Design for Scientific RENAISSANCE

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Financial Information Systems: Business Intelligence Perspectives (Iranian Companies listed on Stock Exchange Case Study)

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Article Info

Received: 14th December 2011
Accepted: 3rd February 2012
Published online: 1st June 2012

ISSN: 2231-8275

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ABSTRACT

After the implementation of Financial Information Systems (FIS) in organizations, still financial managers feel a lack of Intelligence in their management duties and processes. Criteria and methods to evaluate and assess the Intelligence Perspectives and decision support capabilities of Financial Information Systems are useful in deploying suitable business intelligence (BI) in organizations. This research discusses about decision support and Intelligence perspectives factors used in the Iranian Companies listed on stock exchange. Proposed Intelligence perspectives factors can assess the intelligence of Financial Information Systems to achieve enhanced decision support in organizations. The research combines a complete review of the recent literature about intelligence of FIS, survey methodology and statistical methods such as factor analysis. The statistical analysis identified four Business Intelligence Perspectives: "Systematic Decision-support", "Providing Environmental Information", "Optimization and Recommended options", and finally "Rationality". This Business Intelligence Perspectives helps Iranian Companies listed on stock exchange to design and implement Financial Information Systems for better decision support.

***Keywords*: Financial Information Systems; Business Intelligence; Perspectives**

1. Introduction

In today's organization, Data and information are the major wealth. Stakeholders of organization attempt to apply this wealth to gain competitive advantage while business decision making process. Business information systems like Financial Information Systems (FIS) converts and store the important financial data. Therefore, it is important to integrate decision-support into the environment of these systems. Business intelligence (BI) can be set in these information systems to obtain the competitive advantage.

The approaches using an individual system for decision-support, such as decision-support systems (DSS), have been out of date. The increasing trend to use intelligent tools in business systems has increased the need for study business intelligence perspectives of financial information systems. There have been some limited efforts to study BI in business information systems like: Lönnqvist and Pirttimäki (2006) and Elbashir et al. (2008), but they

have also treated BI as a separate system, and no concentration on financial information systems.

Organizations usually utilize functional and non-functional requirements to judge about their systems like FIS, therefore with respect to their decision-support environment as a non-functional requirement, the following question is raised:

1. Which Business Intelligence Perspectives are important about Financial Information Systems (FIS)?

This research was carried out to find answers to the above question and to provide a decision-support viewpoint. The rest of this paper is organized as follows. Section 2, describes brief literature about FIS. Section 3 is about The Securities and Exchange Organization of Iran which is research target. Business intelligence literature (BI) and wide-ranging review about BI and decision-support criteria is summarized in Section 4. Research methodology and research stages (data collection, reliability analysis, factor extraction, and labelling) are discussed in section 5. Finally, Section 6 concludes the research work, its findings and proposed future research.

2. Financial Information Systems

A financial information system (FIS) is a business software system used to input and track financial and Financial data. The system generates reports and alerts that assist managers in effectively running the business.

This term is used for a system that accumulates and analyses financial data in order to make good financial management decisions in running the business. The basic objective of the financial information system is to meet the firm's financial obligations as they come due, using the minimal amount of financial resources consistent with an established margin of safety. Outputs generated by the system include accounting reports, operating and capital budgets, working capital reports, cash flow forecast, and various what - if analysis reports. The evaluation of financial data may be performed through ratio analysis, trend evaluation, and financial planning modelling (Anders Rom & Carsten Rohde, 2007).

Extant Financial information systems research has evolved from the source disciplines of Computer science, organizational theory and cognitive psychology. An advantage of this evolution is a diverse and rich literature with the potential for exploring many different interrelationships among technical, organizational and individual aspects of judgment and decision performance. FIS research also spans from the macro to the micro aspects of the information system (Birnberg & Shields, 1989; Gelinas et al., 2005). Management Financial systems (MFS) also are formal systems that provide information from the internal and external environment to managers (Bouwens & Abernethy, 2000). They include reports, performance measurement systems, computerized information systems, such as executive information systems or management information systems, and also planning, budgeting, and forecasting processes required to prepare and review management financial information.

Research on management Financial and integrated information systems (IIS) has evolved across a number of different research streams. Some research streams put heavier emphasis on the management financial side, while other research streams put emphasis on the

information systems side. Likewise, different research streams approach the topic from different perspectives (Anders Rom & Carsten Rohde, 2007).

3. The Securities and Exchange Organization of Iran

The Securities and Exchange Organization of Iran (SEO) was established in 2006 after Tehran Stock Exchange demutualization and as of Article 5 of the Securities Act ratified by the Islamic Consultative Assembly on November 22nd, 2005. The Organization shall be a public non-governmental institute with legal and financial independence and shall be funded through a service charge and admission fee collected from companies listed in the Exchanges and other revenues. The required funding for commencement of activity of the Organization shall be provided out of trust fund of the Stock Exchange Council deposited with the Tehran Stock Exchange Brokers' Organization.

It is the sole regulatory entity for the regulation and development of the capital market in Iran. It is directly responsible for the regulation and supervision of all activities of the market institutions, including but not limited to stock exchanges, clearing and settlement procedures, financial instruments and financial institutions. Iranian Companies listed on stock exchange which is under the control of SEO are targets of this research.

4. Business Intelligence

Business Intelligence is a majestic term introduced by Howard Dresner of the Gartner Group in 1989 to define a set of ideas and concepts to improve business decision-making by using fact-based computerized support systems (Nylund, 1999). Business Intelligence (BI) was considered to be an instrument of analysis, providing automated decision-making about business conditions, sales, customer demand, and product preference and so on. It uses huge-database (data-warehouse) analysis, as well as mathematical, statistical, artificial intelligence, data mining and on-line analysis processing (OLAP) (Berson and Smith, 1997). Eckerson (2005) understood that BI must be able to provide the following tools: production reporting tools, end-user query and reporting tools, OLAP, dashboard/screen tools, data mining tools and planning and modelling tools.

BI includes a set of concepts, methods, and processes to improve business decisions, which use information from multiple sources and apply past experience to develop an exact understanding of business dynamics (Maria, 2005). It integrates the analysis of data with decision-analysis tools to provide the right information to the right persons throughout the organization with the purpose of improving strategic and tactical decisions. A BI system is a data-driven DSS that primarily supports the querying of an historical database and the production of periodic summary reports (Power, 2008).

Lönnqvist and Pirttimäki (2006), stated that the term, BI, can be used when referring to the following concepts:

1. Related information and knowledge of the organization, which describe the business environment, the organization itself, the conditions of the market, customers and competitors, and economic issues;

2. Systemic and systematic processes by which organizations obtain, analyse, and distribute the information for making decisions about business operations.

A literature review around the theme of BI shows ‘‘division” between technical and managerial view points, tracing two broad patterns. The managerial approach sees BI as a process in which data, gathered from inside and outside the enterprise and are integrated in order to generate information relevant to the decision-making process. The role of BI here is to create an informational environment in which operational data gathered from transactional processing systems (TPS) and external sources can be analysed, in order to extract ‘‘strategic” business knowledge to support the unstructured decisions of management.

The technical approach considers BI as a set of tools that support the process described above. The focus is not on the process itself, but on the technologies, algorithms and tools that allow the saving, recovery, manipulation and analysis of data and information (Petrini and Pozzebon, 2008).

However, in the overall view, there are two important issues. First, the core of BI is the gathering, analysis and distribution of information. Second, the objective of BI is to support the strategic decision-making process.

By strategic decisions, we mean decisions related to implementation and Assessment of organizational vision, mission, goals, and objectives, which are supposed to have medium- to long-term impact on the organization, as opposed to operational decisions, which are day-to-day in nature and more related to execution (Petrini and Pozzebon, 2008). Based on our related work (Rouhani, et al, 2011), literature review was done on business intelligence specifications or criteria that a system should have to cover BI definitions. These criteria listed in Table 1.

Table 1: Criteria for Business Intelligence Perspectives (Rouhani et al., 2011)

Criteria ID	Criteria Name	Related Studies
C1	Group sorting tools & methodology (Groupware)	Shim et al. (2002), Reich and Kapeliuk (2005), Damart et al. (2007), Marinoni et al. (2009)
C2	Group decision-making	Eom (1999), Evers (2008), Yu et al. (2009)
C3	Flexible models	Reich and Kapeliuk (2005), Zack (2007), Lin et al. (2009)
C4	Problem clustering	Reich and Kapeliuk (2005), Loebbecke and Huyskens (2007), Lamptey et al. (2008)
C5	Optimization technique	Lee and Park (2005), Nie et al. (2008), Shang et al. (2008), Azadivar et al. (2009), Delorme et al. (2009)
C6	Learning technique	Power and Sharda (2007), Ranjan (2008), Li et al. (2009), Zhan et al. (2009)
C7	Import data from other systems	Ozbayrak and Bell (2003), Alter (2004), Shang et al. (2008), Quinn (2009)
C8	Export reports to other systems	Ozbayrak and Bell (2003), Shi et al. (2007), Shang et al. (2008)
C9	Simulation models	Power and Sharda (2007), Shang et al. (2008), Quinn (2009), Zhan et al. (2009)
C10	Risk simulation	Evers (2008), Galasso and Thierry (2008)
C11	Financial analyses tools	Santhanam and Guimaraes (1995), Raggad

Criteria ID	Criteria Name	Related Studies
		(1997), Gao and Xu (2009)
C12	Visual graphs	Noori and Salimi (2005), Kwon et al. (2007), Power and Sharda (2007), Li et al. (2008), Azadivar et al. (2009)
C13	Summarization	Bolloju et al. (2002), Hemsley-Brown (2005), Power and Sharda (2007), Power (2008)
C14	Evolutionary prototyping model	Fazlolahi and Vahidov (2001), Bolloju et al. (2002), Gao and Xu (2009), Zhang et al. (2009)
C15	Dynamic model prototyping	Koutsoukis et al. (2000), Bolloju et al. (2002), Goul and Corral (2007), González et al. (2008), Pitty et al. (2008)
C16	Backward & forward reasoning	Gottschalk (2006), Evers (2008), Zhang et al. (2009)
C17	Knowledge reasoning	O¨ zbayrak and Bell (2003), Plessis and Toit (2006), Evers (2008)
C18	Alarms & warnings	Power (2008), Ross et al. (2008), Zhang et al. (2009)
C19	Dashboard/Recommender	Nemati et al. (2002), Hedgebeth (2007), Bose (2009)
C20	Combination of experiments	Courtney (2001), Nemati et al. (2002), Gottschalk (2006), Gonnet et al. (2007), Ross et al. (2008), Hewett et al. (2009)
C21	Situation awareness modelling	Raggad (1997), Plessis and Toit (2006), Feng et al. (2009)
C22	Environmental awareness	Phillips-Wren et al. (2004), Koo et al. (2008), Güngör Sen et al. (2008)
C23	Fuzzy decision-making	Metaxiotis et al. (2003), Zack (2007), Makropoulos et al. (2008), Wadhwa et al. (2009), Yu et al. (2009)
C24	OLAP	(Berzal et al. 2009; Lau et al. 2004; C. Lee et al. 2009; Rivest et al. 2005; Shi et al. 2007; Tan et al. 2003)
C25	Data mining techniques	(Berzal et al. 2009; Bolloju et al. 2002; H. Cheng et al. 2009; Shi et al. 2007)

5. Research Methodology

A questionnaire was designed and structured in two sections. Information related to the basic profile of the interviewees was requested at the beginning of the questionnaire. In the second part, there were 25 questions designed to measure their attitude, based on the BI Assessment Criteria listed in Table 2. The selected response was evaluated by a "Likert Scale" (Likert, 1974) and the responses could be: very strongly disagree, strongly disagree, disagree, no opinion, agree, strongly agree or very strongly agree. In other words, the second part of questionnaire measures their opinions the importance of each BI specification in terms of the intelligence perspectives of FIS.

The main targets of the sampling were financial managers of Iranian Companies listed on stock exchange which is under the control of SEO, whom are involved in systems efforts and

decision-making. The number of questionnaires sent out was 270 and the number returned was 192, which showed a return rate of 71 per cent.

5.1 Demographic Profiles of Interviewees

The demographic profile of interviewees who participate in the survey has been summarized in Table 2. The results show that most of the members (94 per cent) are male. Most of the interviewees (87 per cent) have a Bachelor of Science (BS) or a higher degree, as shown in Table 1. As can be seen, 34 per cent have over 15 years of seniority, 28 per cent have 10-15 years, and 38 per cent have less than 10 years seniority.

Table 2 Demographic profiles of interviewees

	Description	Number of interviewees	Per cent	Cumulative (percentage)
Gender	Male	181	94	94
	Female	11	6	100
	Sum	192	100	
Educational degree	Under BS	25	13	13
	BS	87	45	58
	MS or higher education	81	42	100
	Sum	192	100	
Seniority	Less than 5 years	12	6	6
	5 to less than 10 years	61	32	38
	10 to less than 15 years	54	28	66
	15 to less than 20 years	31	16	82
	20 years and above	34	18	100
	Sum	192	100	

5.2 Extraction of Factors (Perspectives)

Factor analysis is a technique mainly suitable for exploring the patterns of complex, multidimensional relationships encountered by researchers. Factor analysis can be utilized to examine the underlying patterns or relationships for a large number of variables and to determine whether the information can be condensed or summarized in a smaller set of factors or components (Hair et al., 1998).

An important tool in interpreting factors is factor rotation. The term rotation means exactly what it implies. Specifically, the reference axes of the factors are turned about the origin until some other position has been reached. The un-rotated factor solutions extract factors in the order of their importance. The first factor tends to be a general factor with almost every variable loading significantly, and it accounts for the largest amount of variance. The second and subsequent factors are then based on the residual amount of variance. The ultimate effect of rotating the factor matrix is to redistribute the variance from earlier factors to later ones to achieve a simpler, theoretically more meaningful factor pattern. The simplest case of rotation is an orthogonal rotation, in which the axes are maintained at 90^0 (Hair et al., 1998).

In order to determine whether the partial correlation of the variables is small, the Kaiser-Meyer-Olkin was used to measure of sampling adequacy (Kaiser, 1958) and Bartlett's χ^2 test

of Sphericity (Bartlett, 1950) before starting the factor analysis. The result was a KMO of 0.971 and Bartlett test p-value less than 0.05, which showed good correlation as depicted in Table 3. The factor analysis method is "principle component analysis" in this research, which was developed by Hotteling (1935). The condition for selecting factors was based on the principle proposed by Kaiser (1958): Eigen value larger than one, and an absolute value of factor loading greater than 0.5. The 25 variables were grouped into four factors. The results can be seen in Table 4. Four factors had an Eigen value greater than one and the interpretation variable was 74.49 percent. The factors were rotated according to Varimax rotation method.

Table 3 sampling adequacy Indices for factor analysis

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.971
Bartlett's Test of Sphericity	Approx. Chi-Square	5.963E3
	df	561
	Sig.	.000

Table 4 Rotated Factor analysis results

		Rotation Sums of Squared Loadings		
Factor	**Initial Eigen values**	**Total**	**Percentage of Variance**	**Cumulative percentage**
1	16.114	7.264	25.377	25.377
2	3.173	6.244	20.366	45.743
3	1.850	5.044	17.992	63.735
4	1.457	2.977	10.755	74.49

5.3 Perspectives Naming

To indicate the meaning of the perspectives, they have been given short labels indicating their content. "Systematic Decision-support", "Providing Environmental Information", "Optimization and Recommended options", and finally "Rationality" are the names which have been assigned to the extracted factors. Extracted business intelligence perspectives and their loading on main concept of FIS are shown in Fig. 1.

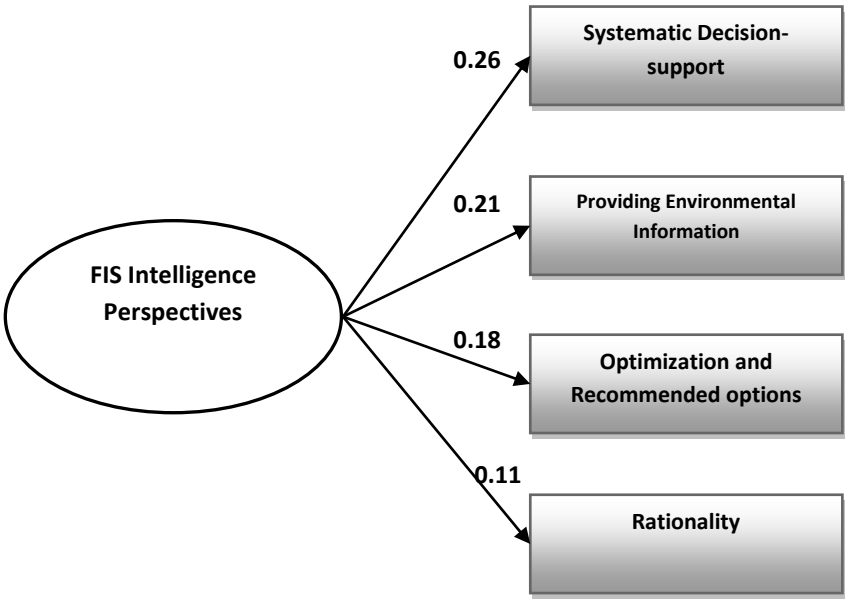


Fig.1. Business Intelligence Perspectives of FIS

6. Conclusion

Business Information systems like Financial Information Systems (FIS) converts and store the data. Therefore, it is important to integrate decision-support into these systems. Therefore needed business intelligence perspectives of FIS can help as guidelines to promote these systems and obtain competitive advantages.

In this paper 25 criteria for Intelligence Perspectives and decision support capabilities of Financial Information Systems were gathered and embedded in the second part of the research questionnaire. The interviewees whom were financial managers of Iranian companies listed on stock exchange which is under the control of SEO; answered the questionnaires and selected the more important criteria from these 25 variables by assigning ranks to them. The research then applied factor analysis to extract the four business intelligence perspectives of FIS. These intelligence perspectives were "Systematic Decision-support", "Providing Environmental Information", "Optimization and Recommended options", and finally "Rationality".

The authors believe that after this research, organizations can make better decisions for designing, selecting, evaluating and buying their Financial Information Systems, using extracted perspectives. And these perspectives help them to create a better decision-support environment in their financial information systems.

With no doubt it is the beginning of this point of view and further research is needed. One area is the design of expert systems to compare vendors' products on FIS. The other is the application these perspectives in a Multi criteria decision making framework to evaluate FIS`s based on business intelligence specification. The complex relationship between decision-making satisfaction of financial managers, and these perspectives should also be addressed in future research.

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