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Contributions of Business Intelligence (BI) on Decisions Programming for Telecommunications Companies in Yemen

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Abstract: This study aimed at studying the contributions of the BI on decision programming. The study was performed in three telecommunication companies in Yemen, namely Sabafon, MTN and Yemen Mobile. Companies' managers as well as IT specialists were selected to expose their views and describe the awareness of the BI and its impact on decision programming. Questionnaire and observation were the best techniques for this study to collect the accurate data. Furthermore, data was statistically analyzed using descriptive statistics tools, MANOVA and Univariate ANOVA test. The empirical findings reveal the role and positive impact of BI on decisions programming at the same time companies do not implement the new technologies that are appropriate for enhancing the BI. Hence it was recommended that companies should start applying machine learning and develop digital dashboards to illustrate all required data and information which cover all companies' areas.
Keywords: BI, OLAP, Digital dashboard, Decision programing.

1. Introduction

A decision programming is considered as a backbone for management process in organizations, it could be gained through the ability to anticipate information, convert it into knowledge, and then acquiring intelligence relevant to the business environment. In order to survive, grow and to become a business leader, an organization has to make strategies or in other words has to align itself with its environment.[1] The effective utilization of decision making develops telecommunications companies' distinctive competencies, which facilitate customer services, internal and external processes. Hence business intelligence (BI) plays a crucial role in decision making programming in telecommunications companies by providing intelligence data and information and that can help managers in making effective decisions.

Business Intelligence indicates to technologies, applications and practices for collecting, organizing, analyzing, and presenting data and information in such way that can make all business operations beneficial for management control and planning, problem solving and decision making. In addition, BI has the ability to provide historical, current, and predict business operations, using data that has been gathered into a data warehouse. This data converts into valuable knowledge for achieving effective decision making and that is the aim of this study which will be carefully investigated and take the benefit of it for telecommunications companies. Spreadsheets no longer serve as the basis for analysis. In contrast, companies favor insightful visualizations and interactive dashboards to help them gain a deeper understanding of business component. Currently in business organizations, data is considered as the new oil. Data plays a crucial role in the digital economy because it has the most useful commodity in businesses. However, the most significant impact of business intelligence has been in the domain of decision-programming. With the help of advanced analytics, business executives now have the power to leverage data and acquire insights to make informed decisions.[2]

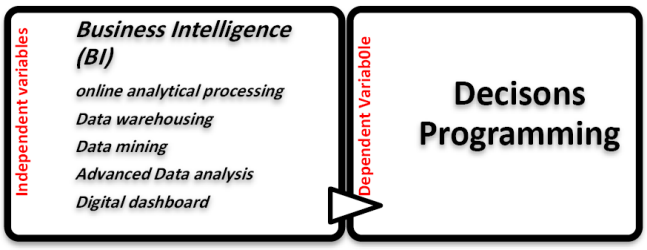

Figure 1. Conceptual framework

2. Problem Statement

Many telecommunications companies face several obstacles that stop and make them disable in making right decisions related to profits, customers' satisfactions, gaining competitive advantages and others. The problem is arisen when these companies in need of analyzing, collecting and representing data in such way that provides a good insight and intelligence into their business. Therefore, Business Intelligence (BI) enables managers and executives to make smarter marketable decisions. The BI has the ability to gather data and information from respective business fields and convert them into knowledge that can be used to the need of decisions. From the previous points the problems give rise to the following questions:

1- *Do Yemeni telecommunications companies implement business intelligence? The first question can be sub-divided into:*

Do companies practice (on-line analytical processing, data warehouse, data mining, data analysis and dashboards)?

2- *Is there a positive impact of business intelligence on decisions programming in Yemeni telecommunications companies?*

This study will give an attempt to find out the impact of business intelligence on decision making process in Yemeni telecommunications companies. The conceptual framework of this study is shown in Fig. 1.

3. Hybotheseses and Related Studies

To provide solution to this research paper, the hypotheses that formulated are:

1- Business Intelligence (BI) plays a crucial role in telecommunication companies in Yemen

The first hypothesis can be sub-divided into: on-line analytical processing, data warehouse, data mining,

Data analysis and dashboards effectively implemented in telecommunication companies in Yemen.

2- There is a positive impact of BI on decisions programming in telecommunication companies in Yemen.

Waman S Jawadekar(2012)[3] explains the BI as a term refers to the sum total gathering and processing data, building rich and relevant information and maintains it live and up to a date. In the same book, OLAP is explained as five basic system, data processing, transaction processing, application processing, system processing, integrated processing at enterprise level. Wieder and Ossimitz(2015) in the study that reveals The impact of Business Intelligence on the quality of decision making – a mediation model- Austraia, it was found that BI management quality has positive direct and/or indirect effects on data quality, information quality, and the scope of BI solutions. Asadollahi(2013) found

business intelligence can improve strategic decisions; and it can have significant positive effects on aspects of strategic decisions such as efficiency, effectiveness, agility, flexibility and integration in the study which titled as Analysis of Business Intelligence on Strategic Decision Making in the ministry of industry, Iran. A. Mukuche(2016) exposes that the various business intelligences used for competitive advantage by the insurance firms in Kenya. There are various challenges encountered by insurance firms in Kenya while using business intelligence for competitive advantage in the study of Business Intelligence and Competitive Advantage in Insurance Firms in Kenya. Al-ma'aitah(2013) in the study of The Role of Business Intelligence Tools in Decision Making Process in Jordanian customs department, Jordan found that business intelligence becomes the main criterion and the strategic performance and There is a significant positive effect of BI on decision making process in Jordanian Custom department.

4. Research Design and Methodology

This study reveals the contributions of BI on programming decisions in telecommunication companies., **the questionnaire** and **observation** were the two appropriate techniques to collect the required data. **The population** of this study consists of managers and IT specialists of three telecommunication companies namely Sabaton, MTN and Yemen Mobile in Yemen. In obtaining the **sample size** 25 managers and 15 IT specialists were responded to the study which means the **stratified sampling** was performed to gain the right data before analysis.

5. Data Analysis and Interpretation

From Table 1, it can be concluded that the highest benefit of data warehousing is that companies have the ability to integrate data and database contains all historical data with a mean of 4.50 and St. Deviation of 0.506. On the other hand, the lowest benefit of data warehousing is that the three companies have the ability to update the data easily and gradually with a mean 2.75 and St. Deviation 0.439 based on Likert Scale.

From Table 2, it is quite clear that the highest benefit of data mining is that companies can provide several reports based on the mining data with a mean rank of 4.75 and St. Deviation of 0.439. followed by the companies can extract historical data without difficulty which stated at high level based on Likert Scale. However, the lowest contribution of data mining is that companies can classify the unstructured data into organized categories and concealed patterns of data with a mean of 2.50 and St. Deviation of 506.

From Table 3, it can be concluded that the highest benefit of OLAP is that companies can response to complex queries easily and make data analysis simpler a mean rank of 4.50 and St. Deviation of 0.506. However, the lowest contribution of OLAP is that companies can display data in different dimensions a mean rank of 2.50 and of St. Deviation 506.

Table 1. Descriptive statistics of data warehousing

Statements of data warehousing	N	Mean	Std. Deviation
Company depends on new technology for data warehousing	40	4.50	.506
The company has a big database that contains all historical data	40	4.50	.506
The company has the ability to transfer all data gradually	40	3.25	.439

The company has the ability to update the data easily and regularly	40	2.75	.439
The company has the ability to integrate data from several databases in different departments	40	4.50	.506
The data warehouse supports all department in the company	40	3.00	.716
Valid N (listwise)	40		

Table 2. Descriptive statistics of data mining

Statements of data mining	N	Mean	Std. Deviation
The company can classify the unstructured data into organized categories	40	2.50	.506
The company can reveal concealed patterns of data	40	2.50	.506
The company can provide several reports based on the mining data	40	4.75	.439
The managers get required information about customers based on the mining data	40	4.75	.439
The managers get required information about competitors based on the mining data	40	4.75	.439
The company can extract historical data without difficulty	40	4.50	.506
The company gets benefit from the historical data for future forecasts	40	3.50	.506
Valid N (listwise)	40		

Table 3. Descriptive statistics of online analytical processing

Statements of online analytical processing	N	Mean	Std. Deviation
The company can display data in different dimensions	40	2.50	.506
The company can response to complex queries easily	40	4.50	.506
Using OLAP makes data analysis simpler	40	4.50	.506
With OLAP information has become more adequate and complete	40	4.75	.439
Valid N (listwise)	40		

Table 4. Descriptive statistics of advanced data analysis

Statements of advanced data analysis	N	Mean	Std. Deviation
The company sets many questions related to data collection	40	2.75	.439

The company wrangles the data after collection	40	3.25	.439
The company classifies the data before analyzing	40	2.75	.439
The company analyses the data using descriptive statistics	40	4.50	.506
The company analyses the data using inferential statistics	40	4.75	.439
The company uses machine learning for data analysis	40	1.25	.439
The company uses new technologies for data analysis	40	4.25	.439
The company shares the results of data analysis for all departments	40	4.50	.506
Valid N (listwise)	40		

Table 5. Descriptive statistics of digital dashboard

Statements of digital dashboard	N	Mean	Std. Deviation
The company implements several software to create interactive reports	40	4.50	.506
The company implements several software to create graphical reports	40	4.50	.506
The company has a performance indicator for all departments	40	3.50	.506
The digital dashboard illustrates all required data for taking the decisions	40	4.50	.506
The digital dashboard provides a high level of monitoring in a real time	40	4.50	.506
The digital dashboard illustrates all required data for daily processes	40	4.75	.439
Valid N (listwise)	40		

From Table 4, it can be concluded that the highest benefit of advanced database is that companies analyse the data using inferential statistics with a mean rank of 4.75 and St. Deviation of 0.439. followed by the companies analyses the data using descriptive statistics which stated at high level based on Likert Scale. On the other hand, the lowest advanced data analysis is that companies use machine learning for data analysis with a mean rank of 1.25 and of St. Deviation of 439.

Table 6. Descriptive statistics of programming decisions

Statements of decisions programming	N	Mean	Std. Deviation
Managers study the problem definition accurately	40	4.75	.439
Managers can express the problem clearly	40	4.75	.439
Managers select related data while studying the problem	40	4.50	.506
Managers have the ability to place numerous alternatives	40	4.50	.506
All alternatives are clear to managers when analyzing the internal environment	40	4.75	.439

All alternatives are clear to managers when analyzing the external environment	40	4.50	.506
Managers classify the alternatives to select the best one	40	4.75	.439
Managers can adjust the cost for every alternative	40	4.75	.439
Managers can adjust the time for every alternative	40	4.25	.439
Managers can adjust the effort for every alternative	40	4.25	.439
Managers are aware of the result for every alternative	40	4.50	.506
Managers make decisions visibly	40	4.50	.506
Managers can extract the information that related to the right decisions	40	4.75	.439
Managers select the right time for executing the decisions	40	4.75	.439
Mangers devise programs, rules and policies for problem-solving process	40	4.25	.439
All actions related decisions making are monitored by managers	40	4.25	.439
Managers gain the necessary information about alternatives as a feedback	40	4.75	.439
Managers can modify the decisions when necessary	40	4.75	.439
Valid N (listwise)	40		

Table 7. Descriptive statistics

	BI implementation	**Mean**	**Std. Deviation**	**N**
data_warehousing	YES	3.7500	.14618	40
	Total	3.7500	.14618	40
data_mining	YES	3.8929	.18794	40
	Total	3.8929	.18794	40
online_analytical_processing	YES	4.0625	.20993	40
	Total	4.0625	.20993	40
advanced_data_analysis	YES	3.5000	.15504	40
	Total	3.5000	.15504	40
digital_dashboard	YES	4.3750	.24964	40
	Total	4.3750	.24964	40

From Table 5, it can be concluded that the highest benefit of digital dashboard in the companies is the digital dashboard illustrates all required data for daily processes with a mean rank of 4.75 and St. Deviation 0.439. However, the lowest benefit of digital dashboard is that companies have a performance indicator for all departments a mean rank of 3.50 and of St. Deviation of 506.

Table 6 shows the decisions programming process, due to the importance of studying this variable and investigate if managers make decision scientifically. Table 6 indicates that all the statement stated at high level with a mean rank of greater than 4 based on Likert scale.

6. Testing of Hypotheses

1- **First hypothesis:** Business Intelligence (BI) plays a crucial role in telecommunication companies in Yemen

The first hypothesis can be sub-divided into: on-line analytical processing, data warehouse, data mining, data analysis and dashboards effectively implemented in telecommunication companies in Yemen.

MANOVA Test:

MANOVA was conducted on five sub-variables (data warehousing, data mining, online analytical processing, advanced data analysis and digital dashboard) as shown in Table 7.

The Bartlett's Test of Sphericity is statistically significant, (P value is less than 0.001) indicating sufficient correlation between the variables to proceed with the analysis as shown in Table 8.

Since P value is less than 0.05, the null hypothesis is rejected. Therefore, it can be concluded that the hypothesis "Business **Intelligence (BI) plays a crucial role in telecommunication companies in Yemen"** is proved. Since Pillai's Trace was significance, Univariate ANOVA was conducted on each sub-variable separately to determine the locus of statistically significant multivariate effect as shown in Table 9.

Table 8. Bartlett's test of Sphericity

Likelihood Ratio	.000
Approx. Chi-Square	199.991
df	5
Sig.	.000

Effect	Intercept		
	Pillai's Trace	Wilks' Lambda	Hotelling's Trace
Value	.999	.001	737.000
F	9089.667[b]	9089.667[b]	9089.667[b]
Hypothesis df	3.000	3.000	3.000
Error df	37.000	37.000	37.000
Sig.	.000	.000	.000

Data warehousing: From descriptive table it can be seen that data warehousing has mean of 3.75. Since P value is less than 0.05 which can be seen from Table 10, the null hypothesis is rejected. Hence it can be concluded that data warehousing *effectively implemented in* telecommunication companies in Yemen.

Data mining: From descriptive table it can be seen that data mining has mean of 3.8. Since P value is less than 0.05 which can be seen from Table 10 the null hypothesis is rejected. Hence it can be concluded data mining *effectively implemented in* telecommunication companies in Yemen.

Online analytical processing: From descriptive table it can be seen that data mining has mean of 4.06. Since P value is less than 0.05 which can be seen from Table 10 the null hypothesis is rejected. Hence it can be concluded online analytical processing *effectively implemented in* telecommunication companies in Yemen.

Advanced data analysis: From descriptive table it can be seen that advanced data analysis has mean of 3.5. Since P value is less than 0.05 which can be seen from Table 10 the null hypothesis is rejected. Hence it can be concluded advanced data analysis *effectively implemented in* telecommunication companies in Yemen.

Digital dashboard: From descriptive table it can be seen that data mining has mean of 4.37. Since P value is less than 0.05 which can be seen from Table 10 the null hypothesis is rejected. Hence it can be concluded digital dashboard *effectively implemented in* telecommunication companies in Yemen.

Second hypothesis: There is a positive impact of BI on decisions programming in telecommunication companies in Yemen.

Simple Regression in the table above shows the level of significance is 0.000 which is less than 0.05. Therefore, it the null hypothesis is rejected and it can be concluded that There is a positive impact of BI on decisions programming in telecommunication companies in Yemen as shown in Table 11.

7. Impirical Findings

Based on the results of questionnaires and observations, the finding of the current study can be summarized as following:

1- Concerning the role of the BI in telecommunication companies in Yemen, it was found that the BI plays a crucial role based on Pillai's Trace with a significance level of 0.000.

2- It was observed that the telecommunication companies do not fully implemented the BI that could enhance decisions programming.

3- Regarding the data warehousing, it was also found that there is the availability of data warehousing according to the test of between subjects with a significance level of 0.000. it was also observed that companies face some difficulties while updating the data gradually due to the huge amount of stored data.

Table 9. Test of between subjects

Source	Variables	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	Data warehousing	562.500	1	562.500	26325.000	.000
	Data mining	606.173	1	606.173	17161.444	.000
	Online analytical processing	660.156	1	660.156	14979.545	.000
	Advanced data analysis	490.000	1	490.000	20384.000	.000
	Digital dashboard	765.625	1	765.625	12285.000	.000

Table 10. Simple regression

R	R Square	Adjusted R Square	F	Sig.	Regression	Sig.
.995[a]	.990	.990	3890.125	.000	.116	.000[b]

a. Predictors: (Constant), BI

b. Dependent variable: decisions programming

4- For data mining and based on the questionnaires it was found that the three companies implement data mining according to the test of between subjects with a significance level of 0.000. It was observed that managers are not completely aware of classifying the unstructured data.

5- Regarding the OLAP, it was found that the companies practice OLAB as it is shown in the table test of between subjects with significance level of 0.000.

6- For advanced data analysis and according to MANOVA test, it was proved that the companies analyze their data using statistics tools. At the same time, it was observed that the companies do not use machine learning at all for data analysis.

7- Digital dashboard was found as an important tool in the BI based on the results of questionnaire as well as the observations but most of the digital dashboards do not illustrate information and data from several areas in the companies.

Based on the result of hypothesis testing, it is clear that there is a positive impact of business intelligence on decisions programming the telecommunication companies in Yemen with a significance level of 0.000.

8. CONCLUSIONS

This study has given attempt to disclose the contributions of business intelligence on decisions programming in telecommunication companies in Yemen. Managers and IT were selected to provide their views and opinions in concern with the BI contributions. Most of respondents' feedback were positive the fact that business intelligence has a positive impact on decisions programming. However, there are some limitations in applying full BI in the mentioned companies such as new technologies for data warehousing and mining as well as machine learning for data analysis. Hence, it can be recommended that the managers in the mentioned companies should think seriously about machine learning when analyzing data using the appropriate technologies such as Python, R and others. Digital dashboards should provide integrated information from several sources to facilitate decisions programming.

Currently data science plays a vital role in organizations, therefore it highly recommended when companies need to practice business intelligence for effective decisions, they should give more focus to data science and the new supported technologies which have emerged recently. So that all processes can be supported, making effective decisions, gaining competitive advantages and helping in future predictions.

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