

An Empirical Study on Business Intelligence System Perceptions at Enterprises Operating in Turkey

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ABSTRACT *.In order to maintain their position in the global environment, it is very important for developing countries to attach importance to innovation, to increase its science and technology capacity and to use information and communication technologies more efficiently. The main aim of this study is to reveal the usage of Business Intelligence (BI) in enterprises operating in the Turkey. For this purpose, a theoretical framework has been established through a literature review. The literature has been reviewed in order to detect the use of Business Intelligence in enterprises and its effects in performance. Without discriminating between sectors, the empirical research has been conducted with questionnaires to 223 managers, BI users and BI developers working in different management levels about BI usage. The level of BI usage is researched. For this purpose, a research model has been established and tested. In can be seen that the enterprises included from our research, mainly use the business intelligence. In this case, it can also be seen that these enterprises are adapting to today's technological innovations. A great majority of enterprises have preferred to use a ready packet system. The information obtained via the business intelligence system, are mainly presented to the employees at every level.*

Keywords : *Business Intelligence, System Usage, Information Technologies*

Introduction

Due to the rapid developments in information and communication technologies and to the rapid nature of the job environment, organizations gradually create and engage with more data. A significant information technology called as business intelligence has been brought the agenda as the information technologies realizing this transformation, store the data acquired from any kind of resource in a suitable form; process these data in the manner that they would response to rapid and instantaneous changes; and transform these data into useful information that would help the executives make the right and strategic decisions.

Business intelligence is the whole methods and processes used in order to develop an exact and distinct understanding on the business dynamics, for the purpose of supporting the decisions to be made.

Despite the fact that the business intelligence components are popular; we know very little about the types, the dimensions of these components' efficiency, and which component is the best for different users and tasks. In literature, while the opportunities offered to the organizations by information and communication technologies are indisputably accepted; the studies empirically conducted on the business intelligence systems regarding the use of business intelligence, are limited. Relevant discussions included in the world's literature, are quite limited.

The studies that introduce today's dimension of the business intelligence, that investigate the efficiency of business intelligence systems in different sectors, and that measure the use of business intelligence from the perspective of the end-user, executive, developer and corporation, are limited in the literature. In this context, the main aim of the study is; to measure the use of business intelligence of the enterprises engaging with business intelligence in Turkey, and to make a general assessment. Then, to develop a conceptual model in order to reveal the knowledge level, education, experience, IT skills and positions of the users on the use of business intelligence; and also to reveal the size of enterprises, the sectors that they are engaged in, and the impacts of the duration of their use of business intelligence. Thanks to this conceptual model, it would be possible to investigate the relationship between the user and enterprise properties of the companies using the business intelligence, and to determine the factors underlying in the creation of possible values.

In this study, individual and enterprise characteristics and the effect of these characteristics on the level of usage of the business intelligence, were empirically analyzed in terms of different criteria. Moreover, determination of the similarities and differences of different sectors, is one of the most significant aspects of this study, distinguishing it from the other studies conducted in this field.

Research Method

The first data collection technique of the research, was the in-depth interview made with the personnel working in the corporation. And the other data collection technique is, the survey form consisting of structured and semi-structured questions. Surveys were conducted in order to evaluate the hypotheses presented in the research. By means of the digitization of the data acquired from the survey forms, the model and hypotheses of the research were tested. Within this framework, usage level factors in the literature, were analyzed both in terms of the information system in general, and of the business intelligence in private; after that an evaluation was carried out. By taking the factors regarded to be significant into consideration, and inspiring from the models developed in the literature within this scope, a conceptual model revealing the present business intelligence applications of the corporations, was developed. Not only a conceptual model was developed in the study, but

also a scale was developed in the following phases of the research in order to test this conceptual model.

Research Population and Sample

Created in the manner that would include the enterprises operating within the references of the companies (SAP, SAS, Microsoft, Oracle) using the business intelligence and producing business intelligence solutions. While the sample for the enterprise using the business intelligence, was determined as 47; the reference enterprises sample was determined as 380. The research was applied on the business intelligence users and business intelligence developers, amounting to 223 individuals in total. While the sample related to the company using the business intelligence, was acquired by means of snowball sampling method; the sample related to the company producing the business intelligence solutions, was acquired by means of analyzing the information on the reference pages of the websites of (SAP, SAS, Microsoft, Oracle) companies, and of analyzing the enterprises' own websites.

Data Analysis Method

In the research conducted, questions of five point likert scale, were asked. The scoring of options in the data analysis, were determined as; 1= Absolutely disagree, 2= Disagree, 3= Not sure, 4= Agree, 5= Completely Agree, and it was subjected to interpretation by this model. After the survey was conducted, the data evaluated by the aforementioned scoring, was analyzed by percentage, frequency, Chi-square, T-test, Anova, Correlation analysis, arithmetic median and standard deviation methods. The aforementioned analyses were carried out by IBM SPSS Statistics 20 program and by Microsoft Excel 2013.

Research Model and Hypotheses

Hypotheses on the size of enterprises, the sectors that they are engaged in, the duration of their use of business intelligence; on the knowledge level, education, experience, IT skills and positions of the users; and on the relationship between the variables and the usage level of business intelligence, were created.

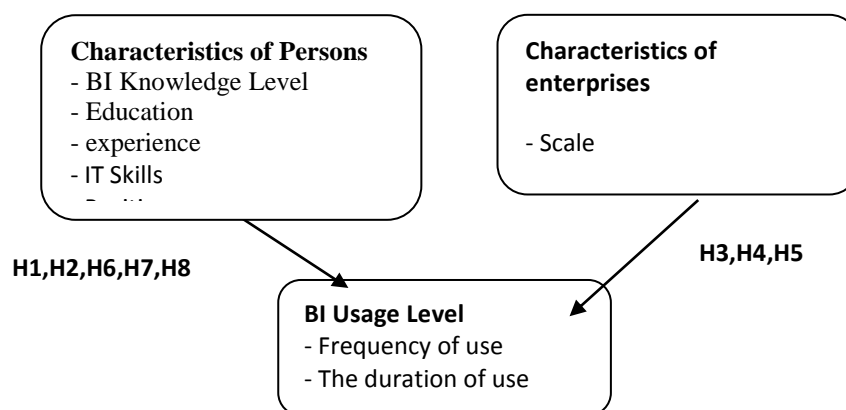


Figure 1. Research Model

Research question: Are the knowledge level, education, experience, IT skills and positions of the users effective on the high level use of business intelligence?

H1: Depending on the knowledge levels related to the business intelligence, the usage levels of business intelligence differ.

H2: The usage level of business intelligence differs according to the positions in the corporation.

H3: The usage level of business intelligence differs according to the size of enterprises.

H4: The usage level of business intelligence differs according to the sector that the enterprises are engaged in.

H5: The time elapsed as of the execution of business intelligence, affects the usage level of business intelligence.

H6: According to education levels, the usage level of business intelligence by sector, differs.

H7: According to the experience levels, the usage level of business intelligence by sector, differs.

H8: According to IT skills, the usage level of business intelligence by sector, differs.

Other questions for which an answer was sought, are:

1. What are the business intelligence preferences of the enterprises operating in different sectors?
2. What is the distribution of the use of business intelligence in the enterprises according to the user group?
3. Are the knowledge level, education, experience, IT skills and positions of the users effective on the high level use of business intelligence?

Data Analyses And Results

Demographic Findings

52,9% of the enterprise workers creating our sample, are end-users, 16,1% are executives, and 30,9% are the employees working in the business intelligence department. 66,4% of the enterprise workers creating our sample, are male; and 33,6% are female. It can be observed that the age range of the participants vary between 21 and 40. When we analyze the education level of the participants, we can see that the percentage of bachelors is high. It was also observed that 85,2% of the participants received undergraduate and postgraduate education. The reason why the education level is high in the relevant enterprises, might be that; the knowledge level of the research was selected from the enterprises in which there were high density of employees available. When we analyze the positions in the enterprises, we can see that; top executives corresponded to 3,1%; mid level directors 12,1%; junior administrative officers 6,3%; and specialists and employees corresponded to 78,5%. 80% of the enterprises participating in the research, can be regarded as small and middle-size, and the remaining 20% can be regarded as big enterprises. It can be seen that 38,6% of the participants had less than 5 years experience, 36,8% had a good work experience, and 24,7% had much more work experience. 11,2% of the enterprise workers participating in the research, operate in banking sector, 18,4% operate in public sector, 9,4% operate in information sector, and 9,4% operate in telecommunication sector.

Findings on the Usage Level of Business Intelligence

When the use experiences and frequencies of the business intelligence is analyzed, it can be seen that; business intelligence experiences were between 1 and 4 years at 48,9%, and more than 5 years at 35,4%. It was observed that nearly half of the employees used the business intelligence more than twice a day, and that their weekly use of business intelligence, was over 40 minutes. It was also observed that business intelligence knowledge levels of more than half employees, were in good state.

When the duration of the use of business intelligence is analyzed, it can be seen that; business intelligence experiences were over 4-10 years at 69,4%, and less than 3 years at 30,4%. It was also observed that the duration of the enterprises' use of business intelligence was in good state.

Participant enterprises' preferences of the business intelligence system are; Microsoft, in-house development and Oracle systems, respectively. The 'other' option indicated in Table 1, includes Data systems, TM1, informatica, Tableau, Inhouse, Spotfire and Sybase IQ producers. Majority of enterprises use the products that belong to Microsoft and Oracle companies.

Table 1: Enterprises' vendor preferences

| Vendor | Frequency | Percentage |
|--------------------|-----------|------------|
| Microsoft | 42 | 23,7 |
| In-house solutions | 37 | 20,9 |
| Oracle | 31 | 17,5 |
| SAP | 16 | 9,0 |
| Business objects | 13 | 7,3 |
| MicroStrategy | 8 | 4,5 |
| Cognos | 7 | 4,0 |
| SAS | 6 | 3,4 |
| Qlikview | 3 | 1,7 |
| IBM | 2 | 1,1 |
| Cyrstal reports | 2 | 1,1 |
| Hyperion | 2 | 1,1 |
| Other | 8 | 4,5 |
| Total | 177 | 100,0 |

A great majority of the participant enterprises indicated that the business intelligence was being used by the employees at every level. In addition to this, there are enterprises in which only executives or several employees along with executives, use these systems. The users of business intelligence systems in the enterprises, are shown in Table 2.

Table 2: Business Intelligence System Users

| BI System Users | Frequency | Percentage |
|--|-----------|------------|
| Only Top level managers | 8 | 7,3 |
| Top and middle level managers | 20 | 18,2 |
| Determined employees | 25 | 22,7 |
| Any employee at any organization level | 53 | 48,2 |
| No idea | 4 | 3,6 |
| Total | 110 | 100,0 |

The outputs of business intelligence are presented to the users by many different methods. It is indicated below by which methods the information acquired from the business intelligence systems, are presented to the users.

Table 3: The methods for submission of the information at the enterprises

| Method | Frequency | Percentage |
|-----------------|-----------|------------|
| Reports | 62 | 35,8 |
| Dashboards | 52 | 30,1 |
| Portal | 45 | 26,0 |
| Scorecard | 12 | 6,9 |
| interaktif cube | 1 | 0,6 |
| No idea | 1 | 0,6 |
| Total | 173 | 100,0 |

Findings on the ability to use the information technologies

When IT-related skills of enterprise workers, are analyzed; it can be seen that the participants' IT skills are good as indicated in the table. Also, IT knowledge level rates appear to be high.

Evaluation of the usage level of business intelligence from the developer's perspective

When the results of the business intelligence developer group participating in the research regarding the perception of business intelligence, were analyzed; it was observed that the users used the business intelligence system effectively, that they were able to change the system outputs as they wished, however the business intelligence was not used in real terms, instead it was perceived as a reporting system.

In terms of business intelligence developer group; it was indicated that the business intelligence system developed, had the feature of "drill-down", presenting "updated information", and "being accessible anytime."

Findings related to hypotheses

In order to determine the relationship between the variables and the use of business intelligence, Chi-Square and Anova analysis; and in order to determine the direction and intensity of this relationship, Correlation analysis was carried out.

Table 4: The use of business intelligence, Chi-Square and Anova analysis

| | (Sig.) | Hypotheses | Result |
|---|--------|------------|----------|
| Knowledge levels related to the business intelligence | ,000 | H1 | Accepted |
| According to the positions | ,000 | H2 | Accepted |
| According to the size of enterprises | ,241 | H3 | Rejected |
| According to the sector | ,311 | H4 | Rejected |
| The time elapsed as of the execution of business intelligence | ,237 | H5 | Rejected |
| According to education levels | ,003 | H6 | Accepted |
| According to the experience levels | ,000 | H7 | Accepted |
| According to IT skills | <0,05 | H8 | Accepted |

As a result of the Chi-square analysis conducted; it was determined that the participants' business intelligence usage levels according to their knowledge levels of business intelligence, were statistically significant and had 0,000 significance level according to Chi-square test. Under these circumstances, participants' use of business intelligence differs according to their knowledge levels of business intelligence. As a result of the analysis, H1 hypothesis was accepted.

It can be seen that, Chi-square test significance level for the business intelligence usage level according to the participants' positions, was 0,000. In that case, it was determined that the usage level of business intelligence in the enterprises, differed in accordance with the positions. As a result of the analysis, H2 hypothesis was accepted. In order to understand in which group the difference was; "Scheffe", Frequency and Crosstab tests were carried out. In the analysis conducted, it was considered that the difference had arisen from the fact that the employees had lower knowledge levels of business intelligence, compared to the "Specialists".

As a result of Chi-square analysis, the significance level for the business intelligence usage level according to the size of the participant enterprises, was determined as 0,241. As this value was over 0,05, statistically it did not constitute a significant difference. In that case, it was determined that the usage level of business intelligence in the enterprises, were not different according to the size of the enterprise. As a result of the analysis, H3 hypothesis was rejected.

It can be seen that the significance level for the business intelligence usage levels by the sectors that the enterprises engage in, was 0,311. In that case, it was determined that the usage level of business intelligence in the enterprises, was not different by the sector the enterprises were engaged in. As a result of the analysis, H4 hypothesis was rejected.

It can be seen that the significance level for the business intelligence usage levels of the participant enterprises according to the duration of their use of business intelligence, was 0,237. In that case, it was determined that the usage level of business intelligence in the enterprises, was not different according to the duration of the use of business intelligence. As a result of the analysis, H5 hypothesis was rejected.

It can be seen that the significance level for the participants' business intelligence usage levels according to their education level, was 0,003. In that case, it was determined that the usage level of business intelligence in the enterprises, was different according to the education levels. As a result of the analysis, H6 hypothesis was accepted. In order to understand in which group the difference was; "Scheffe", Frequency and Crosstab tests were carried out. In the analysis conducted, it was determined that the difference was between High School and, Two-year College and Postgraduate education levels.

It can be seen that the significance level for the participants' business intelligence usage levels according to their business intelligence experiences, was 0,000. In that case, it was determined that the usage level of business intelligence in the enterprises, was different according to the business intelligence experiences. As a result of the analysis, H7 hypothesis was accepted. In order to understand in which group the difference was; "Scheffe", Frequency and Crosstab tests were carried out. It was considered that the difference had arisen from the fact that the usage levels of business intelligence among the groups of "Less than a year" and "Over 5 years", were low.

In order to determine the connection among the business intelligence usage levels according to IT usage skills, Anova and Correlations analyses were conducted. It was observed that, business intelligence usage level statistically created a significant difference according to IT skill levels. As a result of the analysis, H8 hypothesis was accepted.

As a result of the analyses conducted; it was observed that OOS usage skill affected the use of business intelligence at the level of 17%, BÇS usage skill at %31, KDS usage skill at 45%, YBS usage skill at 47%, ÜYBS usage skill at 30%, Database usage skill at 35%, and EVD usage skill at the level of 40%. It can also be seen that, there was a positive relationship among the variables at the significance level of 0,01.

Conclusion

The following results were obtained from this research which was carried out in order to determine the usage level of business intelligence in the enterprises operating within the references of the companies (SAP, SAS, Microsoft, Oracle) using the business intelligence in Turkey and producing business intelligence solutions; at the same time, to determine the knowledge level, education, experience, IT skills and positions of the users on the usage level of business intelligence; and to reveal the impacts of the size of enterprises, the sector they are engaged in, and the duration of the use of business intelligence:

It can be seen that; enterprises engaging in different sectors, highly preferred the products of the companies such as Oracle and Microsoft; which have the capacity to process the high-quality data without any problem; in their preferences of business intelligence products. The outputs of business intelligence, are presented to the users mainly by reports and dashboards. Business intelligence usage level didn't create a difference according to the size of enterprises and to the period when the business intelligence was started to be used. Business intelligence usage levels of the enterprises by the sector they were engaged in, did not differ.

It can be seen that the business intelligence is used by the employees at every level. And this proves that, business intelligence applications are not only used for strategic decisions, but also for the decisions at the operational level. It was observed that the business intelligence experiences of the enterprises, were over 4-10 years at 70%, and in good state.

Business intelligence usage level of the participants differ depending on their education levels, positions and IT usage skills. It was considered that the difference among the groups had arisen from the fact that the employees had lower knowledge levels of business intelligence, compared to the "Specialists", at High School and, Two-year College, Undergraduate and Postgraduate education levels. It was observed that the ability to use IT, affected the use of business intelligence at the rates of 30% and 47%. In this case, as the IT level and education level of the participants increase, the use of business intelligence components and the importance given on the business intelligence, also increase.

Business intelligence usage levels of the participants differ according to their knowledge levels and experiences of the business intelligence. It was considered that the difference among the groups, had arisen from the fact that the employees having less than one-year experience, had low knowledge levels. In this case, as the experience and knowledge level increase, the perception of business intelligence components and the use of business intelligence, also increase.

When the results of the business intelligence developers were analyzed; it was observed that the users used the business intelligence system effectively, that they were able to change the system outputs as they wished, however the business intelligence was not used in real terms, instead it was perceived as a reporting system. In terms of business intelligence developer group; it was indicated that the business intelligence system developed, had the feature of "drill-down", presenting "updated information", and "being accessible anytime". A system, that can be accessed anytime, is quite important in terms of supporting the decision-making process.

Future Directions

The factors related to the usage levels of business intelligence tested in this research, have the characteristics to be a basis for other researches, and to be applied by different business groups and big enterprises. By means of comparing the hypotheses tested in the study, with the SMEs located in different countries, UN countries in particular, the relationship between SMEs' characteristics and the usage levels of business intelligence, might be revealed. In the

studies to be carried out, a research can be conducted by means of the scales developed separately for the employees and executives, and the results of these studies conducted separately from each other, can be compared. Alongside the use of business intelligence in the enterprises as a whole, it might be preferred to measure the impacts of business intelligence on the basis of functional sections.

The use of business intelligence differs according to the knowledge levels and experiences of the business intelligence. It is considered that, if the future studies on this matter are carried out regarding the enterprise and employee properties along with the individuals' point of view on the business intelligence, it would contribute to the literature.

In order to increase the use of business intelligence systems in the enterprises, it is essential to give the necessary updated training to the employees regarding the business intelligence.

The outputs of business intelligence, are presented to the users mainly by reports and dashboards. In this case, in the studies to be carried out, it is considered that focusing on the dashboard design and analyzing its impact on human-system interaction, might be beneficial.

For the purpose of analyzing the effects of the use of business intelligence and contributing to the literature, it is considered that it would be beneficial for the literature to carry out the future studies by taking the organizational structures, characteristics, moral values, organizational cultures and viewpoints of the enterprises into consideration.

Moreover, in the business intelligence literature; it is considered as beneficial to conduct studies for determining a general business intelligence component design strategy that would be suitable for any type of users in the organizations, and determining the design features of an effective business intelligence component. It is essential that the developers of business intelligence components develop different solutions in accordance with the cognitive styles and personalities of the end-users. It is important to conduct studies in this field.