make decisions based on facts and numbers		.825
3 - With my BI, it is easier to use my intuition to make better informed decisions		.721
2 - Although I use my BI for decision making, I still involve my gut feeling for the decision I make		.576
Kaiser-Meyer-Olkin Measure of Sampling Adequacy: .890		
Bartlett's Test of Sphericity: .000	Chi-Square : 35.379	df: .90

All of the items in the BI Success, technological BI capabilities measurement instrument as well as organizational BI capability scale were entered into factor analysis seperately. The Kaiser- Meyer-Olkin (KMO) values for each dimension are of each scale are stated in tables 2,3 and 4 above. The results for each scale marked the homogeneous structure of the variables and the result of Bartlett Test (see tables 2, 3 and 4) showed that the variables were suitable for factor analysis. Few rotations were made to obtain the best representation of the data and items were left out of the analysis that did not have large factor loadings and that had crossloadings. The results of the factor analysis are shown in Table 2,3 and 4.

4.1.2 Relationship between Organizational BI Capabilities and BI Success

In order to analyze the connection among organizational capabilities and BI success, Multiple Regression analysis was used and shown in table 5.

Table 5. Regression Analysis of Organizational BI Capabilities and BI Success

	Dependent Variable
Independent variables	**BI Success**
Flexibility	.451
Intuition	-0.62
Risk	**.298****
R^2	.175
Adjusted R^2	.096
F	3.968
Df	7

*p<0.05

The regression analysis indicates that risk has an explanatory power on BI Success. (p=.021 and β=.298). The model is proved statistically significant with F=3.968 and p=.000. T statistics and related p value indicated that risk contributes significantly to the model and explain at 30% with .000 significance level.

Hypothesis 1, stating "Organizational BI Capabilities will be positively related to BI Success" has found partial support with the finding of the positive relationship between Organization BI Capabilities and BI Success with respect to Risk Factor value (β=.298; p<.05). Also, other organizational BI capabilities factors were checked with regression analysis and no significant result was found.

4.1.3 Relationship between Technological BI Capabilities and BI Success

According to the regression analysis results (table 6), Technological capabilities have an explanatory power on BI success (p=.023 β=.334). Additionally analysis indicates that the similar power on BI success exists in internal data source factors (p=.025 and β=.159). Same goes to the relation between reliability and BI success factors indicating that internal reliability has explanatory power on BI success too (p=.000 and β=.046). The results indicate that data types, qualitative factors and BI success have negative and moderate relation (p=.003 and R^2=-.033) with all other variables have no effect on BI success (p>0.05).

Table 6. Regression Analysis of Technological BI Capabilities and BI Success

	Dependent Variable
Independent variables	**BI Success**
Data types Qualitative	-.033*
Data types Quantitative	***.334****
Data source internal	***.293****
Data source external	-.159
Reliability Internal	***.046****
Reliability External	.059
Interaction	.069
R^2	.280
Adjusted R^2	.166
F	9.649
Df	9

*p<0.05

Qualitative data types, internal data source, and internal reliability contribute significantly to the model. Data types quantitative explains %33 variance in BI success, Data sources internal explains 29%, and Reliability internal explains %4.

When the remaining Technological BI capabilities factors were checked with regression analysis , no significant result was found.

Hypothesis 2, stating "Technological BI Capabilities will be positively related to BI Success" has found partial support. The results indicate positive relationship between Technological BI Capabilities and BI Success with respect to data types quantitative value (β=.334; p<.05), data source internal value (β=.293; p<.05) and, reliability internal value (β=.0.46; p<.05)

4.1.4 Testing the Moderating Role of Human Factors between Organizational BI Capabilities and BI Success

To test the moderating role of Human Factors on the relationship between BI Capabilities and BI Success, hierarchical regression analysis was constructed for each interaction term of the independent and moderator variable. During hierarchical regression, BI success, Human Factors, and BI capabilities were entered into the analysis at successive steps. A significant change in the variance explained by the regression step and a significant beta coefficient for an interaction term results in a moderating effect (table 7).

Table 7. Results of the Hierarchical Regression Analysis

Independent variables	**Dependent Variable: BI Success**		
	Step 1	Step 2	Step 3
Risk	-.081*	-.175	-.278*
Human Factors		.335*	.174
Risk*Human Factors			.393*
R^2	.006	.063	.080
Adjusted R^2	.001	.044	.054
F	1.767	4.334*	5.225*

Independent variables	**Dependent Variable: BI Success**		
	Step 1	Step 2	Step 3
Data types Quantitative	.041*	.045	.227*
Human Factors		.495	.210
Data types Quantitative *Human Factors			.420*
R^2	.017	.046	.065
Adjusted R^2	.011	.038	.057
F	2.282	5.299*	7.609*

Independent variables	Dependent Variable: BI Success		
	Step 1	Step 2	Step 3
Data sources Internal	.024	.081	.231
Human Factors		.287*	.501
Data Sources Qualitative*Human Factors			.239*
R^2	.008	.055	.057
Adjusted R^2	.005	.040	.028
F	1.063	4.718*	5.052*

Human Capital value was found to moderate the relationship between BI success and Data sources internal factor. Although Human Capital had a significant and positive effect on BI Success in the second step, significant effect disappeared when the interaction term entered into the analysis in the third step. No significant effect of data sources internal was found on BI Success alone, but beta coefficients increased in each step (β=.024 to β=.231). According to results of hierarchical regression analysis between the remaining factors and BI success, moderating effect of human factor could not be found.

As a result of the findings of the moderator analysis, Hypothesis 3 stating "The relationship between BI Success and Technological BI capabilities will be moderated by human factors." has found partial support for data types quantitative and data sources internal factors of technological BI capabilities.

5. Discussion and Conclusion

This study aims to develop a comprehensive framework to asses the moderating role of human capital on the relationship between BI capabilities and BI success.

The results show that some of the relationships proposed in our model are supported. Our findings suggest that there is moderate and positive relation between quantitative data types and BI success and better quality of quantitative data brings better BI success performance. However our research did not support the hypothesis that better quality of qualitative data sources brings greater success of BI projects. The reason behind this can be due to the fact that most the responds come from Turkish organizations and these organizations use BI tools with mostly quantitative or quantifiable data rather than on qualitative data. In Turkey, it is very new to use qualitative data such as social media comments, data extraction from visual contents or gathering information from videos etc. are very few yet, but increasing.

The findings also suggest that high quality data that comes from internal sources has an impact on BI success. Data quality is a focal element for BI Success because poor data quality can mislead decision makers at every level of the organization.

Furthermore, another result that can be delivered from the analysis is that reliability of internal data sources influence the overall performance of BI process. BI helps organizations to increase its business agility by providing its user accurate, timely, and consistent information by using the technological capabilities (Parikh and Haddad, 2008).

Additionally, the results suggest that there is no significant effect of the intuition level. This may be the result of that organizations do not involve their intuition when they are making decisions and they use BI tools purely on data came from internal data sources. Prior researches indicate that BI projects using internal data sources have more possibility to succeed compared to BI projects involves intuition of analysts (Hawson, 2007; Sabherwal and Becerra-Fernandez, 2010). Success cannot be assured by the decisions only based on the intuition; However BI provides Fact-based framework and can help to make confident decisions assured for success. Moreover, Business intelligence creates the agile of organization and give it a competitive advantage in evolving market conditions.

It is suggested that the positive influence of intuition level, flexibility, and risk level on BI success is increasing when organizations have high quality human capital. Results of the analysis revealed that only risk level effects hypothesized is significant. This shows that human capital influences the power of the relationship between BI success and organizational BI capabilities partially for risk level factor.

Analysis also show that if the quality of human capital is high and there is high quality of internal data sources, than BI project is more tendency to be considered as successful. This is an expected result because there is more than one way to use data sources in BI projects. Same work can be done with different methods. To use internal data sources efficiently BI users should have certain level of knowledge and skill. This knowledge can be obtained by involving in BI projects.

Furthermore, the results show that technological capabilities are key factors for an effective BI. Organizations should take into consideration to implement these capabilities very rigorously. According to the research findings, there is a moderate and positive relation between quantitative data types and BI success. Since activities of the organization are mostly based on quantifiable data (Gorry and Scott, 1971; Anthony, 1965; Keen

and Scott-Morton, 1978), a better quality of quantitative data brings results in BI success performance. However, there was no relation found between qualitative data and success of BI projects.

The findings also suggest that data quality leads to better BI success. Especially data that come from internal sources have an impact on BI whereas use of high quality external data does not bring better BI success. Organizations do not trust external data source to build important reports or add them into their data warehouse (Verbitskiy and Yeoh, 2011).

The framework and empirical findings in this paper are valuable to relevant BI designers and managers within organizations who want to understand and evaluate more the impact of technological, social, human factors on the success of BI systems. However, future studies should be carried on the role of human factors with samples from specific industries as well as different countries. Such studies will provide valuable insights to industry specific and cross-cultural differences.

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