Measuring the Impact of Business Intelligence on Performance: An Empirical Study

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Abstract:
In this study explain rapidly changing business environment, the need for very timely and effective business information is recognized as being indispensable for organizations not only to succeed, but even to survive. Business intelligence (BI) is a concept which refers to a managerial philosophy and a tool that is used in order to help organizations and refine information and to make more effective business decisions
The sample of study is 50 industrial firms for the period 2007-2011 listed on Amman Stock Exchange .The results indicates the Knowledge economy variable measured by intellectual capital are more significant and effect of performance and this study has shown that the provision of appropriate support with regard to BI is needed as BI plays a crucial role to support decision-making in firms of all sizes more than learning and growth or financial factor but there is no significant level for customer variable
Key Words: Business intelligence, Performance, Competitive Intelligence, Intellectual capital

1. Introduction:
The participation of firms in the knowledge economy is important not only for their own competitive advantage in the marketplace but also for the competitiveness of their country as a whole.
Business intelligence systems combine operational data with analytical tools to present complex and competitive information to planners and decision makers. The objective is to improve the timeliness and quality of inputs to the decision process. Business Intelligence is used to understand the capabilities available in the firm; the state of the art, trends, and future directions in the markets, the technologies, and the regulatory environment in which the firm competes; and the actions of competitors and the implications of these actions
The BI terminology in recent years has been con-fusing. There are different interpretations of BI and many terms applied to it (e.g. competitive intelligence, market intelligence, customer intelligence, competitor intelligence and strategic intelligence). The use of these terms is haphazard both in academia and the business world. After all, almost all the definitions share the same referent even if the term has been defined from several perspectives (Casado 2004) and they all include the idea of analysis of data and information. The main idea in BI is to aid in controlling the vast stocks and flow of business information around then processing the information into condensed and useful managerial knowledge and intelligence. The task described includes nothing too new and it responds to old managerial problems. For example, Gilad and Gilad (1986) have stated that organizations have 'collected information about their competitors since the dawn of capital-ism. The real revolution is in the efforts to institutionalize intelligence activities.' Thus, it is likely that all organizations have some kind of BI activities or similar activities. There are some questions to know BI as following:
Business Intelligence is used to understand the capabilities available in the firm: the state of the art, trends, and future directions in the markets, the technologies, and the regulatory environment in which the firm competes; and the actions of competitors and the implications of these actions. Business Intelligence systems present complex corporate and competitive information to planners and decision makers. The objective is to improve the timeliness and quality of the input to the decision process. Business intelligence is a form of knowledge. The techniques used in knowledge management for generating and transferring knowledge, Davenport and Prusak (1998) apply. Some knowledge is bought (e.g., scanner data in the food industry) while other knowledge is created by analysis of internal and public data. Knowledge transfer often involves disseminating intelligence information to many people in the firm. For example, salespeople need to know market conditions, competitor offerings, and special offerings.
The advent of the "knowledge economy" has engendered a great deal of interest in how intangible knowledge assets or intellectual capital (IC) are managed in organizations. The implicit or explicit assumption in both practical and scholarly work is that better management of IC will lead to unique, sustainable competitive advantage. Consequently, a great deal of time and effort have been expended on measuring IC, on developing systems and tools to manage it, and, to a more limited extent, estimating the impact of IC on performance. IC management is, of course, a variation on the concept of knowledge management. We choose to use the former term in this article given our emphasis on financial data and measurement of knowledge assets.
Most of the technologies needed for business intelligence serve multiple purposes. For example, the World Wide Web is used for both knowledge generation and knowledge transfer. However, specialized software for doing analysis is the heart of business intelligence. This software is an outgrowth of the software used for decision support and executive information systems in the past.

2. Statement of Problem:

The economic landscape in Jordan has changed dramatically in recent years: from a buoyant economic climate with an abundant availability of credit with relatively reliable and stable power supply, firms now find themselves challenged in ways they had never expected. Growth firms face obstacles such as tighter budgets, reduced access to credit, and a technology landscape more complex than ever. Organizations must be flexible and quick to respond to constantly changing business conditions. To do so, timely intelligence about the organization, its processes, and its business partners must be available to inform decisions and actions to achieve or maintain a competitive advantage in the marketplace.
Systems that support decision-making in organizations are therefore an important component in organizational information dissemination and have the potential to impact positively on performance and competitiveness. Making informed decisions is important for any organization, but is especially crucial for firms as valuable time and money cannot be wasted on incorrect decisions when economic belts are already tightened.
Business intelligence (BI) is the most recent development of systems that support organizational decision-making. For example, an owner-manager may want to know not only the revenue generated per client but also how profitable each client is to decide which clients to target for future sales and marketing efforts
The purpose of this study was therefore to engage with firms in Jordan to explore the use of BI in their enterprises in order to provide insight into the situation with regard to BI in firms of Jordan. The research objectives were to understand how information is used in firms; if BI is used, to describe BI in the context of firms or if it is not used, to determine why not; and to indicate the implications of the research results and to suggest future research
This paper aims to offer an insight into the measurement of BI and by doing so, to remedy the lack of case studies on the research field. The objectives of the paper are:
-To discuss the concept of BI and what does BI do and discuss competitive intelligence analysis
- Discuss how BI can be measured and to estimate of BI and impact of performance.

3. Significant of Study:

Business intelligence is a natural outgrowth of a series of previous systems designed to support decision making. The emergence of the data warehouse as a repository, the advances in data cleansing that lead to a single truth, the greater capabilities of hardware and software, and the boom of Internet technologies that provided the prevalent user interface all combine to create a richer business intelligence environment than was available previously
Business intelligence is used by decision makers throughout the firm. At senior managerial levels, it is the input to strategic and tactical decisions. At lower managerial levels, it helps individuals to do their day-to-day job. In some firms, business intelligence capabilities are rolled out to most of its professionals (i.e., 'BI for the masses')

4. Theoretical framework:

4.1 Business Intelligence:

Pirttimäki (2007) remarks that definitions of BI vary depending on the perspective from which it is defined .In most organizations BI capabilities, once adopted, evolve from simple standard reports and queries showing what happened to more advanced analytics such as multi-dimensional analysis that examine why it happened to data mining that predicts what might happen in future (Ponelis, 2009; Dyché, 2007). The systems/technology used to support decision-making can either be informal or formal. Spreadsheets represent the simplest form of decision support and are often found in both SMEs (Levy and Powell, 2005) and large organizations (Chan and Storey, 1996) alike across the analytical spectrum (Kelly, 2008; McGill and Klobas, 2005).
While the term Business Intelligence is relatively new, computer-based business intelligence systems appeared, in one guise or other, close to forty years ago. BI as a term replaced decision support, executive information systems, and management information systems, Thomsen, (2003). With each new iteration, capabilities increased as enterprises grew ever-more sophisticated in their computational and analytical needs and as computer hardware and software matured.
BI systems are defined as follows:
BI systems combine data gathering, data storage, and knowledge management with analytical tools to present complex internal and competitive information to planners and decision makers.
Implicit in this definition is the idea (perhaps the ideal) that business intelligence systems provide actionable information delivered at the right time, at the right location, and in the right form to assist decision makers. The objective is to improve the timeliness and quality of inputs to the decision process, hence facilitating managerial work.

Sometimes business intelligence refers to on-line decision making, that is, instant response. Most of the time, it refers to shrinking the time frame so that the intelligence is still useful to the decision maker when the decision time comes. In all cases, use of business intelligence is viewed as being proactive. Essential components of proactive BI are, Langseth and Vivatrat, (2003):
• Real-time data warehousing,
• Data mining,
• Automated anomaly and exception detection,
• Proactive alerting with automatic recipient determination,
• Seamless follow-through workflow,
• Automatic learning and refinement,
• Geographic information systems
• Data visualization

4.2 What Does BI Do?
BI assists in strategic and operational decision making. A Gartner survey ranked the strategic use of BI in the following order, Willen, (2002):
1. Corporate performance management
2. Optimizing customer relations, monitoring business activity, and traditional decision support
3. Packaged standalone BI applications for specific operations or strategies
4. Management reporting of business intelligence
One implication of this ranking is that merely reporting the performance of a firm and its competitors, which is the strength of many existing software packages, is not enough. A second implication is that too many firms still view business intelligence (like DSS and EIS before it) as an inward looking function.
Business intelligence is a natural outgrowth of a series of previous systems designed to support decision making. The emergence of the data warehouse as a repository, the advances in data cleansing that lead to a single truth, the greater capabilities of hardware and software, and the boom of Internet technologies that provided the prevalent user interface all combine to create a richer business intelligence environment than was available previously. BI pulls information from many other systems.

4.3 Competitive Intelligence Analysis:
Next to knowing all about your own business, the best thing to know about is the other fellow's business." John D. Rockefeller [Amazon, 2003] Competitive intelligence (CI) is a specialized branch of Business Intelligence. It is "no more sinister than keeping your eye on the other guy albeit secretly" [Imhoff, 2003].
Competitive Intelligence is a systematic and ethical program for gathering, analyzing and managing external information that can affect your company's plans, decisions and operations.
In other words, CI is the process of ensuring your competitiveness in the marketplace through a greater understanding of your competitors and the overall competitive environment. "You can use whatever you find in the public domain to ensure that you will not be surprised by your competitors." [Imhoff, 2003].
CI is not as difficult as it sounds. Much of what is obtained comes from sources available to everyone, including [Imhoff, 2003]:
• Government websites and reports
• Online databases, interviews or surveys,
• Special interest groups (such as academics, trade associations, and consumer groups),
• Private sector sources (such as competitors, suppliers, distributors, customer) or
• Media (journals, wire services, newspapers, and financial reports).
The challenge with CI is not the lack of information, but the ability to differentiate useful CI from chatter or even disinformation.
Of course, once a firm starts practicing competitive intelligence, the next stage is to introduce countermeasures to protect itself from the CI of competitor firms. The game of measure, countermeasure, and counter-countermeasure, and so on to counter to the nth measure is played in industry just as it is in politics and in international competition.

5. Literature Review:
The core of business intelligence is the collective sense-making. In literature, sense-making has been defined in different ways. It is an interpretative process where people assign meaning to ongoing events (Gioia and Chittipeddi, 1991). It is the amplification of weak signals and the search for contexts within

small details fitted together for sense-making (Weick, 1995). It is considered as a creative and collective method that can help the organization to give sense and see possibilities in the surrounding disorder (Choo, 2001; Ashmos and Nathan, 2002). (Davison 2001.) A positive aspect of subjective measurements is that the results show how effective the users consider the intelligence products. However, subjective measurements do not establish any monetary value for the effects of BI.
Lesca (2003) proposed a model referred to as VAS-IC (a French formulation of Anticipative Strategic Environmental Scanning-Collective Intelligence) with a core process of collective sense-making. The main steps of VAS-IC are described in figure 1 below
Marin and Poulter (2004), the organizations inter-viewed compare the cost of consultants to the results obtained by the CI division and quantify the strategic deals that the CI team has been involved in and then compare the win / loss ratios to those deals where they were not involved
Levy and Powell (2005) the ―size-adjusted expenditure on items likely to yield primarily long-term returns, is lower amongst small than large firms. SMEs are slow to exploit opportunities offered by new technology to support their growth. The ICT adoption behaviour of SMEs is influenced by a range of factors that can be ascribed to their unique characteristics (Fink, 1998), chief amongst these being their limited resources, financial and otherwise
This is reiterated by Newberry (2006) stating that the majority of the world‘s emerging economies indicate that micro, small and medium enterprises will be the predominant enterprise for the foreseeable future as these enterprises play a key role in economic growth and development.
According to Sen and Taylor (2007) it is ―essential for small businesses in today‘s competitive environment to take a strategic approach to their information needs if they wish to develop and remain competitive
In a preliminary study, the basic idea is the following
Main Hypothesis 1: There is no impact of intelligence business on performance of industrial firms
Hypothesis 1-1: There is no impact of **Learning and growth Variable** on performance of industrial firms
Hypothesis 1-2: There is no impact of **Financial Variable** on performance of industrial firms
Hypothesis 1-3: There is no impact of **Customer Variable** on performance of industrial firms
Hypothesis 1-4: There is no impact of **Knowledge economy variable** on performance of industrial firms

6. Methodology:

The sample of study is 50 industrial firms for the period 2007-2011 listed on Amman Stock Exchange

The Model of Study:

The business intelligence for independent variable and this variable consist many factors for how to measured .Davison (2001) has developed a measurement model called CI Measurement Model (CIMM), which can be used to calculate the return on CI investment (ROCII).
Indeed, the resource-based theory of the firm reinforced the idea that competitive advantage flows from unique resources of the organization (Nelson & Winter 1982), eventually leading to sustainable core competencies (Prahalad & Hamel 1990). As capital and basic labor became readily available to most organizations of any size, scholars began looking for other factors that might explain why one firm is successful and another is not.
Parts of the discussion focused on intangibles, and we're all familiar with concepts such as goodwill and brand equity, so the idea that intangible assets have value is also nothing new. Indeed, the Tobin's Q measure of intangibles (market value to replacement cost of assets) goes back decades. Newer measures developed during the 1990's include the Balanced Scorecard (Kaplan & Norton 1992).

Independent Variables:

Learning and growth Variable measured by: Administrative expenses per customer (AE/C)
Financial Variable measured by: return on investment (ROI)
Customer Variable measured by: Number of customer complaints (NCC)
Knowledge economy variable has engendered a great deal of interest in how intangible knowledge assets or intellectual capital (IC) are managed in organizations measured by: market value less book value (MV-LV).
Dependent variable measured by: return on equity (ROE) as performance indicator.
The equation for Business performance was expressed in the following equation
$$Performance\ (ROE) = a + \beta 1 AE/C + \beta 2 ROI + \beta 3\ NCC + \beta 4 MV\text{-}BV + e_{it} \text{------Model (1)}$$

Correlation Analysis:

A correlation coefficient measured the strength of a linear between the four variables of A correlation Coefficient measured the strength of a linear between two variables. The correlation results were shown in the Table (1).

Table (1): Pearson Correlation between variables Business Intelligence and performance

Ind. Variables	AE/C	ROI	NCC	MV-BV
Person Correlation	0.290*	0.327**	0.213	0.499***
Sig – 2 Tailed	0.065	0.042	0.112	0.001

Note: Asterisks (*) , (**) and (***) indicates significance at 1%,5% and 10% respectively.

This preliminary study suggests that a strong relationship may exist between successful development of intellectual capital and organizational performance and were significant at the 0.01 level **.**The correlations between AE/C, and Business performance were positive and were significant at the 0.10 level, whereas correlation between ROI and Business performance were positive and were significant at the 0.05 level (2-tailed). Finally, no significant level between the NCC and Business performance .Therefore, the study indicates that the correlations between intellectual capital and Business performance were higher than others variables.

Regression Analysis:

In order to further reveal support for hypothesis 1, the factors that influenced Business performance, the four variables of business intelligence process was used in a multiple regression analysis. The regression procedure was employed because it provided the most accurate interpretation of the independent variables. The four independent variables were expressed in terms of the business intelligence factor .The significant factors that remained in the regression equation were shown in order of importance based on the beta coefficients.

Table (2): Regression Analysis Result

Ind.Variable / Dep. Var	Const	AE/C	ROI	NCC	MV-BV
ROE	3.886	2.994	3.121	2.417	5.194
	0.031**	0.061*	0.041**	0.1119	0.0012***
St.co.beta	----	0.310	0.390	0.190	0.480
VIF	1.081	1.441	1.418	1.484	1.145
Model -1-	**Model (1)**				
R	0.4462				
R^2	0.214				
D-Watson	5.954				
F-Statistic	14.158				
Prob(F)	0 .025				

Note: Asterisks (*) , (**) and (***) indicates significance at 1%,5% and 10% respectively.

In this study I used measures its BI performance in various ways. Measurement is used as a tool to develop and improve BI activities as well as to demonstrate its usefulness. Performance measures are chosen based on literature review The methodology section illustrates the chosen focus areas pertaining to BI measurement and they have a direct affect on the four chosen measurement focus areas; financial, , learning and growth , customer and Knowledge economy variable**s**

BI performance is measured by determining the individuals and system activities involved. These activities can be measured by using quantitative, qualitative and time-related indicators. Quantitative measurement involves both input and output indicators. Qualitative indicators include, e.g., the satisfaction of information users and systematic information gathering is a prerequisite for efficient measuring

There are two main challenges in measuring the effects of BI. First, the BI process produces information and knowledge, which have to be utilized before the effects are seen. The effects, if they occur, are intangible by nature, e.g. improved decision-making ability. It is difficult to quantify these

intangible phenomena. These intangible effects may eventually have financial consequences. However, distinguishing between the specific benefits received due to BI and the achievements of ordinary decision-making is challenging .Thus, the second key challenge in measuring the effects of BI is to distinguish what part of a phenomenon, say increased market share, results from increased knowledge produced by BI and what is caused by some other factors

Table (2) showed the results of the regression analysis. To predict the of the regression model, the multiple correlation coefficient (*R*), coefficient of determination (*R*2), and *F* ratio were examined. First, the *R* of independent variables (four variables) on the dependent variable (performance of firms, or *ROE*) is 0.446, which showed that the performance had positive and high overall association with the four attributes.

Second, the *R2* is 0.214, suggesting that more than 20% of the variation of performance was explained by the four attributes.

Last, the *F* ratio, which explained whether the results of the regression model could have occurred by chance, had a value of 14.158 (p =0.025) and was considered significant.

In other words, at least one of the four attributes was important in contributing to performance. In the regression analysis, the beta coefficients could be used to explain the relative importance of the four attributes (independent variables) in contributing to the variance in s performance (dependent variable).

As far as the relative importance of the four business intelligence attributes is concerned, MV/BV has, *B*1=0.480, p=0.0012) carried the heaviest weight for performance, This measure will tend to favor larger firms, who may have more intangible assets because of sheer size, not because they are clearly better at managing such assets. Followed by ROI, *B3*=0.390, p=0.041 and AE/C, *B2*=-0.310, p=0.061. Measuring the learning and growth sector is the most challenging part in the balanced measurement process. Because of its intangibility, it is challenging to measure e.g. organizational learning or if BI has resulted in better decision-making but there is no significant to NCC variable. In conclusion, three from four dimensions are significant. Thus, the results of multiple regression analysis agree hypothesis 1, that there is relationship between the selected Business intelligence and Business performance.

7. Conclusion:

This study has explored the role of BI in industrial firms on Jordan knowledge-based from the perspectives of the key decision-maker**.** This paper has focused on outlining the importance of tacit economic knowledge for the business intelligence process measured by intellectual capital in industrial firms as one perspective affect of performance and learning and growth process , customer and finally financial perspective .These all variable exploring the business intelligence factor.

The main purpose of BI at firms is to enhance decision-making and service efficiency. The main targets include efficiency, reasonable coverage of BI and user satisfaction. BI comprises both internal and external business information, market information and analysis. In fact, the whole concept of BI deals with providing insightful information related to various business activities. Thus, it would be surprising if the managers responsible for BI were not interested in obtaining intelligence concerning its own operations

The results indicates the Knowledge economy variable measured by intellectual capital are more significant and effect of performance and this study has shown that the provision of appropriate support with regard to BI is needed as BI plays a crucial role to support decision-making in firms of all sizes more than learning and growth or financial factor but there is no significant level for customer variable

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