DECISIONS BASED FACTORS TOWARDS THE TECHNOLOGY ASSESSMENT: A RELATIONAL PERSPECTIVE OF JORDANIAN TELECOM SECTOR

MOHAMMAD A. A. ALHAWAMDEH

Consulting Manager
Bisher and Kariman Consulting Est. - PO Box 840078 - Amman 11181 – Jordan
E-mail: m.hawamdeh@prunez.com

Abstract- this research investigated the relational perspective between the decision factors toward technology assessment. In this relational descriptive research, three mobile operator enterprises in Jordan were targeted, quantitative data was collected through questionnaire during 8 months in 2017, which was distributed to representative random sample of (39) IT managers, since 36 questionnaires only were returned and analysed using SPSS. Also, qualitative data were collected through interview with 12 decision makers/executives from the three enterprises. The results of the research revealed that, the timing of the assessment is an important factor contributing to the success of the assessment procedure within any company, technicians' assessment is the basic pillar of general evaluation, and also the development process, whereas the financial factor is the most important challenge limiting science and technology policy. The research recommended that Jordan mobile operators' enterprises have to enhance the role of other factors.

Keywords- Decision Making, Technology Assessment, Jordan Telecom.

I. INTRODUCTION

In decision theory, it is possible to distinguish between normative (how people should make decisions), descriptive (how people actually make decisions) and prescriptive (helping people make better decisions) research. This study is prescriptive due to its identification of global best practices. From a normative perspective, a technological investment decision is a typical decision-making problem that is comprised of decision makers, decision objectives and decision alternatives (Mador, 2000). The decision objectives should be derived from the organization's mission. Additional considerations are budget constraints, competition, and requests from physicians. Decision alternatives represent discrete investment options.

Previous studies have highlighted certain decisional based factors such as the organization mission, Nature of business, cultural context factor, functional factors, political factors, social factors, IT technicians' opinions factors, and financial factors (Csaki et al., 2014; Wernz et al., 2014).

II. PROBLEM STATEMENT

Technology plays a significant role in developing organizations and achieving high quality for their services. Many organizations use technological tools and applications, but they face challenges in assessing the current state of the technology used when they try to develop their work. Many organizations incorrectly assess the technology they use, which leads to the purchase of systems that are not beneficial to the type of business they conduct. Assessing technology depends on several factors that must be noted by decision makers when making good decisions (Kanis and Hiligsmann, 2014; Coordinating, 2014). Organizations may not be aware of these factors, and they may be intangible to managers and policy makers. To make successful decisions based on assessing technology, organizations need to identify the relationships between the factors that affect the decision making process. The problem will be more complicated when the organization cannot determine the relevant factors and identify their importance to the decision made by the board of directors, according to the nature and type of business conducted by the organization at large. It is therefore evident that determining the effective factors affecting the decision-making process to assess the technology used is a challenge that decision makers in organizations face (Kaye et al., 2010).

III. RESEARCH QUESTION

How can the decision makers in Jordanian telecom enterprises be helped to make successful decisions based on assessing technology using decisional based factors?

IV. LITERATURE REVIEW

A. Decision Making Process

Dean and Sharfman (1993) claimed that the importance of the strategic decision is not related to the rationality of the decision. Conversely, the results of the research of (Nooraie, 2008) showed that decisions' level of impact was significantly related to the level of rationality in the strategic decision-making process. There is also a positive relationship between a decision's degree of impact and decentralization in the decision-making process.

B. Technology Assessment

Technology has been seen as the motor of all progress, as a source for human happiness, and as a promise of utopia (Arbulu, 1984). Technology Assessment (TA) is considered as a pillar of organizations to be improved. Porter (1995) defined a technology assessment as "changing in important ways". It can also be defined as a scientific,**a.** interactive, and communicative process that aims to contribute to the formation of public and political opinion on societal aspects of science and technology. As technology is closely related to productivity and the associated production costs (Winer et al., 2005), it has always been a key factor for competitive survival in the business world. Technology evaluation has been defined according to (Friedman et al, 2006) as a set of principles, methods and techniques/tools for effectively assessing the potential value of a technology and its contribution to a company's competitiveness and profitability. A thorough evaluation assesses the technology and its value from technical, market and consumer perspective and reconciles the results within a valid methodology. The evaluation term is usually used to explain the measure processor to describe the organization's intended activity. An evaluation is usually conducted to answer questions or to help make decisions.

C. Decision Based Factors Of Technology Assessment

Decision makers need accurate assessments in order to make creative decisions for development. However, (Guston and Sarewitz, 2002) highlighted the most important challenge limiting science and technology policy, which is the financial factor. This study showed the importance of the financial factor in assessing technology, by taking into consideration the cost of changing the current technical system and buying another one.

Bauer and Brown (2014) studied technology assessments using quantitative study of AT, developing a systematic process for its deployment. This study considered the technicians' assessment as the basic pillar of general evaluation, and also the development process. The most prevalent indicators were community input, affordability, autonomy, transferability, community control, scalability, local availability of raw materials, and adaptability. Using these, a quantitative assessment tool was developed, called the Appropriate Technology Assessment Tool (ATAT).

V. RESEARCH METHODOLOGY

A. Population and Sampling

The population of this study consists of high –level management executives (12 executives / 4 executives from each organization), and IT managers (36 IT Managers); the targeted sample was contacted via interview URL link to the management executives as well as questionnaires URL link to the IT managers, which distributed to a three mobile operators in Jordan, which are ZAIN, ORANGE, and UMNIAH.

VI. RESULTS

A. Data Results'

This section will introduce the analysis of the data that was collected through questionnaires and interviews, questionnaires were analyzed using the SPSS, whereas interviews were analyzed using content analysis.

This section also provides explanations of the results and discusses its compliance with the results of previous studies.

- **Respondent Demographic:**

Questionnaires were distributed to a representative random sample consisting of 36IT managers who used the internal technology from a population of around 100managers at three mobile operator enterprises (Zian, Orange, and Umniah)- Jordan. Moreover, 75% from the sample was male (27 male) and the rest are female, on other hand, 50 % of the sample were aged between 35-44 years, as well as 44% of between 19-34 years.

- **Descriptive Statistics:**

This section will present a descriptive analysis that shows the sample's responses on the statements of decisions based factors towards the technology assessment as part of decision-making processes. by presenting the mean and standard deviation for each statement and general mean for all variables, which will be used later on to explain the effect of decision based factors on technology assessment process according to their views.

This study used a five point scale for rating the frequency of observed statements. This scale is divided into levels according to questionnaire weights (Sekaran and Bougie, 2013):

- 1 to 2.33 Weak Agreement.
- 2.34 to 3.66 Good Agreement.
- 3.67 to 5 Strong Agreement.

1. The effects of decision based factors on technology assessment process.

In this section, the study measures the effect of decision based factors on technology assessment process in the Jordanian mobile operator enterprises, by exploring the participants' level of agreement with the following statements that represent the four factors (timing, financial, nature of business, technicians) respectively. Table (1) shows the participants' agreement regarding each statement and overall factors.

Table1the Effect of Decision Based Factors on Technology Assessment Process

NO.	Statement	SD	Mean
1.	Fact that timing of technology assessment is only take place when a new technology is raised affect process accuracy.	0.981	4.11
2.	Sometimes chosen timing of technology assessment prevents all departments and other parts to participate in technology assessment process.	1.259	2.84
3.	Unplanned timing when technology assessment takes place in the company may limit its comprehension.	0.981	3.92
Timing general mean and SD		0.78	3.62
4.	Financial budget of our company may limit expansion in technology assessment process.	1.002	3.77
5.	Our known of Finical budget of our company may output and recommendation that follow technology assessment process.	1.144	2.74
Financial factor general mean and SD		0.67	3.25
6.	Our nature of business as telecommunication company forces the management to make periodic technology assessment process.	0.919	3.98
7.	Technology assessment process takes more time and effort according to the nature of business as telecommunication company.	1.271	3.45
8.	The nature of business as telecommunication company needs professional people to perform technology assessment process.	1.205	2.66
Nature of business general mean and SD		0.84	3.63
9.	The technicians only in technology assessment process can determine if everyone using the application, software and database of the new system is able to do anything they need.	1.187	2.70
10.	The technicians of the company only can specify if the staff members need more training than they getting in perfect use of the new system.	1.091	3.25
11.	The technicians of the company make the process of assessment more accurate through listing the expected benefits and obstacles of the new technology.	1.078	3.34
12.	The technicians of the company can specify the observable data that should indicate in the training course of the new system.	1.142	2.82
Technicians general mean and SD		0.74	3.28

First regarding the overall mean of all the factors, in the above table (1), it appears that the general mean of all statement related to decision based factors is (3.30), which reflects a good agreement. Moreover, the standard deviation value is (0.70), which is normal and reflects convergence on the response of the sample. The highest mean is (4.11) for statement number 1 "Fact that timing of technology assessment is only take place when a new technology is raised affect process accuracy", which reflects strong agreement, and the lowest mean was (2.66) for statement number 8 "The nature of business as telecommunication company need professional people to perform technology assessment process", which reflects good agreement. In general, the sample attitude toward the questions was positive. Thus, the participants were agreeing that there is effect of decision based factors on technology assessment process. Now regarding the agreement of the sample on each factor effect on technology assessment as part of decision making process, the general mean of each factor will be used to proof that.

- **Sub Question1: Can the nature of the business factor help in assessing technology in yourenterprise?**

Questions 6, 7, and 8 represent this factor, which is the first dimension also, in the above table (1), it appears that the general mean of all statement related to nature of the business is (3.36), which reflects a good agreement. Moreover, the standard deviation value is (0.84), which is normal and reflects convergence on the response of the sample. The highest mean is (3.98) for statement number 6 "Our nature of business as telecommunication company force the management to make periodic technology assessment process." which reflects strong agreement, and the lowest mean was (2.66) for statement number 8 "The nature of business as telecommunication company need professional people to perform technology assessment process", which reflects good agreement. In general, the sample attitude toward the questions was positive. Thus, the participants were agreeing that the nature of their business highly affect and can help in assessing technology in the sector, and participants have a positive attitude towards that.

- **Sub question 2: Can the financial factor help in assessing the technology used in your enterprise?**

Questions 4 and 5 represent this factor, in the above table (1), it appears that the general mean of all statement related to financial factor is (3.25), which reflects a good agreement. Moreover, the standard deviation value is (0.67), which is normal and reflects convergence on the response of the sample. The highest mean is (3.77) for statement number 4 "Financial budget of our company may limit expansion in technology assessment process", which

reflects strong agreement, and the lowest mean was (2.74) for statement number 5"Our known of Finical budget of our company may output and recommendation that follow technology assessment process", which reflects good agreement. In general, the sample attitude toward the questions was positive. Thus, the participants were agreeing that the financial factor can help in assessing technology in the sector, and participants have a positive attitude towards that.

- **Sub question 3: Can the IT technicians' opinions help decision makers in assessing the technology in your enterprise?**

Questions 9, 10, 11, and 12 represent this factor, in the above table (1), it appears that the general mean of all statement related to IT technicians' opinions factor is (3.28), which reflects a good agreement. Moreover, the standard deviation value is (0.74), which is normal and reflects convergence on the response of the sample. The highest mean is (3.34) for statement number 11 "The technicians of the company make the process of assessment more accurate through listing the expected benefits and obstacles of the new technology", which reflects strong agreement, and the lowest mean was (2.70) for statement number 9 "The technicians only in technology assessment process can determine if everyone using the application, software and database of the new system is able to do anything they need", which reflects good agreement. In general, the sample attitude toward the questions was positive. Thus, the participants were agreeing that the IT technicians' opinions factor play a role and can help in assessing technology in the sector, and participants have a positive attitude towards that.

- **Sub question 4: Does the timing of assessments help in assessing the technology used in your enterprise?**

Questions 1, 2, and 3 represent this factor, in the above table (1), it appears that the general mean of all statement related to IT technicians' opinions factor is (3.92), which reflects a good agreement. Moreover, the standard deviation value is (0.78), which is normal and reflects convergence on the response of the sample. The highest mean is (4.11) for statement number 1 "Fact that timing of technology assessment is only take place when a new technology is raised affect process accuracy", which reflects strong agreement, and the lowest mean was (2.84) for statement number 2 "Sometimes chosen timing of technology assessment prevent all departments and other parts to participate in technology assessment process", which reflects good agreement.

In general, the sample attitude toward the questions was positive. Thus, the participants were agreeing that the timing factor have role and can help in assessing technology in the sector, and participants have a positive attitude towards that.

2. The effect of decisions based factors of technology assessment on decision making process and its relative importance.

In this section, the research measures the effect of decisions based factors of technology assessment on decision making process, by exploring the participants' level of agreement with the following statements for each factors and its proposed effect on decision making process. Table (2) shows the participants' agreement regarding the effect of decision based factors of technology assessment on decision making process.

Table 2 Effect of Decisions Based Factors of Technology Assessment on Decision Making

NO.	Statement	SD	Mean	Relative importance
13.	Timing of technology assessment may affect the developed goals and expected results of the new system implementation decision.	1.188	3.42	0.684
14.	Timing of technology assessment impact on the available alternative to make decision.	1.306	2.71	0.542
15.	Timing of technology assessment may limit the process of collecting significant data and information about the current and the new system which impact on the accuracy of the decision making process.	0.977	3.48	0.696
Timing general mean, SD and RI		0.84	3.20	0.64
16.	Financial budget of our company impact on the technology support and maintenance decisions.	1.140	2.89	0.578
17.	Financial budget of our company limit the minimum configuration acceptable for new computer and hardware.	1.172	3.16	0.632
18.	Financial budget of our company influence the type of software and hardware of the technical systems to be bought.	1.216	3.14	0.628
19.	Financial budget impact on the adequacy decision of computers which needed to run all application and software of the new system.	0.855	4.18	0.836
Financial factor general mean, SD, and RI		0.64	3.35	0.67
20.	The nature of our business as telecommunication company determines the needed services from the internet service provider thus, affects decision.	1.085	3.16	0.632

21.	The nature of business as telecommunication company determines the type of database software needed to the company decision.	1.338	3.09	0.618
22.	The nature of business as telecommunication company specifies the expected use of data base (specific info on client, donors, merging letters, labels, and reports) decision.	1.047	3.26	0.652
23.	The nature of business as telecommunication company determines the adequacy of the existing system of technology support and determines the need for system administrator decision.	0.846	4.24	0.848
Nature of business general mean, SD, and RI		0.78	3.44	0.688
24.	Technician's recommendations after technology assessment impact on the decision on the alternative development process of the available systems and applications.	1.134	3.23	0.646
25.	Technician's thoughts support the process of testing and displaying the expected benefits and drawbacks of the alternatives (system, software, application, database ...) in decision making process.	1.046	2.54	0.508
26.	The technicians of the company reinforce the process of collecting significant data and information about the current and the new system to facilitate decision making process.	0.558	3.89	0.778
27.	The technicians of the company provide the necessary counseling and advice to decision-makers about the technical system to be bought.	0.929	3.61	0.722
Technician general mean, SD, and RI		0.86	3.32	0.664

In the above table (2), it appears that the general mean of all statement related to decision based factors is (3.30), which reflects a good agreement. Moreover, the standard deviation value is (0.70), which is normal and reflects convergence on the response of the sample. The highest mean is (4.11) for statement number 1 "Fact that timing of technology assessment is only take place when a new technology is raised affect process accuracy", which reflects strong agreement, and the lowest mean was (2.66) for statement number 8 "The nature of business as telecommunication company need professional people to perform technology assessment process", which reflects good agreement. In general, the sample attitude toward the questions was positive. Thus, the participants were agreeing that there is a direct effect of decision based factors of technology assessment on decision making process.

Through taking each factor separately, regarding the timing its appears from the general mean of its statements (3.20) that sample see timing as a factors that directly affect decision making process, where it affect the developed goal, available alternatives, add to that its possible effect on limiting the process of collecting significant data and information about the current and the new system, which impact on the accuracy of the decision making process. Regarding the second factor, the financial factor, through its general mean (3.35) that sample see that it have also good effect as of their company impact on the technology support and maintenance decisions, also minimum configuration acceptable for new computer and hardware, type of software and hardware, as well as adequacy decision of computers which needed to run all application and software of the new system.

Regarding the third factors which represented as the nature business (3.44) its show good effect also, where it affects decision making process form many point s starting from determining the needed services from the internet service provider, type of database software needed to the company decision, expected use of data base, and adequacy of existing system of technology support and determine the need for system administrator decision. Finally, regarding the technicians support (3.32) that sample show interest in this factors and agreed on its effect as factors of technology assessment on decision making process especially in decision on the alternative development process of the available systems and applications, the process of collecting significant data and information about the current and the new system to facilitate decision making process, and about the technical system to be bought.

- **Relative Importance:**

Sub question 5: What is the relative importance of each factor to the decision-making process in your enterprise?

The table 3 explores the relative importance for each factor of technology assessment to the decision making process. As shown in table 3, nature of business factor has the highest relative importance between the four factors, but in general the relative importance of all factors are fairly close, the relative importance for nature of the business, financial, IT technicians' opinion and timing respectively is: 0.688, .067, 0.664 and 0.64.

Table 3 Relative Importance of the Effect of Decision Based Factors on Technology Assessment Dimension

Dimension	Average Mean	Scale	Relative Importance
Timing	3.20	5	0.64
Financial	3.35	5	0.67
Nature of the business	3.44	5	0.688
IT technicians'	3.32	5	0.664

- **Correlation Test:**

Sub question 6: What is the level of correlation between those decisions based factors from the relational perspective?

Pearson correlation test was used to show the correlation between the four main factors, Correlation matrix describes correlation among Independents variables. This test was run on order to determine the relation between those factors and avoid multicollinearity, which mean that the variables are not orthogonal, all the variables Pearson correlation are under 1, which indicate normal value. And give them rigor to be distinctive and strength the model of this research.

Table 4 Correlation Matrix

Control Variables		Timing	Financial	Nature of Business	IT Technicians' Opinion
Timing	Corr.		0.296	0.430	- 0.611
	Sig.		0.000*	0.000*	0.023*
Financial	Corr.			0.424	0.257
	Sig.			0.000*	0.000*
Nature of Business	Corr.				0.239
	Sig.				0.001*

Below are the test results for this question:

1. There is a positive correlation between the timing and financial at significant level 0.05 since the p-value is less than 0.05.
2. There is a positive correlation between the timing and nature of business at significant level 0.05 since the p-value is less than 0.05.
3. There is a negative correlation between the timing and IT technicians' opinion at significant level 0.05 since the p-value is less than 0.05.
4. There is a positive correlation between the financial and nature of business at significant level 0.05 since the p-value is less than 0.05.
5. There is a positive correlation between the financial and IT technicians' opinion at significant level 0.05 since the p-value is less than 0.05.
6. There is a positive correlation between the nature of business and IT technicians' opinion at significant level 0.05 since the p-value is less than 0.05.

B. Interviews' Results

Interviews were distributed to a representative random sample consisting of 40% of the total population (30executives/decision makers) of the whole decision makers at the three mobile operators, which means that 12 mangers were targeted and 100% responded on the interview, which consists of two parts, the first one is general information about the enterprise, whereas the second one is the technical questions.

A. General information

The responds unanimously agreed that their enterprise has a process of technology assessment, this process take its place according to the need, all of board of directors, departments' manager's and technicians are responsible for performing technology assessment process as mangers' opinions. The targeted departments are involved in the process of technology assessment.

B. Interview Questions

Regarding interviews that conducted with executives, the researcher summarized their answers as follow:

- **To what extent does the nature of business affect the process of technology assessment at yourenterprise? And how?**

Most of the respondents assured that the nature of business affect the process of technology assessment at their enterprise for big extent; by availability of 24/7 high quality heavy duties meet criteria of being scalability, in addition to selecting type of HW and SW platform to work on. Quote1: "*big extend- 24/7, high quality heavy duties meet criteria of being scalability".*

- **To what extent do you take into account the financial fact (the cost of using new technology) when assessing technology the current at your enterprise? And how?**

The mangers' answers on this question revolves around the financial fact, which depends on the outcome of the new technology revenue as high revenue causing low consideration of the cost, and as of budget limitations, also the financial factor determines the cost of the technical systems to be bought. Quote 4: "to extreme extend many importance projects are delayed because of budget limited".

- **How far does the timing of assessment affect the process of technology assessment in your enterprise? And how?**

The timing affect in both way positively and negatively, as it is happened at the time then time will be assistance factor, otherwise it is will be an obstacle. Quote 1: "when there is an instant need, and the process takes so long, it normally makes the business harder".

- **To what extent does the technician's opinion affect the process of technology assessment in your enterprise? And how?**

The technician's opinion effectiveness on the process of technology assessment, since mangers' opinion, have special impact on decision alternative development process of available systems and

applications, in addition to giving advices and evaluation feedbacks. Quote 9: "giving advice & doing evaluation, final decision is always with management".

- **From your point of view, arrange the most important factors contributing to the technology assessment in your enterprise (nature of business, timing of assessment, technician's opinions, and financial factor)?**
  The mangers' responses for this questionwere different but the most common order was according to the following: Nature of business, financial factor, timing of assessment and technician's opinions, such as interview 2 for example "Nature of business, financial factor, timing of assessment and technician's opinions".
- **Describe the status of planning for technology in your enterprise. What are the major challenges?**
  Differentexecutives consider the status of planning for technology is very good, as they mentioned technology vendors, customer satisfaction, budget and timing as main challenges those mobile operators' experiences. For example, the fact of timing that technology assessment is only take place when a new technology is raised affect process accuracy, Quote 3: "budget and timing are the major challenges".
- **To what extent does the technology assessment affect the process of decision making?**
  The executives unanimously agreed that technology assessment's influence on the process of decision making is much extended. Quote 1: "it has a big impact".
- **To what extend does the nature of your business affect decision making regarding recommendation and outputs of technology assessment process?**
  Once again, executives unanimously agreed that the affected classification as impact on decision on the alternative development process of the available system, the nature of business as Telecommunication Company determines the adequacy of the existing system of technology support and determines the need for system administrator decision. Quote 1:" nature of your business has a very big extend, as the nature of business as Telecommunication Company determines the adequacy of the existing system of technology support and determines the need for system administrator decision".
- **To what extend does the financial affect decision making regarding recommendation and outputs of technology assessment process?**
  The mangers agreed that financial factor has a big positive extend, Financial budget also impact on the adequacy decision of computers which needed to run all applications and software of the new system. Quote 3: "will effect positively – big extend, also impact on the adequacy decision of computers".
- **How far does timing assessment affect decision making regarding recommendation and outputs of technology assessment.**

The responders show high aggregation that timing affect the overall goals and extend the result of the new system implementation with big extent. Moreover, timing of technology assessment may affect the developed goals and expected results of the new system implementation decision. Quote 5: "it's highly impact on the overall goals and extend the result of the new system implementation, also it is may affect the developed goals and expected results of the new system implementation decision".

- **To what extend does the technicians' opinion affect decision making regarding recommendation and outputs of technology assessment process?**

As a previous questions, mangers saw that technicians' opinion play major role on the decision making and its major affect can summarized by high quality, availability, and accuracy of the decisions, moreover, technicians of the company provide the necessary counseling and advice to decision-makers about the technical system to be purchased. Quote 15: "to big extent, high quality, availability, and accuracy of the decisions, as technicians of the company provide the necessary counseling and advice to decision-makers about the technical system to be bought".

- **Do you have other comments to add regarding technology assessment process in your enterprise?**

The only comment came from 3 decision makers was related to the time usually the process of technology assessment take a place, as they suggested doing it just when needed. Quote 5: " doing the technology assessment process when need only".

CONCLUSION

Technology has been improved so as to better serve organizations and people in a number of areas. Technology represents a backbone for many organizations, especially those that depend on technical environments such as telecommunication organizations.

Telecom industry and other organizations have to enhance the role of other factors, although the results of this research were very good as a starting step for mobile operators to think and work more on the time factor, which gave less attention comparing with other factors to avoid the current real-obstacles and conflicts between the IT managers and the executive management (decision makers).

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