DESIGNING MIS STRUCTURE: COMPREHENSIVE APPROACH TOWARDS DEVELOPING ERP SYSTEMS

Rajmohan P.

ABSTRACT

MIS structure is the conceptual framework that comprises various process components and information components pertaining to the specific system which could either have an Administrative or Business objectives. The pattern of MIS structure of an organization is affected by its activities and functions. Hence, it significantly varies from one firm to others operating under the common Industry level considerations. Studying the variation of the MIS structure that exists in the firms of specific Industry focus will help in identifying the perfection and degree of coordination with which each of the business entities are functioning. However, lack of clarity in the design methods of MIS structure both in literature as well as in practice is noted and hence, an effort is made in this work to define the design methods for MIS structure. A qualitative research framework comprising the initial reference position established on the previous studies is the methodological approach followed in the work. A model is developed as an outcome of this work and it will act as the check list towards designing MIS structure for any group of firms operating under common Industry level considerations. This understanding helps in mapping the best breed of process models for the Industry and thus, a standard can be established towards the creation of best practice software like ERP systems

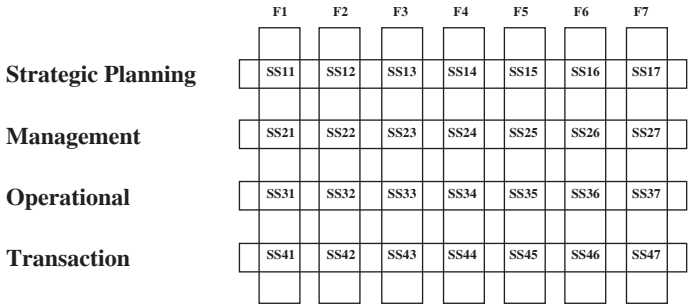
Keywords: MIS Structure, ERP System, Best Breed of Process Models, Design Methods and Qualitative Research.

MIS Structure

MIS structure is the conceptual framework that comprises various process components and information components pertaining to the specific system which could either have an Administrative or Business objectives. According to Davis and Olson (1984), the conceptual structure of management information systems is a federation of the functional subsystems, each of which is divided into four major information processing components namely Transaction processing, System support on Operational control, System support on Management control and System support for Strategic planning. According to Gupta and Sushil (1993a), MIS structure of an organization is nothing but the holistic representation of the organization as a network of Decision units and Information Units and they proved that a cyclic relationship often exists between the MIS structure of the organization and its smooth functioning. According to Davis and Olson (1984), the MIS structure of an organization is affected by its activities and functions. Hence, it significantly varies from one firm to others operating under the common Industry level considerations. Studying the variation of the MIS structure that exists in the firms of specific Industry focus will help in identifying the perfection and degree of coordination with which each of the business entities are functioning. This understanding helps in mapping the best breed of process models for the firms operating under single Industry focus and thus, a standard can be established towards the creation of best practice software like ERP systems.

The MIS structures of the enterprises is basically conceptualized as a matrix with the columns representing organizational functions and the rows representing transaction processing, operations control, management control and the strategic planning component of an enterprise. This model of MIS structure was proposed by Davis and Olson (1984) and it is diagrammatically represented as shown in the Figure- 1, where F1, F2, F3, F4, F5, F6, and F7 could represent different organizational functions like sales and marketing, production, logistics, personnel, finance and accounting, information processing and top management. In Figure –1, representing the conceptual model of MIS structure the different cells (SS11, SS12, SS13…etc.) of the matrix will represent the different subsystems with which the business or administrative enterprises are functioning. Each of the subsystems will have different set of activities which are required to be identified towards determining the perfection and co-ordination with which the business enterprise is functioning.

Figure-1: Conceptual Structure of Management Information Systems



Source: Davis (1984)

According to Gupta and Sushil (1993a), the clarity and smooth functioning of any organization depends on the clarity of its MIS structure or architecture. Hence, they stated designing of MIS structure as a potential research problem towards the development and implementation of MIS. In this context, it should be noted that MIS structure always exist for all categories of enterprises out of which a few were conceptualized and mapped with best breed of process models in some of the existing ERP systems. However, market potential for new ERP product always exist as many firms under different Industry perspective moves towards computerization and automation. Despite this, only a few ERP products are successful in the market and it's because of their incorrigible fitment into the organizational systems (Wagner et al, 2006).This problem can be solved, if appropriate MIS structure of the organizations are properly designed and analyzed before assessing the suitability of the ERP product or creating entirely a new one based on Industry focus. However, non clarity in methodological focus in designing MIS structure is viewed as the core issue in developing new ERP products.

Benefits of designing MIS structure of an organization.

From various literatures on MIS structure, the following benefits are worth mentioning in the context of designing MIS structure of an enterprise.

1. It will help in identifying and defining the various functional subsystems in an organization. In this context, Davis and Olson (1984) stated that the structure of information systems can also be described in terms of the organizational functions. The identification and definition of various functional subsystems in an organization will in turn help in computerizing the enterprise in terms of providing complete ERP solutions.

2. It will also help in identifying the degree of perfection and co-ordination with which an organization is functioning. In this context, Gupta and Sushil (1993a) reported the existence of cyclic relationship between the MIS structure of the organization and its smooth functioning. Also, Davis and Olson (1984) stated that the structure of MIS is affected by management activity and organizational functions.

3. It will help in understanding the holistic outlook of the enterprise with various functional activities and the corresponding control applied over it. In this context, Davis and Olson (1984) stated that the overall architecture or structure of the information system provides a framework for detailed organizational level planning. Also, Gupta and sushil (1993a) stated that the major purpose of designing MIS structure is to provide the holistic outlook that can facilitate the network representation of the enterprise.

4. Most of the system analysis and system designing procedures are found to be without clarity because of the non-availability of universally accepted methodologies. However, designing MIS structure will act as the source document based on which the system designing tasks can be carried out with well-sorted boundaries of various subsystems. According to Davis and Olson (1984), further amplification of the structure is the introduction of common software. The common software solutions can be provided for each of the subsystems separately or it could be in the form of common ERP solutions for all the functional subsystems.

Issues on System Development

The major concern in System Development task revolves around kind of focus that should be improvised in terms of researching the enterprise under study. In this context, Cooper (1990) and Kwon (1987) have classified the research focus of Information system design and development into three categories called process research, factors research and political research. These researches can be carried out with the help of various models developed and validated. On methodological issues of System Development, Banbille and Landry (1989) stated that the study of Information Systems is undertaken in various ways with no unique methodological framework. Further, it is opined in the above study that the scholars working in this area should consider other disciplines as possible areas that can add to the richness and complexity of Information System studies.

Studies providing the model building methods on validating the systems developed could be identified as Mahmood and Soon (1991) developed a model that can be used to study the performance of Information Technology and its strategic impact in an Organization. As an extension of this study, Sethi and Carraher (1993) validated the model developed by Mahmood and Soon (1991). This model was extended and subsequently used by Palvia (1997) to study the impact of IT in a global strategic context. Similarly, Rajmohan and Panchanatham (2003) developed a model that can be used to find out the economic feasibility for investments in Electronic Commerce Systems. Regarding the implementation aspect of MIS, Rajagopal (2002) stated that the implementation of newer MIS could potentially lead to re-structuring of the entire organization and hence, he observes case study method as the suitable method for studying the implementation aspect of MIS in an Organization.

In an attempt to build Information Systems with more organizational focus, Rajmohan and Panchanatham (2000) suggested case building methodology to computerize the back office activities of share brokers and Depository Participants. However, Benbasat et al (1987) have opined that case study is suited for research in Information Systems, if the problem identified has more orientation towards organizational issues rather than the technical issues. Also, it is identified that the case study is employed by the researchers to solve the problems pertaining to a specific organization and hence this methodology cannot be generalized for all types of research in Information Systems.

Regarding the traditional System Development Life Cycle (SDLC) approach, Xu (1992) stated that there exist a mismatch between the IS Development methods and the system to be built. Further, its opined in the above study that SDLC could further be improved by introducing a new framework to Information System Design. Thus, this study reiterates that the new framework should be built upon the system paradigm consisting mainly of the concepts of systems, subsystems, and dimensions matching appropriate methods to systems types and characteristics. Regarding the Object-Oriented approach for system development, Shounhoung Wang (1997) stated that the methodology of Object-Oriented Analysis for Information System Development is far from mature. Further, its opined in this study that a separate research is required to investigate an extension of the Object-Oriented approach usable at macro level particularly in the context of ERP systems.

The methodology named as Unified Approach for Information System Development given by Ali Bahrami (1999) has used simple Business Process modeling using UML activity diagram. In similar vision, Jacobson et al (1995) proposed two methodologies called OOBE (Object Oriented Business Engineering) and OOSE (Object Oriented Software Engineering) that can cover the entire life cycle of the system development. But both these methodologies rely heavily on CASE tools. "The availability of automated support tools helps the programmers and system analysts concentrate on the truly creative part of the job and spend less time worrying about mundane parts of the job". (Yourdon, 1989) However, Sadahiro et al (1995) stated that the success or failure when introducing the CASE method largely depends on management factors like developers maturity and the resources under the utility.

In a remarkable shift towards defining system design methods, Booch et al (1997) proposed a methodology that categorizes system development process into macro development process and micro development process. This study mentions 'design of system architecture' as third step in any macro system development process consisting of five different steps. The terms system architecture and system structure were interchangeably used by Gupta and Sushil (1992) when they proposed a methodology for structuring the information flow in the Large Scale Systems (LSS). In the methodology proposed by them, MIS Structure for Large Scale Systems is represented as the network of only Information units and Decision units with no consideration for process aspects in the system.

The conceptual articles of Ackoff (1967) and Dearden (1972) have emphasized the fact that the design of MIS should be compatible with the structure and process of the organization in which they are embedded. In similar vision, Gupta and Sushil (1992) stated that it would be much easier to achieve a fit of MIS with the organizational structure, if both are taken up for simultaneous design. The above study observes that the design of structure or architecture aims to achieve fit between the form and the context. Forming the context of MIS is the outcome of design efforts as 'MIS architecture' that can provide a holistic view of the system. In this context, Gupta (1990) stated Architecture or structure as Design problem in MIS development.

Problem statement

The review of different methodologies and related literature of MIS reveals the fact that the MIS structure or architecture is required for all macroscopic System Development approaches including Object-Oriented approach and CASE (Computer Aided System Engineering) based approaches. Thus, it is identified that the MIS structure is an important link between the application as well as implementation aspect of the Information System and the development of the same for a specific Business establishment. Hence, design of MIS structure for various Business Models can be considered as potential research problem in making entirely a new ERP product. However, inadequacy of comprehensive methodology to design MIS structure of different business models is visible through various literatures. In this context, a need is felt to develop the methodology that can help in designing the MIS structure for various business models as prelude towards ERP system development. Hence, the following are taken to be the objectives for this qualitative study.

1. To provide the holistic view of the entire system (i.e) the business model under consideration as network, with various information units, decision units and the processes.

2. To help in identifying the various subsystems in the business model under consideration.

3. To help in identifying the various business processes that can be selected and improvised in terms of BPR(Business Process Re-engineering).

Proposed method for Designing MIS structure

Step-1

The first step in designing the structure of MIS should concentrate on establishing the relation ship between the various organizational elements and the various activities in the business model. This can be achieved by formulating the matrix consisting of identified activities and the various positions corresponding to each identified activities. This method of formulating the matrix, was proposed by Kirchgessner (1980) and he suggested interview method for collecting the information regarding activities and the positions in the organization. But, before proceeding with the interview schedule the formal documents like organization chart can be reviewed. Interview method will be more suitable if the study is carried out in a single organization, but if the information is required to be collected from the group of similar business establishments, then questionnaire method can also be followed. The Matrix developed at the end of this stage of the design process will be like the one shown in the figure-II.

Figure- II: Showing the matrix of positions and activities

Related activities	Position 1	Position 2	Position 3	Position 4	Position 5
Activity 1.	RC11	RC12	RC13	RC14	RC1N
Activity 2.	RC21	RC22	RC23	RC24	RC2N
Activity 3.	RC31	RC32	RC33	RC34	RC3N
Activity 4.	RC41	RC42	RC43	RC44	RC41
Activity N.	RC21	RC21	RC21	RC21	RCNN

In figure – II, the organizational elements like various positions are taken in the columns of the matrix. The various organizational activities are taken in different rows of the matrix. Inside the cells of the matrix the various relationship codes (RC11 to RCNN) are give. Kirchgessner (1980) suggested set of relationship code that can relate the position and the activity in an organization. They are " (a) General responsibility (b) Operating responsibility (c) Specific responsibility (d) Must be consulted (e) May be consulted (f) Must be notified (g) must concur". These sets of relationship codes can be considered for designing the interview schedule or a questionnaire, required to collect the information for the construction of matrix. A similar type of matrix was proposed by Gordan.B.Davis (1984) with Operational control and Management control taken in the rows and various activities taken in the columns. He adapted this method to mention the different functional sub-systems in an organization.

Step – II

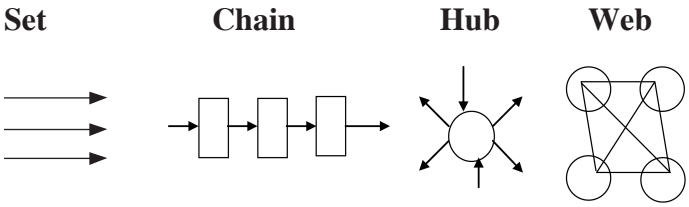
The matrix developed in the step – I, will represent the static model of the organization where the process will be either a completed one or a non-starter. To over come this inadequacy in the designing process, the tool developed by Hendry and Ludo (1999) named Organigraphs can be used to represent the dynamic model of the organization. This drawing tool developed by them will help in representing the organization with different ongoing processes. Based on the details generated from the stage –I of the design process, the Organization can be represented as the model with set, chain, hub and web.

Symbols used in organigraph:

The symbols used in the Organigraph namely set; chain, hub and web are shown in the figure-III and

they can represent the different basic forms of organizing.

Figure III showing the symbols of Organigraph

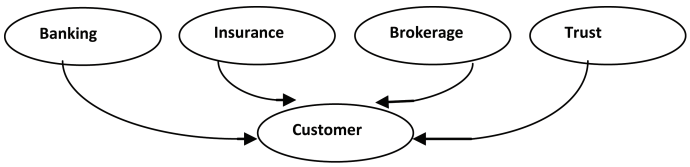


According to Hendry and Ludo (1999) every organization is a set of items, sharing independently or collectively, the common organizational resources and those set of items include people, machines and finished products. The symbol chain is used in the organigraph to represent the sequence of events and they can help in clarifying and systematizing the many complex process that constitutes the business The symbol hub is used to represent the coordinating centers in the business. Hub depicts movement to and from one focal point. The symbol web can be used to represent the interrelated connectivity between different hubs.

Organigraph and dynamic system modeling

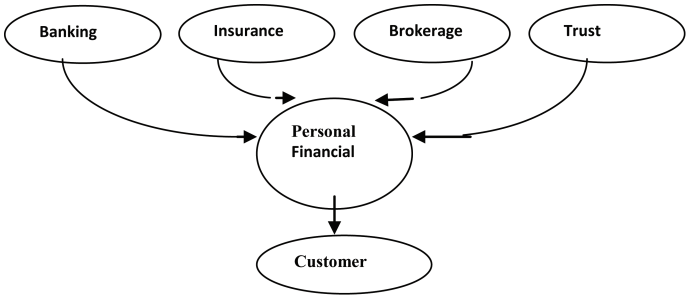
Hendry and Ludo (1999) demonstrated the flexibility of Organigraph with 3 different process models for the same banking corporation as shown in the figure iv, v and figure vi

Figure IV



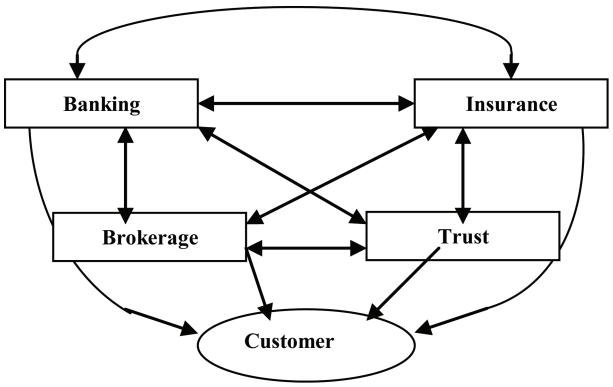
In the first possible process pattern shown in the figure IV. The organigraph depicts the bank's original structure, where each division with different member sets operates independently and approaches the customer independently.

Figure V



In the second possible process pattern, shown in the figure V, the organigraph depicts one strategic option that all divisions converge on financial advisers acting as hub and he can approach the customers in an integrated way.

Figure VI



In the third possible process pattern shown in the figure VI, the representatives from each business, work cooperatively in the pattern of web but, approaches the customer independently. Thus, the organigraph can be used to represent the specific business model with various possible process patterns. Hence, at the end of the second step of the design process the designer can identify the macroscopic view of the business organization as a business model with different possible process patterns. This will help the designers to develop a list of key business processes in the organization under study.

Step III

The details generated out of the first two steps of the design process will help in identifying the various process and function based subsystems in the business organization under study. However, Hassan Gomma (1989) stated the seven criteria to identify the subsystems. According to him, a subsystem may satisfy more than one of these criteria. They are given as follows.

1. **Functionality**.A sub system performs a well-defined function or closely related group of functions. The data traffic between these functions may be high, so that structuring them into separate subsystem would potentially increase system overhead.

2. **Server**. This subsystem provides the service. It responds to request from client subsystems. It does not initiate any request. Frequently the server provides services that are associated with a data store.

3.**Agent**. An agent subsystem provides an indirect service. In order to perform the service, it has to make requests of other subsystems. Thus, it acts as an intermediary between a client and a server.

4. **Proximity** to the source of Physical data. This ensures fast access to the physical data and is particularly important if data access rates are high.

5. **Localized control**. In some cases the subsystem performs a specific site-related function. Often the same function is performed at multiple sites. Each instance of the subsystem resides on a separate node that provides greater autonomy and local control. Assuming a subsystem operates relatively independently of other nodes, then it can be operational even if nodes are temporarily unavailable.

6. **Performance**. By providing a time critical function within its own node, better and more predictable performance can often be achieved

7. **User interface**. With the proliferation of workstations and personal computers, a subsystem providing a user interface may run on a separate node, interacting with subsystems on other nodes. A user interface subsystem performs an actor role."

Based on these criteria, the designer can identify the various subsystems in the business organization under study. This will help in disintegrating the system into key subsystems so as to facilitate system development in modules within the holistic and integrative framework provided by overall MIS structure of the system under consideration. This method of disintegrating the system into subsystems and then integrating all the subsystems inside the single framework namely MIS structure was adapted by Gupta and Sushil (1990). Hence, at the end of the third step of the design process the designer must be able to generate the details of various subsystems in the system under the study.

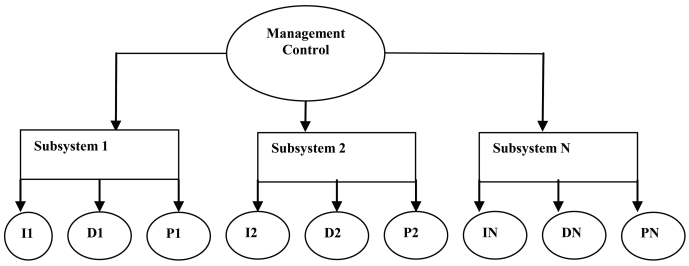
Step-IV

The details generated at the end of the third step of the design process namely the different subsystems can further be structured and analyzed with the conventional tools for structured analysis like DFD (Data Flow Diagram), STD (State Transition Diagram), Process Flow Charts and Data Dictionaries. In this step of the design process, each identified subsystem should be considered individually for further structuring and analysis. At the end of this step of the design process, the designer should be able to find out the complete list of Subsystems, Information units, Process units and possibly the Decision units all within the holistic framework of MIS structure.

Step-V

The details generated at the end of the fourth step of the design process namely the list of Subsystems (1,2 and N), Information units (I1,I2 and IN), Process units (P1,P2, and PN) and Decision units (D1,D2,and DN) can now be represented diagrammatically as network of different units under the centrally controlled component namely 'Management Control'. This type of network representation will provide the structure of Management Information Systems as shown in the figure vii

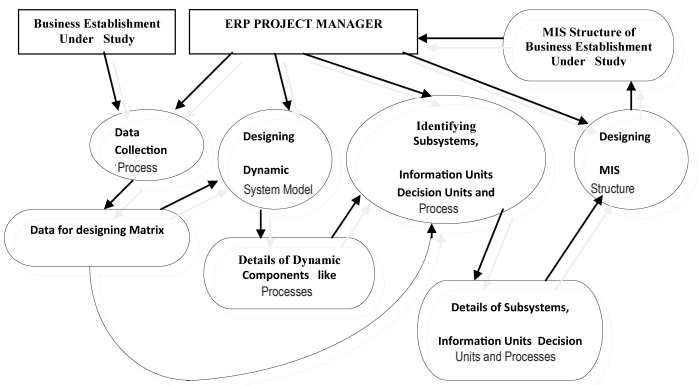
Figure VII showing the structure of MIS with different subsystems



Conclusion

The MIS structure shown in the figure VII will provide the holistic view of the entire business system under study. This will also act as the blue print for computerizing the various Information Units and Decision Units. Also, the processes identified in the various subsystems can be analyzed for possible Re-engineering. The various steps stated in this work are developed as Model designed with conventional Data Flow Diagram (DFD). This model is shown in the figure VIII, which could act as initial reference position towards creating new ERP products with specific Industry focus.

Figure VIII Showing Model for Designing MIS structure



References

Ackoff R.L(1967), "Management misinformation systems", Mgt.Sci., 14,4 147-156.

Ali Bahrami(1999),Object Oriented Systems Development., New Delhi: Irwin McGraw-Hill Publishing Company Limited

Banbille. C and M.Landry(1989), " Can the field of mis be disciplined?", Communications of the ACM 32(1),1989, pp 48-60.

Benbasat.I, D.K.Goldstein, and M.Mead(1987), "The case research strategy in studies of information systems", MIS Quaterly 11(3) pp.369.

Booch,Grandy; Jacobson,Ivar; and Rumbaugh,James (1997). The Unified Modeling Language, Notation Guide Version 1.0 January.

Cooper(1990),"Information technology implementation Research: a technological diffusion approach.", Management Science 36(2).pp.123.

Dearden J (1972), "MIS is a mirage", Havard Business Review,50,1, 90-91.

Gordan.B.Davis (1984).Management Information Systems :Conceptual foundations, Structure and Development. Singapore: McGraw-Hill Book co

Gupta M.P and Sushil (1992) , " Methodology for Design of Mis Architecture(INFLOS) " Information Systems Research 1992

Gupta M.P (1990), Modellig and Analysis of Management Information System Architecture at National Level, : Ph.D . Dissertation, I.I.T .Delhi.

Hassan Gomaa(1989), " A Software Design Method for DistributedReal – Time Applications " , The Journal of Systems and Software 9, 81-94(1989).

Hendry Mintzberg and Lundo Van der Heyden(1999), " Organigraph: Drawing How Company Companies Really Work" Havard Business Review, September-October 1999.

Jacobson, Ivar, Ericsson, Maria; and Jacobson, Agneta (1995),:The Object Advantage Business Process Reengineering with Object Technology. Reading, MA: Addison-Wesley,1995.

Kwon.T(1987), "Unifying the fragmented models of information systems implementation,in: Boland,Hirschheim(Eds.)", Critical Issues in Information Systems Research,Wiley,New York.

Mahmood M.A and S.K.Soon(1991), " A comprehensive model for measuring the potential impact of information technology on organizational strategic variables", Decision Sciences 22(4),1991, pp869.

O'Brein (1999).Management Information Systems : Managing Information Technology in the Internetworked Enterprise. New Delhi:Tata McGraw-Hill Publishing Company Limited

Palvia.P(1997), " Developing a model of the global and strategic impact of information technology.", Information and Management 32, 1997, pp 229.

Rajagopal.P.S(2002), "An innovation-diffusion view of implementation of enterprise resource planning (ERP) systems and development of a research model", Information and Management 40 pp87-114.

Rajmohan.P and PanchanathamN (2003).,"Economic Feasibility model for Investments in Electronic commerce systems " , Annamalai Economic Papers Vol.4,2003 pp.219-233.

Rajmohan.P and N.Panchanatham (2000)."New strategies for Depositories". Indian Management,Vol.12,pp-64-66.

Sahiro Isoda,Shuichiro Yamamoto,Hiroaki Kuroki, and Atsuko Oka(1995), "Evaluation and Introution of the structured Methodology and a CASE Tool",J Systems Management 1995; 28:49-58.

Sethi.V and S.Carraher(1993), "Developing measures for assessing the organizational impact of information technology: a comment on Mahmood and Soon's paper", Decision Sciences 24(4), 1993.pp.867.

Shounhoung Wang(1997), " Modelling information architecture for the organization", Information and Management 32 pp303-315

Thomas E. Kirchgessner(1980), " Structured Analysis" Journal of Systems Management, April,1980

Wagner Erica,L, Susan V.Scott and Robert D.Galliers (2006)," The 'Creation of Best Practice' Software: Myth, Reality and ethics", Information and organization 16(2006).pp.251-275.

Xu.L.D(1992), "Systems Characteristics in Information Systems Design", Systems Research 1992.

Yourdan Edward(1989): Modern Structured Analysis: New Delhi, Prentice Hall of India Private Limited(Third printing,2003).

Dr. Rajmohan P.
Assistant Professor of IT,
Skyline University College,
University City of Sharjah
Email: p_raj_mohan@yahoo.com