

Improving Decision Making with Information Systems Technology – A theoretical approach

Mihane Berisha-Namani, Albana Qehaja

Abstract

Traditionally, information systems were used to support operational functions and to reduce costs by automating many of business operations. As business has become more aware of the importance of information systems, the role of information systems has changed. From its conventional function of supporting business operations, today information systems are used to reduce business risks and to ensure that correct information is made available, so managers can make better decisions. The purpose of this paper is to give an understanding how businesses are using information systems to achieve their goals. It specifically addresses more closely the impact that information systems have in improving the decision making. Although limited this paper sets out to explore the importance of information systems in decision making and concludes that more attention should be paid to information systems usage for decision making purposes. Finally, suggestions for further research are made.

Key terms: *decision making, information systems, types of information systems.*

Introduction

The use of information systems is often understood to be changing the way business and organisations work as well as help the process of decision making. The business usage of information system has expanded significantly over the years. Until 1960s and 1970s the role of information systems was simple transaction processing, record keeping, accounting, and other data processing

application¹. An important role for information systems appeared in 1980 and continues into 1990. This was the concept of a strategic role of information systems, sometimes called strategic information systems. In this concept information system becomes integral part of business processes, products and services that help a company gain a competitive advantage².

Towards the end of the twentieth century many organisations realized that the old ways of organisation structures were no longer appropriate. The technology driven companies have become knowledge driven companies and information systems have become crucial to the functioning of modern organisations and businesses³. The rapid growth of Internet, intranets and extranets and other interconnected global networks dramatically changed the capabilities of information systems in business. Today, information systems technology is playing a critical role in business which is conducted in a global environment and could not serve without information systems⁴.

In addition to traditional systems which assist in the day-to-day business operation, information system is providing support to decision making. Several studies have found and reported findings that information systems are playing an increasingly important role in organisations of all types. Furthermore, most authors agree that information systems support decisions at all levels of the organisation. They noted that information systems technology support business operations in general and specifically decision making process⁵.

Along this line our study objective concentrates on usage of information systems for decision making purposes. The focus is to show how organisations can use different types of information systems to support decision making and help managers make better decisions. Our study is important to managers since it help them to understand how information technology can be used as a tool to support major components of business and decision making process.

¹ James A. O'Brien and George Marakas, *Management Information Systems with MISource*, 8th edition, 2011.

² Kenneth Laudon, and Jane Laudon, *Essentials of Management Information Systems*, 9th edition, 2011, pg. 105.

³ It is important to recognize that in the study of information systems we consider how computers and other information technologies help, reinforce or reshape, essentially human and organizational activities, not just what the computers themselves do or how they operate. In this we are saying that an information system is essentially an organizational rather than technological phenomenon.

⁴ James O. Hicks, Jr.: *Management Information Systems, A User Perspective*, 3rd ed., 1993, pg. 7-8.

⁵ See: Terry Lucey: *Management Information Systems*, 9th edition, 2005, pg. 292; James O.Hicks, Jr.: *Management information systems*, 3rd edition, 1997, pg. 90; Gordon B. Davis, and Margrethe H. Olson: *Management Information Systems, Conceptual Foundations, Structure, and Development*, 2nd edition, 1985, pg. 667.

The paper is organised as follows: in the following section we provide knowledge about decision making process and we then describe information systems and its role in decision making. The next section continues with types of information systems and decision making levels. Lastly, we conclude our study with a discussion and suggestions that there is a recognized need for more research in this field.

1. Decision making process

Decision making is a complex process involving many variables that sometimes we do not yet fully understand. However, the scientific literature suggests that many aspects of decision making process are clear and decisions take place at each level of management in an organisation. In contemporary decision making literature, decision making means recognizing problems, generating alternative solutions to the problems, choosing among alternatives, and implementing the chosen alternative⁶.

It is universally agreed that decision making is a key managerial activity and managerial function, maybe the key activity that often decides the fate of organisations. Decision making is a critical managerial function⁷. Managers need information to size up the problem, to take decisions, but also in order to act in a variety of management functions. This task can prove very difficult and information systems play an important role in supplying the needed information⁸. The attention of managers' increase rapidly from one issue to another and when problem accrues usually there is not enough time for decision maker to get deeply involved in a wide range of issues. Therefore it is usually that information processed from information systems are required when organisation grows and management function is performed by people who are specialized to make decision.

Decision making falls into one of two general categories systems that help users⁹ to analyze a decision making situation and make some sort of recommendation concerning action to take¹⁰. Crawford observed that given the nature of the work, decision makers tend to rely upon information that is likely to be less accurate than more formal and complex information systems¹¹.

⁶ Patrick McKeown: *Information Technology and the Networked Economy*, 2009, pg. 181.

⁷ S. Shajahan and R. Priyadharshini: *Management Information Systems*. Available at: <http://www.books.google.com>.

⁸ Patrick McKeown: *Information Technology and the Networked Economy*, 2009, pg. 182.

⁹ The user is the decision maker or analyst who seeks the solution to a problem.

¹⁰ Terry Lucey: *Management Information Systems*, 9th edition, 2005, pg. 172; Stephen Haag and Maeve Cummings: *Information Systems Essentials*, 2006, pg. 133.

¹¹ Crawford, I.M.: *Marketing Research and Information Systems*, Marketing and Agribusiness, Text-4. 1997. Available at: <http://www.fao.org/docrep/W3241E/w3241e0a.htm>

Today, decision making is the key to the long - term survival of organisations. Making good decisions isn't sufficient; the organisation must make them quickly as well. Failure to react to the dynamic environment of the networked economy and to adequately handle the increase level of innovation risk can result for a company going out of business. Making good decisions often requires information systems that can provide the decision maker with data, information and answer to questions¹². Without such support decisions may be based hunches or bad information.

Making a decision is a multistep process. After reviewing the different models of decision making process, we restrict our attention and more specifically we focus on the well known model proposed by Herbert A. Simon which will be used as the basis for describing the decision making process. Simon's model consists of three major phases: intelligence, design and choice¹³ but does not go beyond the choice phase. Some other models of decision making include implementation phase and feedback from the results of the decision¹⁴. We consider that it is useful to present a framework for exploring the nature of decision making that includes an understanding of seven steps of decision making process (Figure 1).

¹² Patrcik McKeown: *Information Technology and the Networked Economy*, 2009, pg. 180.

¹³ Gordon B. Davis and Margrethe H. Olson: *Management Information Systems, Conceptual Foundations, Structure, and Development*, 2nd edition, 1985, pg. 164.

¹⁴ Kenneth Laudon and Jane Laudon: *Essentials of Management Information Systems*, 9th edition, 2011, pg. 369.

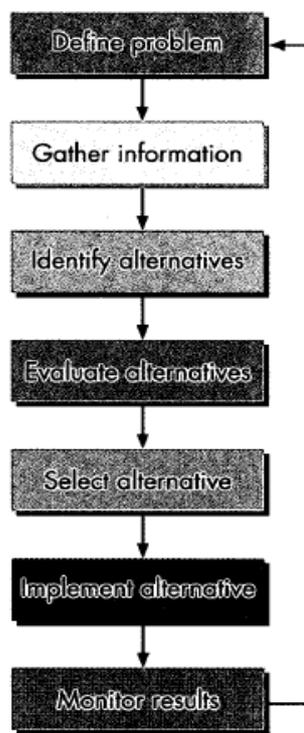


Figure 1 – Model of decision making process

As illustrated in Figure 1, the decision making process begins with the definition of the problem requiring a solution or decision. After defining the problem we gather information on the problem. In the next phase, we identify alternatives to resolve a problem or to exercise a competitive initiative. The decision makers then evaluate these alternatives in light of criteria established by the organisation. Next, we implement the selected alternative. Implementing alternative is often the most difficult part of decision making and many good decisions have failed to solve the original problem because they were not successfully implemented. Finally, we must monitor the results of the implementation to provide feedback to management for review of the selection criteria, the alternatives, and the decision. An effective information system is necessary to carry out these activities and to provide the information necessary for decision making¹⁵.

¹⁵ James O. Hicks, Jr.: *Management Information Systems, A User Perspective*, 3rd ed., 1993, pg. 52.

2. Information systems and its role in decision making

In recent decades there has been an increasing recognition of the significance of information functions both in organisation and in economy as a whole. A modern organisation devotes a great deal of attention to how they set about capturing, storing and processing the information that they use in their operations and decision making¹⁶. Furthermore, it has become widely accepted that information, and information systems that handle it, are key resources of an organisation.

As noted earlier, information technology is technology used to store, manipulate, distribute or create information. Greater use of these technologies in organization is often associated with improved availability of information, productivity, quality of work, effectiveness and efficiency in accomplishing tasks, the increase in efficiency and productivity as well as subsequent reduction of costs brought about by information technology is leading to the creation of new products, new services and distribution channels within traditional industries, with innovative business models and whole new industries. Information technology can contribute to income generation and poverty reduction and enables people and enterprises to capture economic opportunities by increasing process efficiency, promoting participation in expanded economic networks¹⁷.

Through the use of information systems and related technologies organisations can improve business decision making and service quality or increase efficiencies and productivity and thereby increase profit. In either case, effective use of information systems technology involves changes to the organisation. Businesses can reduce operational costs by decreasing material, can also use more and better information to improve the value of their products, and can make better decisions. These characteristics suggests that information systems technology has the potential to be a powerful enabler of development of organisations and businesses.

According to Chaffey, Bocij, Greasley and Hickie, information systems are the means by which organisations and people, using information technologies, gather, process, store, use and disseminate information¹⁸. The use of information technologies and information systems is often understood to be changing the way that business, government and society work and it is a dominant belief that the widespread deployment of information technology

¹⁶ Chrisanthi Avgerou and Tony Cornford: *Developing Information Systems, Concepts, Issues and Practice*, 2nd edition, 1998, pg. 42.

¹⁷ <http://www.pot-init.org/framework/pages/2.3.2.html>

¹⁸ Paul Bocij, Dave Chaffey, Andrew Greasley and Simon Hickie: *Business Information Systems, Technology, Development and Management for the e-business*, 2nd edition, 2003, pg. 43.

will lead to benefits for all as well as there is some evidence that information technology has a significant effect on the structure of the organisation¹⁹.

When information technology is used in organisations, it often goes by the name information systems²⁰. In this paper the term information systems refers to systems that process the information that managers and other employees combine with knowledge to make decisions. Organisations use information systems in many ways to reduce risks and help managers make decisions. McKeown observed that information systems are used in organisations for three purposes or functions: handling the present, remembering the past and preparing for the future (Figure 2)²¹. Similarly, Avgerou and Cornford pointed out that the first domain of information systems is concerned with adequate information handling to support the various tasks of organisation²².

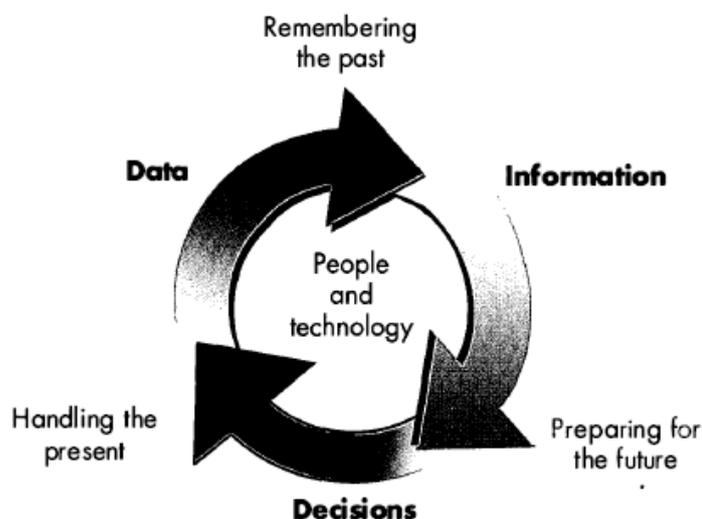


Figure 2 – The information systems cycle

The main job of decision maker is to make decisions and information processed by information systems is linked to decision making. According to Haag, Baltzan, and Philips, business activities can not be realized without the use of information systems technology and managers can not make quality

¹⁹ Terry Lucey: *Management Information Systems*, 9th edition, 2005, pg. 172; Stephen Haag and Maeve Cummings: *Information Systems Essentials*, 2006, pg. 237-240.

²⁰ Information systems uses technology in the form of hardware, software and communications links.

²¹ Patrick McKeown: *Information Technology and the Networked Economy*, 2009, pg. 180.

²² Chrisanthi Avgerou and Tony Cornford: *Developing Information Systems*, Concepts, Issues and Practice, 2nd edition, 1998, pg. 229.

decisions²³. This implies a relationship between information systems and decision making process.

To understand the relationship between information systems and decision making process, we must look at several studies of well known and leading authors on information systems who found that decision making is a complex process and information systems can be used to improve decision making²⁴. Similarly, Lucey emphasises the decision focus of his definition of information systems²⁵. He observed that "information systems is a system to convert data from internal and external sources into information and to communicate that information in an appropriate form to managers at all levels in all functions to enable them to make timely and effective decisions for planning and controlling the activities for which they are responsible". Furthermore, information systems play a crucial role in supporting all types of decisions: structured, semistructured and unstructured (Table 1)²⁶.

Table 1- Types of decision making

Type of Decision	Information Required	Identification of Alternatives	Selection of Alternative
Structured	Well defined	Limited	Use rules
Unstructured	Not well defined	Ambiguous	Use intuition and judgment

Decisions can be programmed or so called structured decisions and unprogrammed also known as unstructured (ad hoc) decisions²⁷. According to Laudon and Laudon decisions are classified as structured, semistructured and unstructured²⁸. The key points mentioned so far can also be found in a study published by Davis and Olson²⁹. They pointed out that structured decisions are made by following a set of rules, usually on a repetitive basis. The type of problem addressed by structured decisions is especially amenable to solution by computerized mathematical models. In contrast, unstructured decisions

²³ Stephen Haag, Paige Baltzan and Ammy Phillips: *Business Driven Technology*, 2006, pg. 7.

²⁴ See: Kenneth Laudon and Jane Laudon: *Essentials of Management Information Systems*, 2011, pg. 367; Gordon Davis and Margrethe H. Olson: *Management Information Systems, Conceptual Foundations, Structure, and Development*, 1985, pg. 368.

²⁵ Terry Lucey: *Management Information Systems*, 9th edition, 2005, pg. 179.

²⁶ Table 1 compares structured and unstructured decisions in terms of information required, identification of alternatives and selection of alternative.

²⁷ Patrick McKeown: *Information Technology and the Networked Economy*, 2009, pg. 182.

²⁸ Kenneth Laudon and Jane Laudon: *Essentials of Management Information Systems*, 9th edition, 2011, pg.368.

²⁹ Gordon B. Davis and Margrethe H. Olson: *Management Information Systems, Conceptual Foundations, Structure, and Development*, 2nd edition, 1985, pg. 168.

involve complex situations and often must be made on a once only basis using any available information. No clear cut solution methodologies exist for these decisions, and their resolution requires a high degree of human intuition and judgement.

It is often stated that information systems is a tool to help managers by using available information for action and to facilitate decision making and one of the main contributions of information systems has been to improve decision making³⁰. Managers who understand what information system is, and what information system can and cannot do, are in the best position to help their organisation succeed and make better decisions³¹.

Research over the years has confirmed the influence of information systems technology on the way how businesses operate. Srića and Spremić, emphasize that information systems can influence not only business process, but also decision making process³². Some authors, however, argue that that information technology³³ has the potential to change the structure and performance of organisation and human enterprises³⁴. On the other hand Lucey pointed out that research over many years has confirmed a significant influence of information technology on the structure of organisations and on the way they operate³⁵. Indeed information systems technology deals with the information requirements of the business processes of organisation and has the potential to energise business systems and even improve decision making.

Application of information systems in decision making as well as in other forms of business brought major changes in the decision making process. The application of information systems in decision making in today's complex business world is possible only when information systems are based on a computer system support. Kroenke and Hatch, pointed out that the key functions of information systems can sometimes be performed without the use of a computer. But, their findings emphasize that computers enhance our processing abilities so much that most information systems do include computers³⁶.

³⁰ Kenneth Laudon and Jane Laudon: *Essentials of Management Information Systems*, 9th edition, 2011, pg.

³¹ Stephen Haag, Paige Baltzan and Ammy Phillips: *Business Driven Technology*, 2006, pg. 95.

³² Velimir Srića and Mario Spremić: *Informacijskom tehnologijom do poslovnog uspeha*, 2000. pg.

³³ Technologies are changing rapidly and relevant market boundaries are fluid and difficult to define.

³⁴ See: Gordon B. Davis and Margrethe H. Olson: *Management Information Systems, Conceptual Foundations, Structure, and Development*, 2nd edition, 1985, pg. 368; James O. Hicks, Jr.: *Management Information Systems*, 3rd edition, 1993, pg.90.

³⁵ Terry Lucey: *Management Information Systems*, 9th edition, 2005, pg. 100.

³⁶ David Kroenke and Richard Hatch: *Business Information Systems, An Introduction*, 5th edition, 1993, pg. 19.

3. Types of information systems and decision making

No doubt, the 1980s were golden years in the area of information systems usage in decision making. As noted earlier, it is almost a universal assumption in the literature that information technology has made a significant impact in decision making and the evolution of the usage of information systems technology in organisation for decision making purposes has been documented. It is important to realize that information systems in the real world are typically integrated combinations of several types of information systems.

There are four types of information systems for supporting the different levels of decision making³⁷. Information systems specifically designed to help managers make better decisions include a variety of types of information systems, which often go by different names such as: *decision support systems* (DSS)³⁸, *group decision support systems* (GDSS), *Management Information Systems* (MIS) and *executive support systems* (ESS). These information systems have specific roles in the organisation that are often associated with various managerial levels. Information systems that support decision making are commonly referred and grouped together under the broad term as *decision support systems*³⁹.

On the other hand several authors agree that various information systems became available to support management and decision making, and enable organisation to enhance their efficiency and productivity⁴⁰. Perhaps more importantly, management information systems (MIS) deal with processing data that already exist in operational systems, in order to improve the managerial efficiency of organisation. Management information systems (MIS) serve the management level of the organisation, providing managers with reports and often online access to the organisation's current performance and historical

³⁷ Kenneth Laudon and Jane Laudon: *Essentials of Management Information Systems*, 9th edition, 2011, pg. 371.

³⁸ The term decision support system (DSS), like management information systems (MIS) and other terms in the field of information systems, is a content free expression that means different things to different people. Therefore, although there is no universally accepted definition of DSS, by some is used as a specific tool and by others as an umbrella term to describe any computerized system that support decision making in an organisation. (See: Efraim Turban, Jay E. Aronson, J. and Ting Peng Liang: *Decision Support Systems and Intelligent Systems*, 7th Edition, 2005, pg. 309.).

³⁹ Patrick McKeown: *Information Technology and the Networked Economy*, 2009, pg. 183.

⁴⁰ See: Terry Lucey: *Management Information Systems*, 9th edition, 2005, pg. 179 ; James O. Hicks, Jr.: *Management Information Systems*, 3rd edition, 1993, pg. 3-7; Gordon B. Davis and Margrethe H. Olson: *Management Information Systems*, Conceptual Foundations, Structure, and Development, 2nd edition, 1985, pg. 410.

records. MIS provide information on organisation performance to help managers monitor and control the business, often in the form of reports based on data summarized from *transaction processing systems* (TPS), which record and process data resulting from business transactions. The basic transaction data from TPS are compressed and are usually presented in long reports that are produced on a regular schedule. Most MIS support structured decisions and some semistructured decisions⁴¹.

Table 2. Types of information systems

Decision Type	Type of Decision-Support System
Unstructured	Executive support systems (ESS)
Semistructured	Management information systems (MIS) Decision-support systems (DSS) Group decision-support systems(GDSS)
Semistructured Structured	Decision-support systems (DSS) Management information systems (MIS) Group decision-support systems (GDSS)

Table 2 summarizes the features of the four types of information systems. It should be noted that each of the different systems may have components that are used by organizational levels and groups other than its main constituencies.

Decision support systems (DSS) are the natural progression from transaction processing systems (TPS) and management information systems⁴² (MIS). Decision support systems (DSS) also serve the management level of the organisation and help managers make decisions that are unique, rapidly changing, and easy specified in advance. DSS combine data, analytical models, tools and user-friendly software into a powerful system and address problems where the procedure for arriving at a solution may not be fully predefined in advance.

It is important to note that while management information systems (MIS) are oriented almost exclusively to internal, not environmental or external sources, decision support systems (DSS) use internal information from TPS and MIS and often bring in information from external sources. DSS are interactive, computer based information systems that use decision models and specialized database

⁴¹ Kenneth Laudon and Jane Laudon: *Essentials of Management Information Systems*, 9th edition, 2011, pg. 72.

⁴² Dimitrios Buhalis: *eTourism, Information Technology for Strategic Tourism Management*, 2003, pg. 13.

to assist the decision making process of managerial users. DSS can support semistructured or unstructured decision making⁴³.

Group decision support systems (GDSS), is a generic term that includes all forms of collaborative computing. GDSS evolved after information technology researchers recognized that technology could be developed to support the many activities normally occurring at face-to-face meetings⁴⁴. Although GDSS support group work processes and help people meeting together in a group arrive at decisions, is still considered a specially designed information system and since the mid-1990s many of the special capabilities of GDSS have been embedded in productivity tools⁴⁵.

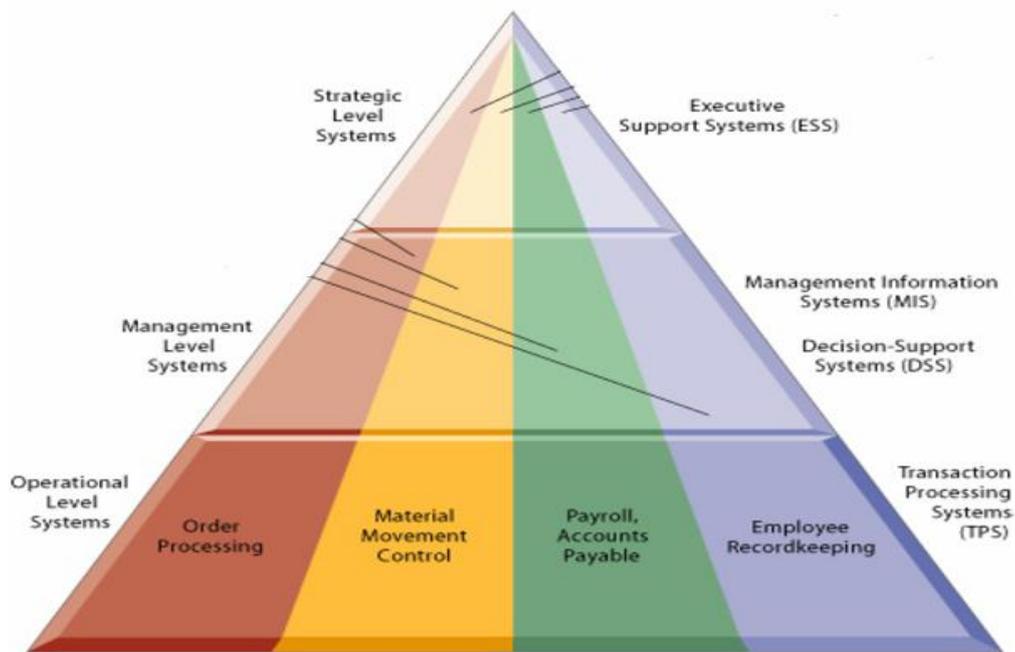


Figure 3- The four major types of information systems

Figure 3 provides examples of TPS, DSS, MIS, and ESS, showing the level of the organization and business function that each supports. Senior managers use executive support systems (ESS). ESSes are management information systems tailored to the strategic information needs of top management to help them

⁴³ Gordon B. Davis and Margrethe H. Olson: *Management Information Systems, Conceptual Foundations, Structure, and Development*, 2nd edition, 1985, pg. 370.

⁴⁴ Efraim Turban, Jay E. Aronson and Ting Peng Liang: *Decision Support Systems and Intelligent Systems*, 7th edition, 2005, pg. 379.

⁴⁵ For example, Microsoft NetMeeting is part of Windows, and most of GDSS are easy to use and provide support for activities like idea generation, conflict resolution, and voting.

make decisions. They address nonroutine decisions and are designed to incorporate data about external events, but they also draw summarized information from MIS and DSS. ESS filter, compress, and track critical data, displaying the data of greatest importance to senior managers. We should emphasize that unlike other types of information systems, ESS are not designed to solve specific problems. Instead, ESS provides a generalized computing and communications capacity that can be applied to a changing array of problems. ESS helps senior managers with unstructured problems by combining data from internal and external sources⁴⁶.

Conclusion

Development in information technology in our age and exponential growth in use has brought important changes in the needs of organisations and businesses. In our paper we show that towards the end of the twentieth century, information systems technology has transformed the organisation structure and improved decision making process. It is interesting to note that most authors links information systems technology usage to decision making process and confirmed the influence of information technology on organisational structure⁴⁷. Also, literature shows that there is a recognized need for more research in this field in order to raise our understanding of functioning of modern organisations and businesses. Additionally, today information systems usage to support decision making process is imperative. Organisations that do not know the importance of information systems in decision making can be successful in the short term, but never gain strategic benefits from information systems and its use. As a conclusion of this paper, it is possible to state that more knowledge about effective use of information technology to improve decision making is needed and more attention should be paid to usage of information systems for decision purposes.

⁴⁶ Kenneth Laudon and Jane Laudon: *Essentials of Management Information Systems*, 9th edition, 2011, pg. 379.

⁴⁷ Kenneth Laudon and Jane Laudon: *Essentials of Management Information Systems*, 9th edition, 2011, pg. Lucey: *Management Information Systems*, 9th edition, 2005, Patrick McKeown: *Information Technology and the Networked Economy*, 2009, pg,

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<http://www.fao.org/docrep/W3241E/w3241e0a.htm>
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