ICTs FOR DECISION MAKING PROBLEMS AND PROSPECTS

Qamar Afaq, Shakeel Ahmad, Najeebullah Khan, Allah Nawaz and Gohar Zaman.

Department of Public Administration Gomal University Dera Ismail Khan, Pakistan

ABSTRACT

Information and communication technologies (ICTs) offer unprecedented tools and techniques for decision-making in any organization world-over. Research reveals that computerization is neither automatic nor emerges only with the purchase of leading-edge hardware and software for different levels of management. Successful infusion of ICTs into organization in general and decision-making levels in particular, depends on the understanding of enabling technologies on the one hand and the user requirements on the other. This understanding may result into best possible plans for developing and using ICT-based tools for different levels of decision-making. This paper is an effort to contribute to the expected understanding by juxtaposing relevant concepts to paint a real-world image of the 'ICTs for Decision-Making.'

INTRODUCTION

The emergence of global and information-based marketplace has forged a unique environment for today's business decisions (Boiney, 2000). As compared to early 1990s, today's markets are characterized by rapid change, increased competition, faster response and greater flexibility in terms of meeting differing customer requirements (McManus and Wood-Harper, 2004). A decision is a judgment, choice between alternatives, right or wrong or almost right and probably wrong (Drucker, 1974). The term decision making refers to a range of activities, including defining and structuring a problem, identifying stakeholder values and objective, generating alternatives, identifying key uncertainties and possible consequences, evaluating the alternative and finally choosing a course of action and implementing it (Boiney, 2000). Good decision making depends on in depth analysis of different available alternatives, which should be exercised through computerized search and comparison (Turban *et al.*, 2004).

The existing literature reveals that science and technology may improve modern decision making. Different kinds of decision support systems can be used to extend technological support necessary for effective decision making (Forgionne and Kohli, 2000). ICTs are coming up with innovative solutions for the decision makers to use new tools,

which are specific to different decision requirements and situations. For example, TPS and office automation tools are more helpful at the lower level, while DSS and ESS stand out for the top management.

There is mounting literature on both the technological innovations in ICTs for decision-making and project studies of different organizations, experimenting with these new ICT-based artifacts. The documents on the enabling technologies present varying approaches in the development and use of different supporting technologies for varying decision-making environments.

This paper is an effort to juxtapose facts and figures from both the conceptual developments and real-world cases. Multi-dimensional data is available about the pros and cons of ICTs-enabled decision-making as well as there are case studies of the practical applications by public and private organizations world-wide. Thus the method for data collection is the survey of different online and off-line sources with the objective of connecting together relevant theories, tools, techniques, opportunities, threats and prospects of 'ICTs for decision-making in the organizations.'

It is obvious that for most of the part, traditional decision making is now being replaced by a systematic research and analysis preceding every decision (Weihrich and Koontz, 1999). Decisions are based on the availability of relevant information. Currently, it has become impossible to 'manually process' the available facts because:

1. The number of alternative to be considered is ever increasing, due to innovations in technology, improved communication, development of global markets and use of the internet and e-Business.
2. More decisions must be made under more time-pressure.
3. There are increased fluctuations and uncertainty in the decision making.
4. It is often necessary to rapidly access remote information, consult experts, or have a group decision making session, all without large expenses (Turban *et al.*, 2004).

Some forty years ago, the management guru Peter F. Drucker (1974) remarked "Information is the tool of a manager." This is more relevant today than ever

before. Several forces have dramatically altered the business environment for decision making over the past decade including emergence and strengthening of the global marketplace; and transformation of advance industrial societies into information-based service communities (Boiney, 2000).

Production, marketing, finance and human resource are the key functional areas of many companies. Traditionally, information systems were designed at such functional levels to increase company's effectiveness and efficiency. However, such traditional organizational structures are not usable today as modern companies are more dynamic and performed activities at several functional areas (Turban *et al.,* 2004). Computer-based information system (CBIS) is used to convert raw data into information and knowledge so that competitive advantage could be created (Eom, 2000).

ICTs normally include computers, telecommunication technologies, and associated software and operating systems (Walsham, 2000). On the basis of these technologies leading scholars introduced modern frameworks like management support system (MSS), to extend integrated support to decision making process (Forgionne and Kohli, 2000). Decisions are increasingly made in a more decentralized fashion, often by teams that may be geographically dispersed across the globe, and in the face of over-whelming amounts of information and limited time (Boiney, 2000).

Every organization is making efforts to embed ICTs in their functions. Although few organizations possess required infrastructure and capacities to successfully complete their projects, however, most of the organizations failed to complete their projects in time due to inefficient and ineffective management (McManus and Wood-Harper, 2004).

Enabling technologies for mangers are also called Management Support Systems (MSS), which consist of several software tools for decision-making (Turban *et al.,* 2004) (See Table 1). An MSS is a workstation-based combination of the tools that:

1. provides central repositories for decision data, models, and knowledge;
2. incorporates a user-extensible knowledge-representation

scheme that links information, knowledge, and models;

3. delivers models that support an organization-oriented view of strategic decision making;
4. assists staff in understanding business decision making tasks, events, and processes; and
5. serves as a learning tool for future business policy decision makers (Forgionne and Kohli, 2000)

Table 1 Enabling Technologies for Different Levels of Decision-Making

	Decision Situation	**Technology**	**Decision-Maker**
1	Structured, Operational-Level	Transaction Processing Systems (TPS), Data Warehousing and Enterprise Resource Planning (ERP)	Bottom-Line Management
2	Structured Management Control	Management Information System (MIS) & Decision Support Systems (DSS)	Middle Management
4	Unstructured-Strategic Level	Executive Support Systems (ESS) and DSS	Top Management
3	Relatively Unstructured Knowledge-Level	Data Mining (DM) and Artificial Intelligence (AI)	Data and Knowledge-Workers
5	Forge Group Consensus	Groups support systems (GDSS)	All Levels of Management

Adapted from: Boiney (2000), (Turban *et al.*, 2004)

Following is an account of the most popular contemporary enabling technologies widely used in local, national and multi-national organizations around the world:

a. Transaction Processing System (TPS)

A TPS processes thousands of routine transactions that occur every day in most organizations, including sales, payments made and received, inventory shipped and received, and employee payroll (Bioney, 2000). Likewise, an online transaction processing system (OLTP) is one where transactions are processed as soon as they occur. TPS is a complex process that involves vendors, customers, telecommunications and various kinds of hardware and software (Turban *et al.,* 2004). The operational level data within the TPS is the critical foundation for higher-level systems. For example, the data are input to DSS, ESS and knowledge management (Bioney, 2000).

b. Data-Mining (DM)

Data mining is also called data-dipping, data-archeology, data-exploration and information harvesting (Turban *et al.*, 2004). It is an area of the intersection of human intervention, machine learning, mathematical modeling and databases. Using mathematical techniques, such as neural networks, decision trees, linear programming, fuzzy logic and statistics, data mining software helps the managers to easily discover valid, useful and previously unknown information from large databases to make useful business decisions (Shi, 2000). It is a systematic process of finding useful information from huge data bases. Data mining provides automated predication of trends and behaviors and discovery of unknown patterns (Turban *et al.*, 2004). This technique can also be used by nonprogrammers. These non-programmers are the end users, if equipped with data drill and other query tools and techniques can collect necessary information useful for making rational decision with out required programming skill.

c. Data-Warehousing (DW)

A data warehouse is a central repository of massaged, reorganized and integrated data which are subject-oriented (according to business entities like customers, vendors, suppliers products etc), integrated (consistent in many ways like consistent coding structures, consistent measurement of variables etc), time-vibrant (data is accurate at some time unlike TPS data which represent current values), nonvolatile (data cannot be updated, overwritten or changed. Data are static – long lived – as opposed to operational data which are updated – short lived) in support of management decision making (Eom, 2000).

Data-processing in organizations can be either transactional or analytical. Analytical processing is also referred to as business intelligence. There are two options for analytical processing:

1. Directly using the operational systems through software tools and components known as front-end tools and middleware which allow end users to directly conduct queries and reports on data stored in operational databases. But use of these tools requires a medium to higher degree of knowledge about databases. Web-based tools improved the situation but if data

is in multiple formats, its collective analysis is difficult.

2. Using a Data Warehouse: It overcomes the problems of front-end tools. It based on three concepts: (a) a business representation of data for end users, (b)a web-based environment that gives the users query and reporting capabilities, and (c) a server-based repository (the data warehouse) that allows centralized security and control over the data (Turban *et al.*, 2004)

Large companies only use warehouses as these are too costly to be used by small scale business units. These small units preferably use data mart, which is a less-costly version of data warehouse and is designed for strategic business units (Turban *et al.*, 2004).

d. Document Management System (DMS)

DMS is an electronic system of managing documents within an organization. It controls electronically all kinds of documents, page images, spreadsheets, work processing documents, and other complex documents throughout their life cycle within an organization. It enables the management to control the production, storage, retrieval and distribution of documents in a more accurate and speedy way. DMS creates efficiency and effectiveness in record keeping system and reduce product cycle times. A DMS deals with knowledge in addition to data (Turban *et al.*, 2004).

e. Enterprise Resource Planning (ERP)

ERP represent a new generation of information systems that are designed to process routine business activities across multiple functional areas of large corporate enterprises. ERP provides highly integrated solutions that rely on the use of common database systems. Most of the current ERP systems are based on client-server architecture and use commonly available relational database technology both for data management and report-generation, and move data through standardized data communication protocols. The major software makers who are selling ERP systems include: SAP, Oracle, PeopleSoft, BANN etc (Saharia and Sandoe, 2000).

f. DSS and ESS

These are special software tools for middle and top level decision makers.

These are based on the above cited tools like TPS wherefrom data is extracted to feed the models in (DSS) and (ESS). DSS is a computer based information system which by combining models and data and involving end users tries to solve unstructured and semi-structured problems. Likewise, an ESS is information systems, which support executives by distilling data from all the low-level information systems (Turban *et al.,* 2004).

Research indicates that information system development projects suffer from a high failure rate (Jiang *et al.,* 2006). It is well reported that majority of IT projects when failed to deliver overshoot their budgets and timetables (McManus and Wood-Harper, 2004). Likewise very high proportion of IS development projects are also neither capable to deliver nor able to meet their initial targets (Turban *et al.,* 2004).

In such a scenario, it appears that management of the ICTs in organizations is an uphill and demanding task. Too often implementation of new IS fails. The relationships between an IS and its organizational context are complex and the understanding of these complex phenomena and relationships are still incomplete (Ågerfalk *et al.,* 2006). Major critical failure factors in ICTs projects are:

1. Frequent requests for changes by users,
2. Users' lack of understanding of their own requirements and poor or imprecise requirements definition,
3. Insufficient communication,
4. Lack of adequate methodology and guidelines,
5. Lack of coordination in systems development,
6. Changes in information systems development personnel,
7. Insufficient time for testing of system and training of users, and
8. Poor business strategy alignment (McManus and Wood-Harper, 2003).

The need for effective decision making is a key factor driving the quest for information and the development of supporting technologies (Boiney, 2000). Consolidation of separate decision

support system, expert system, and executive information system is imperative for comprehensive support to develop integrated capabilities to fight with the challenges and complexities of this competing age (Forgionne and Kohli, 2000).

As wide use of the Internet has become a reality in the global economy. The future development of data mining is to link the Internet, data warehouses and data mining across national boundaries (Shi, 2000) as leading scholars unanimously differentiating IS innovations in an organization from other innovations (Bajaj, 2000).

However, the effective use of IC in organizations requires the sensitive handling of human issues in addition to the technical matters. Human resource development underpins all aspects of ICT policy and organizational implementation. Education and training are necessary for the general public, policy makers, technology users, and the IT/S professionals (Walsham, 2000).

The first managerial skill is making effective decisions (Drucker, 1974). However, in today's fast-paced, global, highly competitive and information-intensive environments, managers face new decision-making challenges (Boiney, 2000). For example, in this competing age for the achievement of strategic objectives, an executive will need more integrated approach of analysis and sharing of information and knowledge (Forgionne and Kohli, 2000). Furthermore, future IT/S will focus less on data gathering and more on sifting through data for patterns and potential problems or opportunities (Boiney, 2000).

Given the complexity and competitiveness of the strengthening global marketplace, the trends towards group and distributed decision making, the need to make decisions under time pressure when facing information overload new technologies are indispensable (Boiney, 2000). The digital revolution enables companies to automatically capture and accumulate huge data through source data automation devices (Eom, 2000). For example, using an Internet browser to access clean data from a data warehouse on a related website, analysts can interactively carry out data mining for a certain business objective and provide discovered knowledge or useful information (Shi, 2000).

Implementation of ICTs is not a simple rather complex and complicated task that was first debated decades ago and has been under debate ever since. Despite such efforts, the practitioners still confronting many so-called 'go-live' problems such as non-customized technologies, operational complexities, lack of end-users supports and overall dissatisfaction with the new system (Bondarouk, 2006).

Clear distinction between initiation, adoption and diffusion within and across organizations has been well cited in the innovative literature. It is well reported in the existing literature that the need-pull or technology-push forces are the factors responsible for taking different initiatives (Boiney, 2000). Likewise, the approaches for the development of ICTs projects, taken from the industrialized countries may not transfer effectively to the different environments of the developing countries (Walsham, 2000).

ICTs have opened-up new vistas for the decision-making and decision-makers of the public, private, large, medium and small organizations. However, the access to and availability of simply the technological artifacts is not sufficient to develop effective MSS, which can truly support management in creating and manipulating and presenting all relevant facts and figures so as to make well-informed, timely and comprehensive decisions.

It requires consideration of several surrounding variables/factors which forcibly intervene in the ICTs development and use practices. Management has to harness these factors in the favor of organizations. For example, resistance to change by the users can be neutralized by first giving the users a genuine participation in the project development and then providing them all possible resources of training and education about how to use new systems.

The future work of the researchers includes the collection, analysis and presentation of facts and figures about ICTs for decision-making in different departments of NWFP, Pakistan.

REFERENCES

Agerfalk P, Goldkuhi GJ, Fitzgerald B and Liam B (2006). Reflecting on action in language, organizations and information systems. European Journal of Information Systems., 15 (1): 4–8.

Boiney LG (2000). In: Zeleny, Milan (editor) The IEBM handbook of information technology in business. Thomson Learning, Business Press; pp32-39.

Bondarouk TV (2006). Action-oriented group learning in the implementation of information technologies: results from three case studies. European Journal of Information Systems., 15 (1): 42–53.

Drucker PF (1974). Management: Tasks, responsibilities, practices. Heinmann: London; pp 233-245.

Eom SB (2000). Data warehousing. In: Zeleny, Milan (editor) The IEBM handbook of information technology in business. Thomson Learning, Business Press; pp 496-503.

Forgionne, Guisseppi A and Rajiv K (2000). Management support system effectiveness: further empirical evidence. Journal of the Association for Information Systems 1 (2): 12-17.

Jiang, James J, Gary K and Hong-Gee C (2006). The Effects of User Partnering and User Non-Support on Project Performance. Journal of the Association for Information Systems., 7 (2): 68-68.

McManus, John and Trevor Wood-Harper (2004). Information systems project management: Methods, tools and techniques. Pearson Education, Limited, UK; pp 76-85.

Saharia, Aditya N and Kent S (2000). Enterprise resource planning (ERP) systems. In: Zeleny, Milan (editor) The IEBM handbook of information technology in business. Thomson Learning, Business Press; pp 516-527.

Shi Y (2000). Data Mining. In: Zeleny, Milan (editor) The IEBM handbook of information technology in business Thomson Learning., Business Press; pp 490-495.

Turban, Efraim, Ephraim M and James W (2004).Information technology for management: Transforming organizations in the digital economy. 4th Edition. John Wiley & sons, Inc; pp 231-245.

Walsham G (2000). T/S in developing countries. In: Zeleny, Milan (editor) The

IEBM handbook of information technology in business. Thomson Learning, Business Press; pp105-109.

Weihrich H, Harold K (1999). Management: A global perspective. 10th ed. McGraw-Hill. Inc; pp 156-178.