A VIABLE SYSTEM APPROACH TO TACKLE COMPLEX ENTERPRISE SITUATION FOR SISP

Rodina Ahmad, Mohammed B. Yusoff
Faculty of Computer Science and Information Technology
University of Malaya
50603 Kuala Lumpur
Malaysia
Email: rodina@um.edu.my

ABSTRACT

Enterprise information model (EIM) development within Strategic Information System Planning (SISP) is crucial to provide comprehensive information requirements of the enterprise to assist in the accurate identification of Information System (IS) applications in order to realize the enterprise's goals. One of the issues for the development of EIM is to understand, capture and represent core enterprise information requirements. This issue has been aggravated in a complex and uncertain enterprise situation in which multiple players are involved dynamically and they might have varying activities and expectations. This kind of situation demands an enhanced approach particularly in determining enterprise requirements and providing linkage for IS requirements identification. As the result, this research proposes an approach that uses Viable System Model (VSM) as an organizational instrument to facilitate the information determination process. Concepts from VSM, strategic context and enterprise systems are used as important dimensions for the proposed process. In brief, the approach was found to be useful as a means to elicit enterprise requirements and to provide structure to the development of an enterprise information model. It also offers several beneficial features such as inherent reengineering ability, multi-level analysis capability and prescriptive ability.

Keywords: Strategic Information Systems Planning (SISP), Enterprise analysis, Viable System Model (VSM).

1.0 MOTIVATION FOR THE RESEARCH

Hardcore Poor Development Program (HPDP) is one of the special programs implemented by the Malaysian Government to help the identified poor people in Malaysia. It is developed by the government to plan for various social and economic projects to provide the essential needs of the poor in the country. Its main objective is to provide ways to enable the poor to become economically and socially independent. Even though its objective is simple, its planning and implementation require various efforts from different players such as the ministries, governmental agencies, non-governmental bodies, individual groups and private organizations. These players have their own strength, target and expectation. Moreover, the players may contribute in a variety of means and forms. At the same time, the targeted hardcore poor come from various backgrounds and education, live in dispersed geographical areas and have different needs. At present, six of the states in Malaysia had been identified to contain most of the poor families in the country and twenty districts had been identified of having more than 70% of those registered poor families.

The situation above can be regarded as an enterprise that is characterized as complex and uncertain. It has much similarity with the characteristics outlined by Mumford [1] which include:

- The uncertain boundary between the referred situation and its environment
- Make up of individuals, groups or organizations that have roles and positions that are not well determined.
- May have components or parts that may be seen as situation and the components may have relationships with one another that may change in time.
- May not have a structural form that is predetermined, or the form may change in time or the form may not be apparent.

The second part of this section gives the explanation of the basic concept of Strategic Information System Planning (SISP) and the enterprise information model. SISP had been defined by Galliers [2] in the early days of its use as a "management task which is concerned with integrating information systems considerations into the corporate planning process". As the role of Information Systems (IS) changes and evolves in the organisation, SISP changes as well. Similarly, another definition was given by Lederer and Sethi [3] as "the process of identifying a portfolio of computer based applications that will assist an organization in executing its business plans and realizing its business goals". As time goes, the expectation and the nature of SISP evolves according to the changing role of IS in organisational enterprise and due to its potential impact on the strategic development.

SISP for the present post-Net era creates higher demands on enterprise management to ensure successful employment of information and communication technology to assist them in executing and realizing their business goals. Even though it has been perceived as one of the most established development needs and challenges for organisations for more than two decades, it is not an easy task [4]. It is considered a complex activity that relates to many organisational issues [5, 6]. The activity does not primarily deal with technology alone but involves more on understanding the organisational business environment and business strategies in order to derive the most appropriate IS requirements. One of the means to ensure proper requirements of the organizational situation are analyzed and represented well is through the development of enterprise information model. In other words, enterprise information model had been proposed to be produced during SISP process to represent the enterprise's high-level requirements [7, 8]. Its uses include:

- giving an overall picture of the enterprise and acting as a communication and planning tool
- recognizing crucial changes to enable the enterprise to meet its objectives
- identifying innovative opportunities for the benefit of the enterprise
- identifying critical applications to realize the enterprise' objectives.
- defining the critical information entities

2.0 EXISTING ENTERPRISE ANALYSIS APPROACHES

A study performed by the authors on eight well-known enterprise analysis approaches within the SISP literature indicates a few shortcomings that should be improved to ensure the achievement of the objectives of SISP. The shortcomings are summarized as follows:

a. Lack of mechanism to provide structure and guidance to determine enterprise requirements of a complex enterprise situation

Available approaches provide very few specific mechanisms to address complex and uncertain enterprise situation in which multiple independent players are involved. Most of the reviewed analysis approaches assume that the enterprise situation is well-defined with established business units and identifiable users who have well-defined roles and positions within the enterprise. The approaches are mainly dependent on users or existing business strategies within the established business units as input for the enterprise requirements. The approaches are inapplicable in situations that may not have well-defined boundaries or the players or groups involved may not have well-determined roles and positions or the players may be involved in dynamic relationships.

b. Lack of a concrete guidance for enterprise information model development

Since the process of scanning or analysing an enterprise situation within SISP is critical for the success of SISP, the process should produce a solid and useful output to facilitate further identification and development of IS projects. Many of the analysis approaches examined do not support the development of a specific information model. SISP methodology such as Business System Planning (BSP) uses Entity-Relationship (ER) modelling technique to model the enterprise data requirements. Specifically, BSP offers the definition of the information model which is very limited to

data and process representation in the form of an ER model and data/process matrix [9]. From the reported experience of the use of methodologies that support the development of enterprise information model, the surveyed organizations criticized SISP methodologies to be too detailed, time consuming and expensive in terms of enterprise model development [10]. In addition, the resulting enterprise model is said to be not useful for further IS developments [5] or there exists a semantic gap between the output of the SISP process with the subsequent system analysis process. This might be due to the differing paradigm used during the enterprise planning process with the subsequent analysis process. The theory of strategic information systems planning by Lederer and Salmela [6] puts forward that an IS plan that is useful produces greater plan implementation. It also implies the importance of using more consistent analysis concepts from the planning process of capturing the enterprise information requirements, developing an information model and further mapping them to IS projects. It will be beneficial if the outputs from the planning process can provide useful inputs to the systems analysis process for specific IS project developments.

c. Lack of sound theoretical basis

Most of the examined approaches are not based on any sound theoretical basis to provide the holistic understanding of enterprise requirements. The typical usage of organisational models in the approaches is to increase human understanding in complex matters such as the enterprise and its interactions. In the context of SISP, enterprise needs to consider comprehensively the components of the internal and external environments to ensure a full understanding of its situation. Moreover, not only business strategies can influence and be influenced by the IS strategies. The organisational strategies which include the focused objectives, organisational design and the choices it makes in defining, setting up, coordinating and controlling its work processes, can exert the same influence [11]. It seems logical that an approach that can provide a comprehensive enterprise understanding from the three angles of organisational strategy, business strategy and information strategy would be much more useful in assisting the enterprise to face the global era of unpredictable changes. Apart from focusing on aligning the IS strategies to the business strategies, efforts should be made to obtain an appropriate enterprise understanding that can provide positive influence on the development of improved information and IS strategy. The application of an organizational theory or some other established sciences on organization to provide a deeper understanding of the enterprise situation is obviously desirable and justifiable.

d. Lack of a comprehensive methodology that covers the information determination and modelling within SISP to cater for future needs

Changing enterprise requirements are the norm currently. Hence, there is a need to focus not only on the present requirements but also the requirements of the immediate future. This is not catered for in most of the reviewed techniques. The scope of requirements should not only focus on the main operational activities of the enterprise but also should cover the managerial activities. A wider scope of analysis that includes all the essential activities of the enterprise such as planning and coordinating, will enhance the enterprise planning capability in identifying an extensive variety of IS applications that can instigate and sustain the enterprise successfully. This has to be reflected in methodologies for enterprise analysis particularly in identifying and relating the requirements of the enterprise to its IS and information requirements. Existing techniques seem to stress on identifying enterprise requirements and its IS requirements. Very few continue to identify further information and data requirements for the enterprise which will be very beneficial to bridge the semantic gap from the planning analysis to business analysis and systems analysis.

The conclusion that can be made from the examined techniques and approaches is that they are mainly deficient in the ability to address complex enterprise situations and the ability to relate the enterprise requirements to IS requirements and specifically provide sufficient detail requirements to facilitate further systems development process. Very few SISP methodologies offer comprehensive enterprise situation analysis and enterprise analysis models development [7]. Table 1 below shows the summary of the analysis made and highlights the analysed features of each technique. Subsequently, this research is directed towards addressing such deficiencies. It intends to develop an approach for strategic enterprise analysis that is based on cybernetic model namely Viable System Model (VSM) with the objective of providing a critical insight into enterprise core requirements and relates them to IS requirements. The approach will be equipped with the mechanism to handle complex enterprise situation and information modeling capability.

Table 1: Summary of the features of the existing Enterprise Analysis Approaches

FEATURE / TECHNIQUE	ADDRESS COMPLEX SITUATION	SUPPORT MULTIPLE LEVEL ANALYSIS	SUPPORT INFORMATION /DATA MODELLING	HAVE SOUND THEORETICAL BASIS	DETERMINE EXISTING REQUIREMENTS	DETERMINE FUTURE REQUIREMENTS
Critical Success Factor	**None**	*	**none**	**None**	**	**
SWOT Analysis	**None**	**None**	**none**	**None**	**	***
Process Analysis	**None**	*	**none**	**None**	**	*
Normative Analysis	**	*	**none**	**None**	**	*
End Means Analysis	**None**	*	**none**	***	**	**
Business Strategy Analysis	**None**	**None**	**none**	**None**	*	**
Value Chain Analysis	**None**	**None**	**none**	**None**	*	**
Porter Five Forces	**None**	**None**	**none**	**None**	*	**

*** -- HIGH EMPHASIS	** -- MEDIUM EMPHASIS	* -- LOW EMPHASIS	none—NO EMPHASIS

3.0 VIABLE SYSTEM MODEL

Viable System Model (VSM) is an organizational model based on cybernetics. Cybernetics is defined as the study of communication and control in man and machine [12, 13, 14]. The objective of cybernetics is to understand and formalize the underlying principles of systems such as living system and to employ feedback control in order to achieve its main purpose of survival. As the result, VSM inherits basically the described characteristics of living system.

The founder of VSM was Stafford Beer. He explained the characteristics of VSM and the logic behind it [12, 13, 14]. Since its development in 1972, VSM has been primarily used as a conceptual tool to analyse and understand complex working of organisation and diagnose the effectiveness of an organisation's structure. VSM is considered versatile and has the potential to be applied in various other fields due to its abstract nature [15, 16].

VSM has upheld the concept of viability as an important characteristic which is needed by organisation to survive and succeed in its environment. Hence, organisation needs to possess the features of a viable system. Viable system is defined as a system which is able to maintain a separate existence [12, 13, 14]. To possess the quality of viability, Beer has described the required structural features in VSM. In essence, Beer uses "Law of Requisite Variety" to develop those structural features needed to support viability in organisation. This law states that the variety of controller should be equal or more than the variety of what it controls. Hence, the structure of an organisation which is formed to survive in its environment should possess the features needed to control the complexity of its environment. Interaction between organisation and its environment is considered complex and the purpose of management is to control this interaction in its best possible ways.

Beer has suggested the use of recursive structure to reduce the complexity in viable system. To study a complex organisation as a viable system, we can divide it into several systemic levels. For each systemic level of analysis, a main operational system (System One) which is mainly focused on core operation and meta-system which acts as controller or

manager of the operational system are identified. Each meta-system consists of four subsystems which are called System Two, System Three, System Four and System Five. Fig. 1 illustrates the five subsystems and the possible relationships among them which has been adapted from Beer [12, 13, 14]. The brief descriptions of the functions of each subsystem are given as follows:

- System One consists of core operational systems. System One can have several core operational units and each of them consists of main activities to support the organisation's identity and local management structure to manage the operational unit.
- System Two provides the coordination functions for System One. It intends to reduce the instability produced as the result of possible conflicts between the core operational units of System One.
- System Three needs to ensure that the organization achieve its objectives. This is done by checking the performance of the main operations against the policy set by the upper management. Briefly, System Three needs to translate the organizational policies and objectives into lower level procedures to manage the lower level operations.

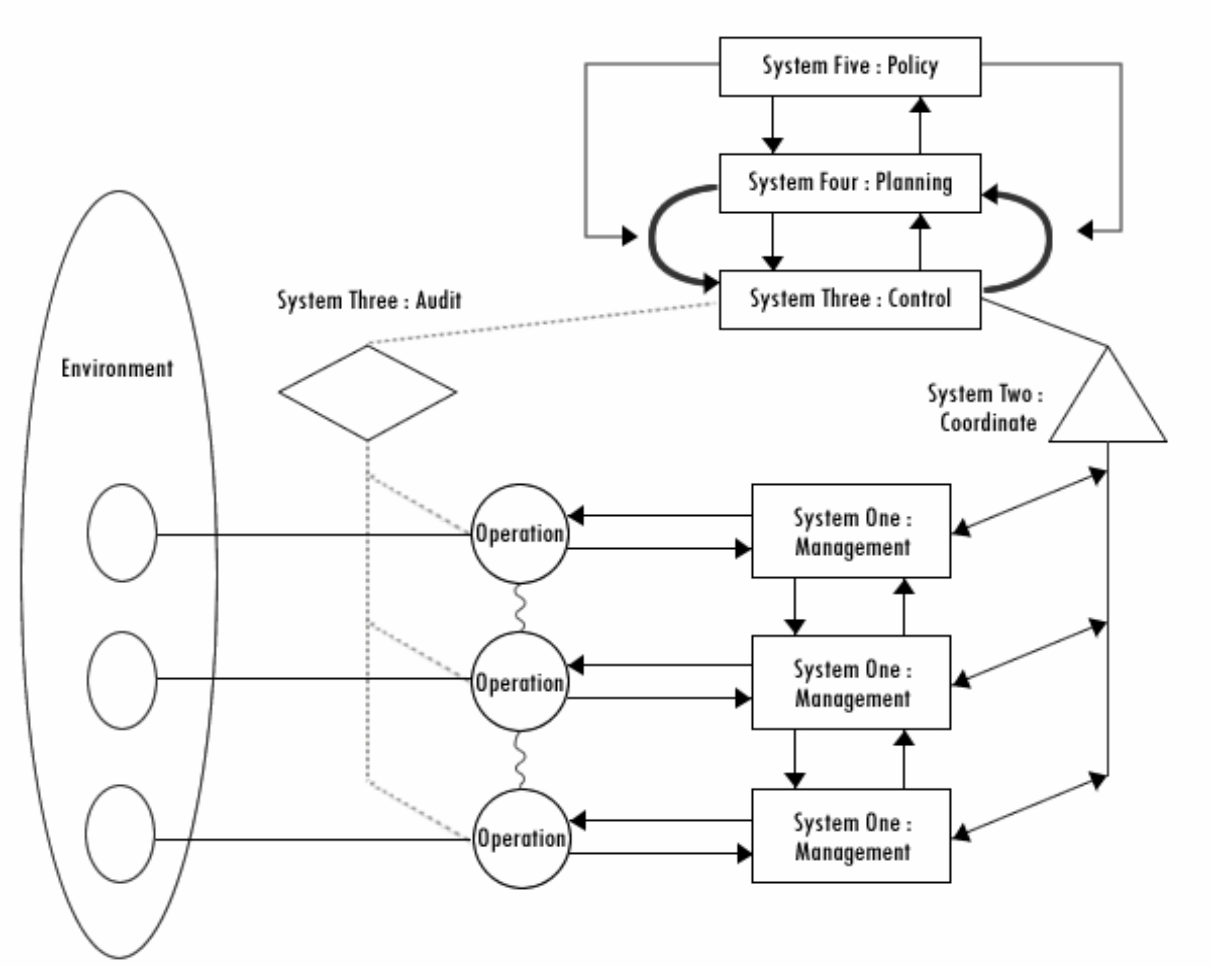

Fig. 1: Viable System Model (VSM)

- System Four reports on external development and opportunities to benefit the advancement of organization. It needs to collect and analyze current and updated information. From the analysis, it should propose new plans or changes to make the organization adaptive to external demands.

- System Five need to set organizational policies. Its main function is to balance between emphasizing System Three functions and System Four functions. This means it needs to set priorities between focusing on the internal or existing operations and looking for changes from external demands to implement new or enhanced operations.

VSM has been frequently used recently in diagnosing problems and identifying appropriate computerised information systems by IS researchers and practitioners such as Kawalek [17]. Its concepts has also been used to develop software process model [18] and in developing viable system architecture [19]. This research is a part of a wider research in attempting to apply it in information system planning (ISP) and information modelling [20].

4.0 VIABLE ENTERPRISE ANALYSIS FRAMEWORK

Viable Enterprise Analysis (VEA) framework is proposed as a means of performing strategic enterprise analysis to develop an enterprise analysis model that captures important aspects of the enterprise to assist in the process of SISP. VEA framework emphasizes on the understanding of enterprise activities and relating them to its IS and information requirements that will enable the enterprise to survive in the present competitive environments. The framework covers understanding, diagnosing and reengineering of the existing enterprise situation to produce the desired enterprise situation in order to survive in its environment. The objectives of VEA framework include: to identify critical enterprise requirements from the perspective of viability, to identify IS and information requirements based on the identified enterprise requirements, to define an enterprise-wide information model and to promote greater efficiency and effectiveness in the enterprise decision making process. The three dimensions emphasized in the framework are:

a. Viability

Viability is defined as the ability of the enterprise to survive and maintain its identity [1, 2, 3]. This ability includes ensuring that the main operational activities are well performed and also making sure that the essential managerial activities are well implemented. The ultimate goal of viability prescribes that a viable organization must focus on the core operational, coordinative, control, planning and decision making activities which are System One, System Two, System Three, System Four and System Five. These five functionalities are used as the main guides to elicit and determine the enterprise requirements and their corresponding IS requirements.

b. Enterprise System

This second dimension emphasizes that an enterprise situation must be perceived as a dynamic and open system. It is a complex and active entity that is able to create influences and be influenced by internal and external environments. Two main elements of an enterprise system that can be managed and shaped are the information and human activities. Human activities are activities that are performed by human to serve certain purposes. By understanding and identifying critical human activities that support the purpose of the enterprise, we are able to understand critical requirements of the enterprise that will form enduring requirements of the enterprise. This kind of requirements is the foundation to further understand the IS and information requirements and to plan for IS applications development.

c. Strategic Context

One of the important steps in SISP is strategic situation analysis. In this context, VEA plays its role within SISP. The purpose of strategic situation analysis is to gather relevant information so as to enable the formulation and evaluation of strategies. In this research, strategy refers to the managerial guidelines or statements which serve decision-making. To ensure successful implementation of SISP, certain environments must be analysed and understood to provide significant inputs to the process. Four of the recommended environmental inputs [21] are the external business environment, internal business environment, external IS environment and internal IS environment. Subsequently, this framework emphasizes on analyzing relevant environments that can provide beneficial inputs for more effective formulation of enterprise strategies as a whole.

5.0 VIABLE ENTERPRISE ANALYSIS PROCESS

Viable Enterprise analysis is defined as a process to promote a comprehensive and strategic understanding of an enterprise situation and determining its core requirements from the perspective of supporting the viability of the enterprise. It is a strategic situation analysis process that aims to understand, diagnose and reengineer the existing enterprise functions to produce the desired enterprise situation that is able to respond to its internal and external environments. It also aims to determine and model core enterprise requirements and relate them to information systems and information requirements. It sets to achieve more than strategic alignment between business strategies with the formulating IS strategies but also intends to ensure that the whole enterprise activities are supporting the enterprise purpose and are moving towards the right direction. The process includes enterprise analysis model development that can capture core enterprise requirements in terms of critical functions and activities and their corresponding information requirements which can benefit not only in the IS strategy formulation but also business and systems analysis process.

VEA process is enhanced and extended from works of [7] and Flood and Jackson [21] to specifically include the stage to elicit and model the enterprise information requirements. The whole process is divided into two parts which are viability diagnosis and information determination and modeling. Viability diagnosis involves structuring recursively the enterprise situation, identifying existing enterprise shortcomings in meeting with the prescribed functionalities of VSM, proposing beneficial changes to the existing enterprise situation to produce the situation that is able to survive to its environment. The second part involves the identification and analysis of core enterprise requirements in terms of critical functions, critical activities and information requirements. Fig. 2 shows this process. The process is delineated to consist of four phases which are:

1. Purpose and recursive structuring identification
2. Diagnosis of existing situation and recommendation for change
3. Critical functions, critical activities and information requirements analysis
4. Information modeling and representation

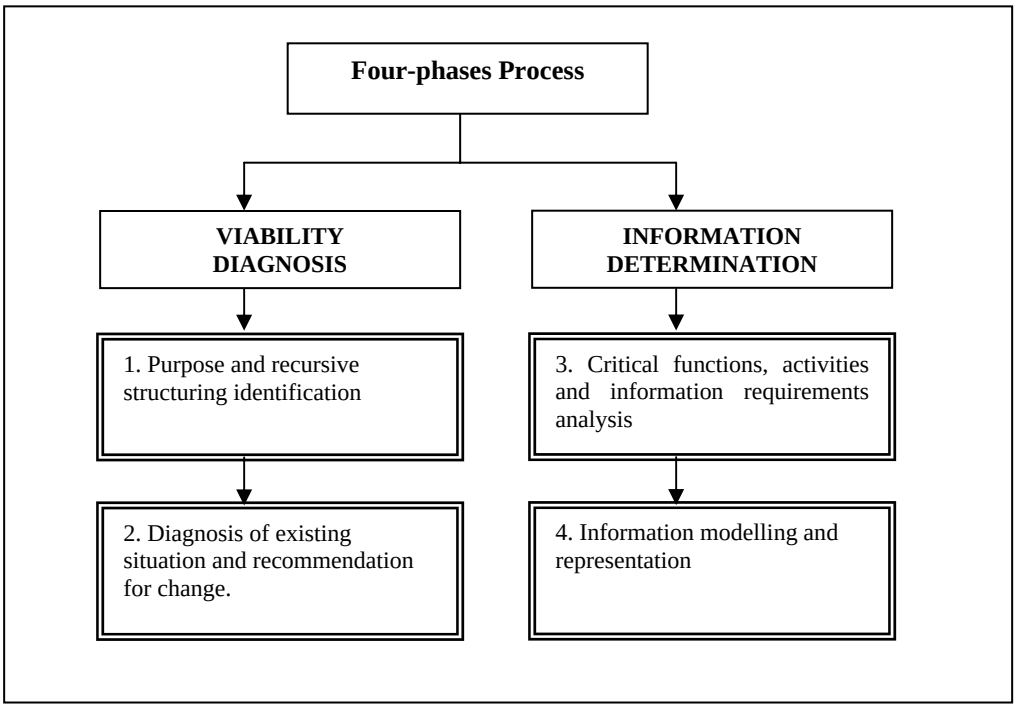

Fig. 2: The four-phase process of determining and modeling information requirements

The following subsections provide the brief explanation on each phase of the process.

Phase 1: Purpose and recursive structuring identification

This phase involves clarifying the main purpose of the enterprise situation and identifying autonomous units within the enterprise situation that can aid in the process of control and communication. Autonomous units are the independent chunk of processes that can be on its own. The basic belief from VSM is that enterprise complexity accumulates from various enterprise functions and processes. This complexity can be reduced if identification of autonomous units (in terms of its products or services offered) is performed. Each autonomous unit has full or is given full autonomy and the capacity to adapt to change. Once these autonomous units or systemic levels are determined, the analysis will be performed on each systemic level systematically. This will enable the analysis process to focus on each systemic level individually thus preventing too much complexity at any one time. This feature is referred to as the recursive mechanism which is inherent in most of the systemic approaches. The steps in modelling the recursive structure for the situation are suggested as follows:

1. Perceive the whole enterprise situation as one large autonomous unit or Systemic Level S1. Identify and elaborate its primary activities.

2. If the identified primary activities in (1) is complex or consists of too many processes, elaborate and identify further independent subunits or autonomous units that may be contained inside Systemic Level S1. Refer to the identified autonomous units within it as Systemic Level S2.

3. Repeat step 2 as many times as necessary to identify more autonomous units within each identified Systemic Level or until no further units can be identified.

4. Draw a pyramid diagram as illustrated in Fig. 3 to show the recursive relationship that exists between each systemic level with one another.

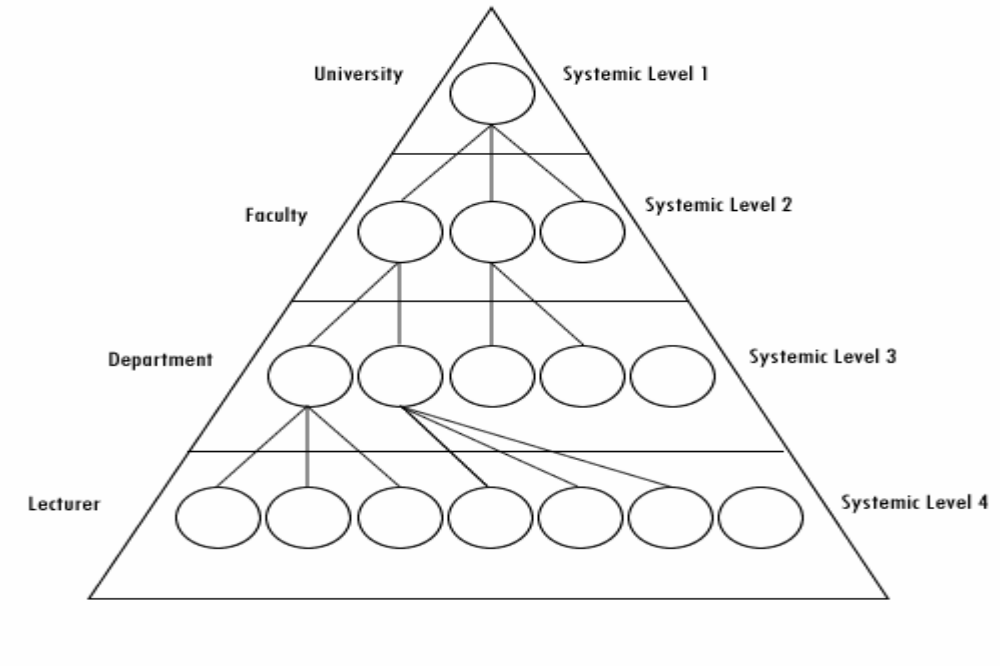

Fig. 3: An example of a pyramid diagram that shows the recursive relationship of a university situation.

Phase 2: Diagnosis of prescribed functionalities and recommendation of required functions

This phase involves examining procedural components or activities that support VSM's five prescriptive functionalities. The investigation is performed to identify activities that fulfill the required functionalities and the possible problems that are occurring. The objective of this stage is to check whether the existing procedural components or activities are adequate or satisfactory to fulfill the five prescribed functionalities of VSM. Nevertheless, this checking and diagnosis stage can be performed in a variety of ways and may not have specific output as observed from [7] and Flood and Jackson [8]. Hence, for consistency and tractability reasons, this approach assumes that an enterprise situation may already have a list of formal functions that it needs to carry out. Formal function is a descriptive statement of the responsibility or major task that needs to be performed by the assigned enterprise unit. Thus, the investigation and the diagnosis will focus on determining the adequacy of the existing formal functions in fulfilling the five prescriptive functionalities. If the diagnosed formal functions are found lacking, additional or revised formal functions can be recommended. As the result, the output from this stage will be in the form of a list of required formal functions whether existing or recommended to serve each of the functionality of the identified systemic levels. To be comprehensive, this phase also involves understanding the problems that can prevent the formal functions from being implemented. The insight will also help to determine the appropriateness of the existing formal functions.

Phase 3: Critical Functions, Critical Activities and Information requirements analysis

The purpose of this phase is to examine the critical functions which were gathered, in order to derive specific information requirements to support them. Since these critical functions specify the responsibility or major tasks that need to be done, they are generally abstract and require further clarification. In essence, critical functions that are gathered specify the main responsibilities that need to be fulfilled to ensure the working of each functionality or subsystem prescribed by VSM. To ensure the critical functions are understood within the context of the enterprise situation, derivation of their objectives, performance indicators and the critical success factors to accomplish them are recommended to be performed. The Critical Success Factors (CSF) referred to the identified areas or focused activities that can ensure the successful implementation of the critical functions. Based on these CSF, specific critical activities can be determined together with the actors of the activities. While the critical function only specifies what to do in certain situation, the critical activity includes more specific action or specifies how the function will be implemented. Subsequently, based on the identified critical activities, information resources that are perceived to be useful to support those activities can be derived.

Phase 4: Modeling and Representation in Analysis models

After the critical functions analysis in phase 3, the core components from the outputs need to be modeled and represented. The developed model is referred to as Viable Analysis Model(ViAM) which is one form of enterprise model. Our research proposed ViAM which mainly consists of three main elements. The elements are critical functions, critical activities and information resources which are illustrated in Fig. 3. Since the focuses of the approach are to enable the model to be tracked, sustain and manage the information requirements of the rapidly changing requirements and to support the identification of essential IS applications for the enterprise, the selection of key elements to be included inside the model is critical. The approach emphasizes the need to select the invariant elements that are less-prone to changes. Nonetheless, it is important as well to capture the information resources as they provide the links to the development of information and database applications. As the result, the approach chooses the critical functions as the core elements of the model together with their supporting critical activities and the required information resources to be represented in Unified Modeling Language (UML) diagrams. Nine graphical models which made up ViAM are suggested to be developed for representing those important elements. Table 2 summarized the nine models.

6.0 CASE STUDY

Viable Enterprise analysis is performed on the initial case study which is the Hardcore Poor Development Program (HPDP) to test for its practicality and usefulness. Four systemic levels are identified within HPDP. They are Federal, State, District and Agency. Within each systemic level, focus analysis is done to identify the formal or critical functions for each of the five prescriptive functionalities of Operation, Coordination, Control and Monitoring, Planning and Policymaking. System checklist which contains detail questions and tables are provided to guide the process of

diagnosis. Essentially, the checklist provides questions to identify procedural components or activities that are supporting the five functionalities. Similarly, the checklist provides a list of information categories and forms that can be used as guidance to identify information resources that are beneficial to support the identified critical activities. In this particular case, support means either the information resources are produced or are the input to the implementation of the critical functions. The following paragraphs briefly explain the analysis that had been done for HPDP.

Table 2: Nine graphical models to represent core output from Viable Enterprise Analysis

Viability Perspective	**Information Systems Perspective**	**Information Resource Perspective**
SL Model Shows Enterprise Systemic Levels	*CA Model* Shows process-view of critical activity	*RRS Model* Shows relationship of resources between systemic levels
FCF Model Shows Functionality –to – Critical Functions	*CAS Model* Shows structuring or decomposition of critical activities	*RRF Model* Shows relationship of resources between functionalities.
CFCA Model Shows Critical Function to critical activities	*CAR Model* Shows the resources needed for a critical activity.	*RRW Model* Shows relationship of resources within a functionality

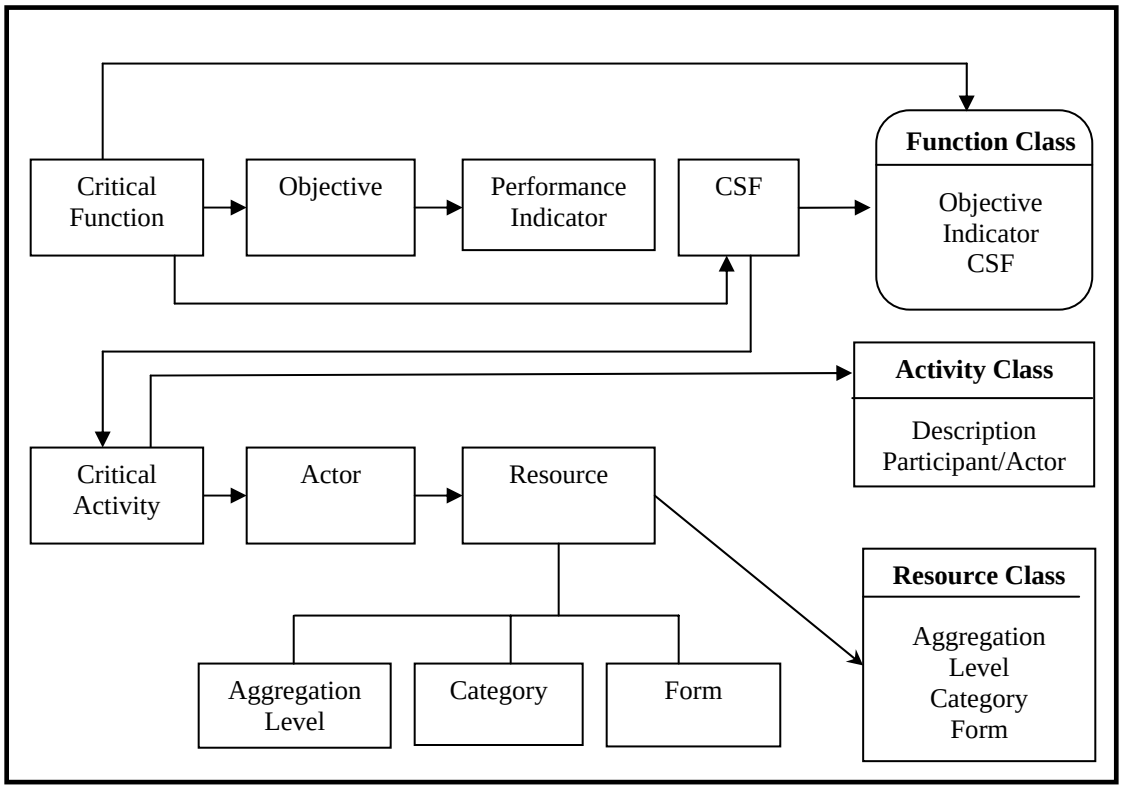

Fig. 4: The core output from Viable Enterprise Analysis

Phase 1: Purpose and recursive structuring identification

In this situation, to ensure the comprehension of the whole situation, the identification of transformation, actors, suppliers and clients are performed. The identification of systemic levels or autonomous units is carried out and four systemic levels are shown in Fig. 5.

Transformation: The major transformation is to plan, design and implement various projects to assist the identified poor group to break out from their poverty line. In this particular context or at the point of the research, the poverty line is defined as the household who is earning below RM425.

Actors: The actors or implementers are from various governmental and non-governmental bodies, private bodies as well as social agencies and societies such as village committee and volunteer groups.

Suppliers: The main supplier in terms of financial support is the governmental agencies. Other private and social agencies also provide expertise, effort and financial contribution.

Clients: The benefits will go to the identified registrants who are categorized into the poor group or who earn below the poverty line.

Phase 2: Diagnosis of existing situation and recommendation for change

Diagnosis needs to be performed for each systemic level to identify missing support for the prescribed functionalities. For example, within Federal systemic level, list of formal functions are gathered and categorised into Operation, Coordination, Control and Monitoring, Planning and Policymaking functionalities. Diagnosis in terms of the adequacy of the gathered formal functions was performed by having a discussion with HPDP management people. The missing functions that are perceived to be important are recommended. The list of formal functions gathered for Federal systemic level after the recommendation for policymaking functionality is shown in the following table.

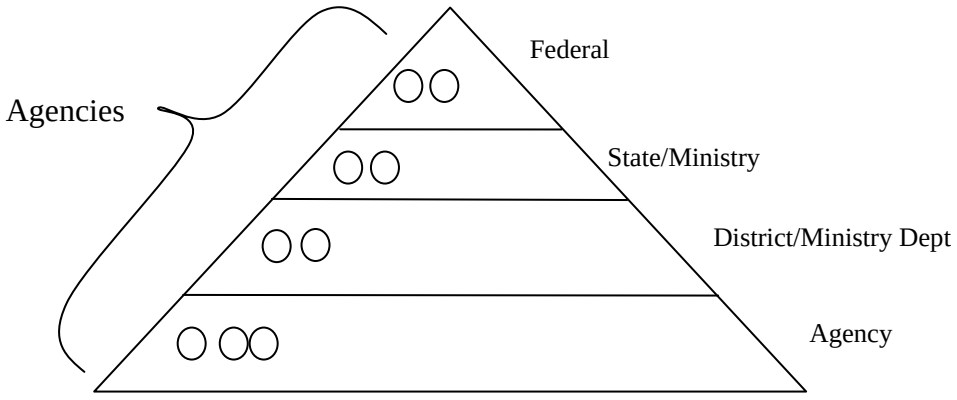

Fig. 5: The identified systemic levels for HPDP

Table 3: Critical Functions for System Five of Federal

Systemic Level	**VSM Functionality**	**Functions (existing, revised and recommended)**	**Actor/Implementor**
Federal	5	1. Set the direction, objectives and strategies for HPDP	Poverty Eradication Section (PES) Committee
Federal	5	2. Prepare the guidelines for planning and implementation of HPDP projects	PES committee and invited experts
Federal	5	3. Review the existing project implementations	PES steering committee

Phase 3: Critical Functions, Critical Activities and Information requirements analysis

Each formal function has to be analyzed in order to understand its objectives, CSF, performance indicators and the possible critical activities to support and implement it. Subsequently, information resources which are perceived as important to support them are identified as well. Table 4 shows the analysis of one of the formal or critical functions of Federal systemic level for policymaking functionality. Table 5 shows the output of the refinement of the identified critical activities as well as the potential information resources to support those activities. It is advisable to perform the identification and the refinement of the critical activities with the enterprise users to get direct feedback from them and to provide the validity of the activities.

Phase 4: Modeling and Representation in Viable Analysis models

Several graphical models from Table 2 are produced to represent the critical information extracted from the viable enterprise analysis. Fig. 6 shows the three critical functions to support policymaking functionality for System Five**.** Fig. 6 is the Functionality to Critical function model (FCF). It mainly represents the identified critical function to serve System Five which is the policymaking functionality. From the perspective of viability, these three functions are the essential functions and should be the focal point for support. Fig. 7 shows the two critical activities in implementing SetDirection critical function of System Five. Fig. 7 is the Critical Function to Critical Activity model (CFCA). It represents the identified critical activities to implement the critical function of SetDirection of System Five at Federal level. Fig. 8 shows the identified resource objects to support one of the critical activities at System Five of Federal level. Essentially, the diagrams enable the representation of critical functions, critical activities with their corresponding information resources. The information resources and its categories are adapted from Wang [22, 23, 24]. The information categories ranges from the most abstract such as goal and cognizance, to the most concrete such as physiomorphic, procedural, note and instrument. The physiomorphic category enables the representation of information about physical objects, human staff and other tangible enterprise resources. In traditional SISP, attention is paid only to information object of this category. During this analysis, it is observed that most of these physiomorphic information classes are derived or needed to support operational and coordination functionality. Essentially, the critical activities and information resources identified will form the basis to identify key IS applications for the enterprise situation.

Table 4: Analysis of the Critical Functions for System Five of Federal

Critical Functions	**Objectives**	**CSF**	**Indicator/ Measure**	**Critical Activity**
1. Set the direction, objectives and strategies for HPDP.	To ensure direction for HPDP.	Clear, flexible and innovative policies. Get input from social and economics experts.	Number of successful projects.	Acquire solid understanding on hardcore poor group. Form qualified committee to identify HPDP strategies.
2. Prepare the guidelines for planning and implementation of HPDP projects.	To provide guidelines for implementing agencies.	Produce clear and practical guidelines.	Clear Guidelines.	Form qualified committee to produce guidelines.
3. Review the existing project implementations.	To learn from previous implementation.	Get updated and comprehensive project progress report.	Reduced number of implementation problems.	Identify and address implementation problems.

Table 5: Identification of information resources for System Five of Federal

Critical Activity	**Refinement of critical activity into action and operation**	**Information Resource**
Acquire solid understanding on hardcore poor group. Form qualified committee to identify HPDP strategies.	Study on poverty Study on problems of the poor Thorough analysis on the registered HPDP poor.	Hardcore Poor Analysis Report- % of Poor per state, % of Poor per age group Poverty factors, Social Analysis Report Economic Report Market Analysis Report, Market factor, List of committee member
Form qualified committee to produce guidelines.	Select committee members	List of committee member Guidelines
Address implementation problems		Categories of Implementation Problems

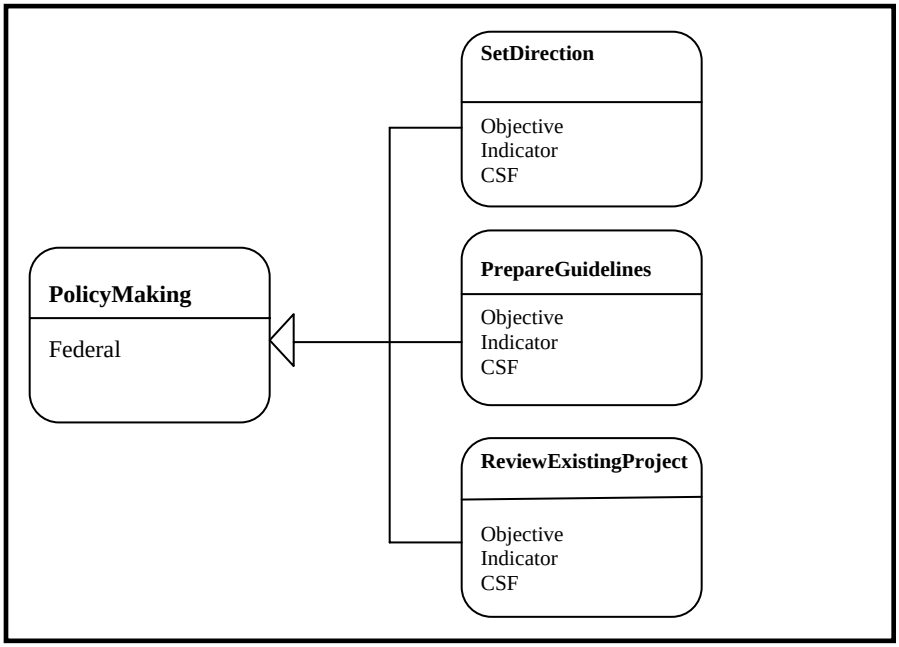

Fig. 6: Critical Functions for System Five of Federal Level in FCF model.

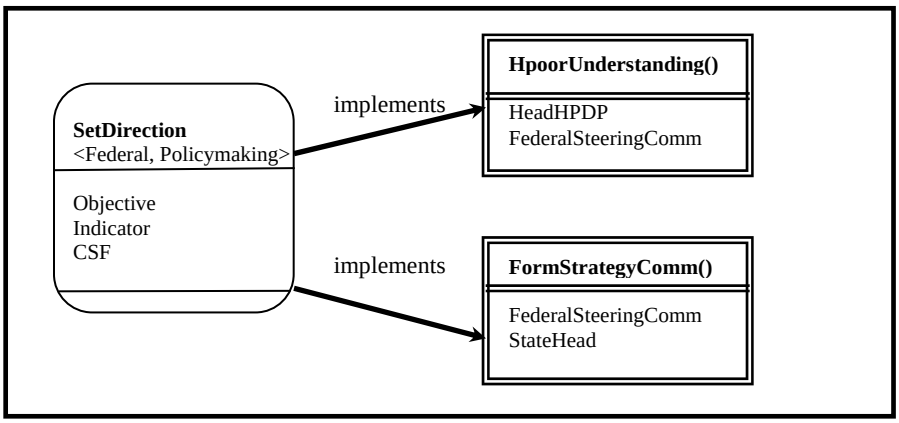

Fig. 7: Critical Activities that implement critical function of SetDirection in CFCA model.

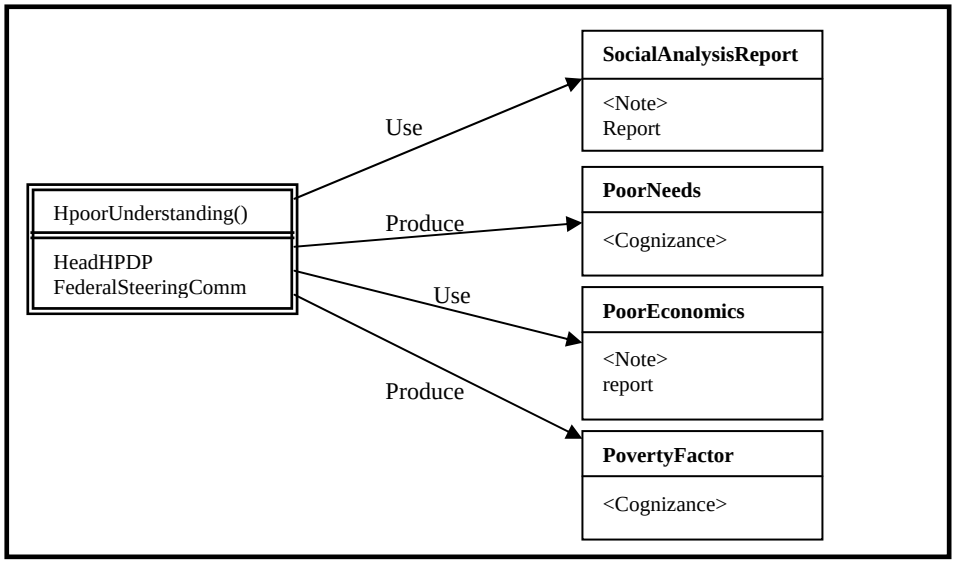

Fig. 8: Resource objects in CAR model at Federal level

7.0 DISCUSSION OF RESULTS

The output of the analysis is in the form of diagrams and tables which represent the critical functions, critical activities and critical information resources for the enterprise situation. The representation of the results in diagrams provides a clear starting point for the identification of relevant IS project applications. Table 6 provides examples of potential IS projects that have been identified based on the analysis made for HPDP. The CA models, CAS models and CAR models developed for the enterprise provides the detail requirements of activities used for the understanding and implementation of computerised IS. The RRS model, RRF model and RRW model are very beneficial for the design of information and database for the enterprise. In HPDP, all of these models have been used as inputs for selection of systems and for the design and implementation of computerised IS projects.

Table 6: Potential IS projects based on the analysis made for Agency level

Name	**Functionality**	**Description of Detail Functionalities**	**Systemic Level**
HPDPProject Mgt	Operation	Individual project management that keeps track of resources and the registered hardcore poor.	Agency
ProjectAllocation	Coordination	Keep track of resource, budget allocation to projects	Agency
ProjectImplementation	Coordination	Keep track about problems and progress of individual projects	Agency
ProjectRepository	Coordination	Keep track of participant assignment to projects and each project implementation schedule. Keep updated project guidelines.	Agency
BudgetManagement	Control	Keep track of present budget and past budget	Agency
ProjectControl	Control	Keep track of status of ongoing projects and the usage of resources for the projects. Also keep track of the report submission from each project head. --- ProjectImplementation	Agency

8.0 SUMMARY

This paper has outlined and elaborated an approach to determine and model information requirements with the purpose of planning for its IS from an enterprise situation that is described as complex and uncertain. Due to the complexity of the situation, the approach used Viable System Model (VSM) as an organizational instrument to guide and structure the situation in facilitating the determination process. The main contribution of this research work includes the development of Viable Enterprise Analysis framework, the Viable Enterprise Analysis process which extends from existing literature and the proposal for Viable Analysis models development. This paper shows a partial application of the approach in one complex case study. Overall, the approach was found to be useful to structure and elicit core enterprise requirements and their corresponding information requirements. Simultaneously, the approach attempted to overcome several of the shortcomings identified during the review of existing approaches such as the deficiency in addressing the complex and uncertain enterprise situation, the lack of support for information model development and the lack of solid theoretical basis. Several of its outstanding features include having the inherent reengineering ability, multi-level analysis capability and prescriptive functionalities. The approach will be applied and tested further in other similar enterprise situations to determine its usefulness and practicalities.

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BIOGRAPHY

Rodina Ahmad is a senior lecturer in software engineering and information systems at the Faculty of Computer Science and Information Technology, University of Malaya. She teaches information systems and software engineering modules at both the undergraduate and master levels. She holds a degree in Computer Science and Mathematics from Hartford, Conn. Her master degree was from Rensselaer Polytechnic Institute, USA. Her PhD degree in Information Systems is from Universiti Kebangsaan Malaysia.

Mohammed B. Yusoff is a Professor in information systems at Open University Malaysia. Currently, he is the Dean of Faculty of Information Technology and Multimedia Communication at Open University Malaysia. He received his PhD and DIC from Reading. His research areas include IT Policies and Systems Thinking.