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GROWING INFORMATION SYSTEM: NEW VISION IN INTEGRATION OF INFORMATION SYSTEM INTO ORGANIZATION

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Abstract

Since organization change from stable to emergent condition, information system (IS) as part of organization should have capability to follow the changes of requirement from the functional purposes and interactivities with the users. Need of new strategy in IS development methodology is urgent. Integration of IS and organization could be seen as new vision and growing IS could be the new paradigm in IS development methodology. The research conducted concludes that growing IS could be developed using role and task as organic constructor. This paper presents theoretical approach leads to requirement of growing IS model (GiSM).

***Key words**: growing information system, emergent condition, organic constructor, role, task*

1. Introduction

An information system as a system developed based on assumption that an environment needs it, which is an organization or another superior system. In real life, an IS is developed to accomplish information needed by an organization where IS took place or by business systems related to the organization. Most of methodology used in IS development (ISD) tends to translate the system procedure from existing manual operation to computerized operations. It seems to be mechanized using way of thinking about "how to use".

An emergent organization tends to change according to internal or external forces, or because of the business managed by the organization forced to be more efficient. These organizations include many corporate, commercial, or governmental organizations. Such organizations are said to be in "emergent condition", seeking stability and hard to achieve it. The problems faced in that condition, not only because of the changes happened, but because of uncertainty about the direction of change as well.

IS should be in order to support the performance of the organization, but in realities IS artifacts as a result of ISD could not meet the requirements especially in fast changing environment. This paper proposes alternative way of thinking in ISD, investigated about "what the problem". The research questions are 'could we define growing concept in IS as an opportunity in ISD" and "could we define concept that IS as an organic part of the organization should be grow ensemble with its environment".

1.1 Previous Works

Literature studies show some reasons of that condition come from (1) (4) (14) resumed:

a. Why IS does not meet the user requirements in emergent organizations? The requirements are changing constantly because of the fast change in business and their environment. The requirements are never complete even in a stable business environment because of limited rationality and the limitations of most of the stage oriented methodologies assuming a stable business environment. The requirements are denying the organizational dynamics; they are starting as a small company but are growing to big companies with a different organizational structure and management style.
b. Why model used in ISD does not representative for emergent organization? The current ISD methodology usually stage oriented and tends to mechanize the object (existing) system, and not represents the essential alignment of the IS to the environment.

The difficulty in defining requirements influenced by different perceptions about the essence of IS in the organization between users and managers in one side and IS specialist in other side. In emergent organization, this condition became more complicated by the changes of requirements that happened continually influenced by the changes on functional aspects and changes on the needs of user interaction.

From these conditions, problem arose in ISD is to understand the essential of the emergent organization and identify opportunity of the research to find an approach in ISD capable to generate adaptive IS. Some researches has been conducted and arrived at common conclusion about the importance of new paradigms, methodologies, models, techniques and tools to support the need of ISD methodology related to emergent organization (6) (7) (14).

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Regarding the problems of needs versus requirements, in the view of method there are still two weaknesses. First, methods are to expert driven, and therefore do not facilitate smoothness in communication between user, IS specialist and managers (barriers in communication). Second, methods are based on a static change strategy, while methods based on an evolving change strategy are needed. This becomes the opportunity for the growing model.

There are lacks in ISD methodology especially there is a lack in intermediating the growing IS needs in an emergent organization and the supply of flexible software.

Based on these lacks of methodological knowledge, we define that our research is design oriented and aims to model guidelines based on the task conception in order to bridge the requirement and design stage in ISD methodology. Our research has been done according to assumption that there are some lacks:

a. Lack of definition and position of growing model in ISD methodology. The research question here is "why IS in an emergent organization should grow?"
b. Lack of idea in integrating the core of growing model within organization, IS, and supported software system. The research question here is "how could growing IS model used as fundamental concept to accommodate and facilitate the natural growth of IS in emergent organization?"

1.2 Purpose of the Research

Research objectives are to gain a better understanding of "growing IS" in emergent organizations and to develop a strategy for ISD appropriate in emergent organization. Related to the research problem described above and according to defined research objective, research strategy is to find prototype of the growing IS model and test it in the laboratory.

This research proposes an approach based on the idea of growing IS modeling. The idea is to present a modeling language used to model the basic component of IS integrated to the emergent characteristic of the environment itself.

The aim of this paper is to propose a frame of thinking about model used to support the strategy for developing a growing IS model (GiSM) in emergent condition, presents as theoretical approach leads to requirement of growing IS model. The following sections after describing introduction are section 2 present related works. Section 3 presents ontology of Growing Information System. Section 4 presents the state of the art and requirement for Growing IS Model. Section 5 present laboratory experiments. Finally, analysis and conclusions are presented in section 6.

2. Related Works

Change in emergent organization is continuous and IS in such organization need to be adaptive. The idea of IS model in such organization should correspond with addition or change in system requirements or functionality as organization point of view and domain-imposed requirements or usability as user point of view (9) (16) indicates that IS and its environment are in order.

Facing unstable (emergent) organization, some of related works contributed in framework or methodology on the IS level presented in literatures, such as the concept of Information Engineering, Framework of Enterprise Architecture, Evolving IS, and on software level, as Reuse Technique, Concept of Component-based Software, and Agile method.

The contribution in model on the software level presented such as: Task world model (15), Task Design (10), Growing Software Modeling (11). What is required now is contribution in IS modeling which still not identified sufficiently.

3. Ontology of Growing Information System

The characteristic of emergent is changes happen continually and fast. In the sense of growing we consider making IS and its environment to be in order. Growing could be justified since first time IS born in its environment (created with certain limited requirements); growing up for some function purposes and becomes mature and refined for some interaction purposes. Growing could either be seen for the purpose of one business system following changes or addition of function requirements and interaction refinement (we stated as vertical growing concept) or used for growing up the other business system in the same environment (stated as horizontal growing concept).

According to nature of problem described and lacks of knowledge about growing IS and searching the basic for our research in the sense of definition and concept, we use Wijers framework cited in (20) consists of the way of thinking, the way of controlling, the way of modeling, the way of working and the way of support. In this paper, we limited and focus on the way of thinking and the way of modeling.

3.1 Growing IS Paradigm and Assumption

The way of thinking Wijers in (8) provides a paradigm and defines the assumptions made by the method with respect to the elements, function of an IS in its environment, the environment of the IS, and the major characteristics of the components of the IS and its environment.

This research based on our "growing paradigm" that is "growing is process to adapt an entity; in this research means IS, either to more satisfied its own live or to meet the change of the

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needs of its environment". This paradigm wants to stress about what the "basic component" to be enhanced and modified continuously and how to make grow happen naturally. So growing will affect the entity itself and its environment.

We proposed natural growing concept for Growing Information System Model (GiSM) based on the assumption that:

a. Change is continuous through the lifetime of the system.
b. The environment of growing IS is an emergent organization tends to change continually.
c. Bounded rationality, means the user and system evolve incremental following their knowledge about IS they use and their new needs coming up.
d. Agile condition happened means changes occurs and IS could be adapted to the changes of the environment using it.
e. Software is flexible in supporting the growing of the IS and could be reused. Software could be used in supporting and following the changes in IS and it could be reused from one application to another in the sense of identified similarity.

To position our model in ISD methodology, according to Wijers (8) we focus in way of thinking and way of modeling in providing modeling concepts, modeling elements and their relationships. To represent our proposed GiSM, following framework IS concept (3) according to modeling framework (13) we define ontology, architecture, and formal description of GiSM.

3.2 Research Framework

As the aim of the research is search for a model for growing IS, we derived our research from ontological view to define concept of modeling (3) relevance to characteristic of emergent organization. Related to philosophical direction for ISD (6) guides to adaptive IS for the future, we adopted IS research framework (5) and modified it by combining design-science and behavioral-science paradigm using knowledge base already exist and relevant to characteristic of IS environment.

Our modeling framework (13) consist of 3 basic dimensions, modeling context, modeling element and structured modeling techniques and the way of modeling Wijers (8) to provide modeling concepts and their relationships. It structures the models which can be used in the IS development, i.e. provides a (formal) language in which to express the models.

According (3) concept representation in semiotic layers consists of 6 layers: physical, empirical, syntactic, semantic, pragmatic and social, this research focus to represent growing concept in semantically layer describes about meanings and denotations. In our research, we propose GiSM as task based growing IS model and used Ontology to represent the idea of modeling elements (13) describe about the abstract of all basic element of growing IS model and the idea of formal approach for IS (3).

4. State of the Art and Requirements of Growing Information System Model

Inspired by the growth of human, plants, etc. it is more about substantial (sense of organic) than mechanical, and therefore the research question here is "how could information system in an emergent organization grow naturally?"

Aligning with growing paradigm and to make harmony in the lifetime of the system as a whole, we assume "role" as common "raison d'être" of the organization and information system. By defined roles, system should have the capability to serve the environment and growing system could be embedded to the environment where it is used.

"Task" used as concept to realize role in growing IS as a representative core of growing model at one side: organization-task represents information-oriented job descriptions, on the other side: IS-task represents activities/processes and supporting SW represent problem solving tasks and interaction tasks.

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Therefore "role" and "task" is conceptual construct, following the goal of ISD in the concept of continuous change "to preserve all artifact of existing IS application to be continuously enhanced and modified in order to match organizational requirements". With task modeling we provide insights into how system operates and interact with users (10) (15).

According to research problem, IS research framework (5) used and modified in combining behavioural-science and design-science paradigm to bridge the two sides of the relevant behaviour of the emergent condition and essential for IS design using the knowledge about how is modelling could be developed (see Figure 1).

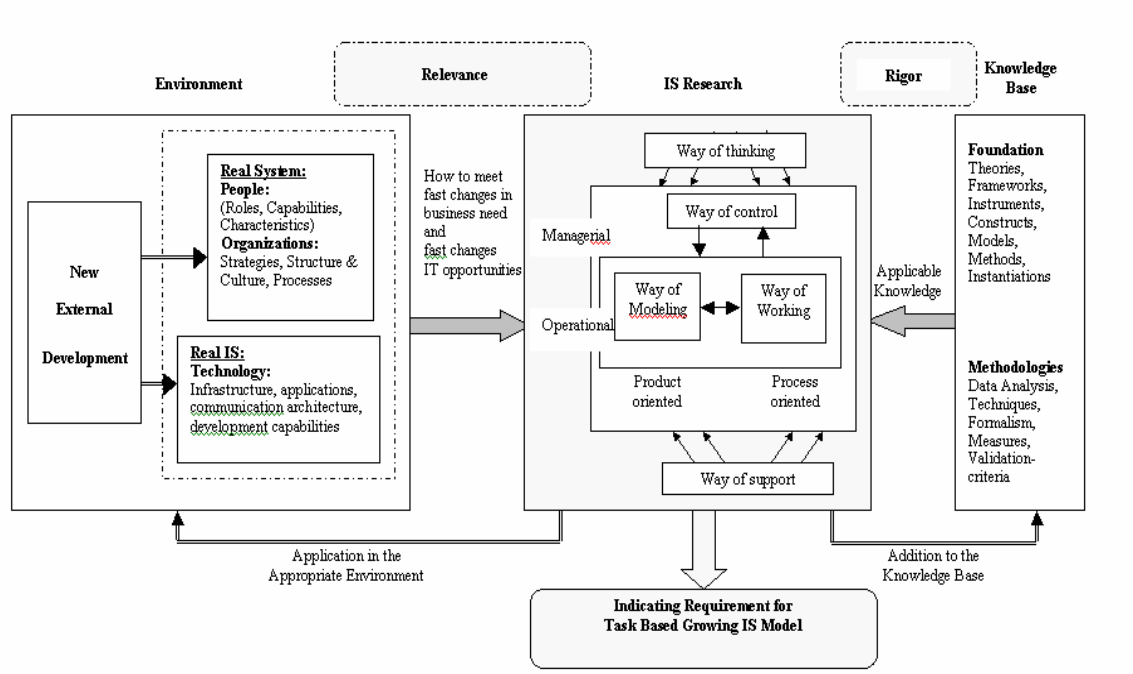

Figure 1. Growing IS Research Framework adopted and modified from (5, p. 80)

Study of the environment leads to the conclusion of the characteristic of emergent organization and give chances for relevance of growing IS research and finding of the essential element of growing IS concept. A resume from previous work about requirements and the scale of services underlines the importance from point of view of real system (people and organization) while methodology and model used represents real IS from point of view of technology used.

The opportunities of growing IS model could be supported by software technology. Advance technology has made some steps forward with component based software technology, reuse technique in software engineering, and family of Agile methods provide some prospects and offers in supporting ISD in point of view of software development.

Using knowledge base of the foundation and methodologies leads to the knowledge of how to represent IS model. The idea of technical approach in reusing artefacts of one system within the system or to other systems could be used in accommodating either the growing of one IS in an organization (vertical growing, means strengthening the existing business or same functions) or serving the possibility to grow another IS within same organization (horizontal growing, means developing new business capability of the organization). Reuse approach proposed in this research based on classification of the system and tasks, using analogy in the case of similarity of task between systems.

To accommodate this condition, our basic approach is to integrate emergence factor represented by "role" into existing environment, and "task" used to facilitate and accommodate the evolution of the system itself.

To avoid misinterpretations and put in order the idea of growing IS, we propose definition of basic terms:

a. Emergent organization is an abstract of organization, refers to a commercial corporation, government agency, educational establishment, or any other unit that regard itself as self-contained with respect to its business interactions with the world at large and changes frequently because of several reasons and effects the change of needs in its supporting IS, adapted from (2) and (14).

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b. Growing Information System is a model of IS, using a set of roles and tasks in order to integrated into dynamic in the environment, by system requirements and user needs.

Based on described problems and opportunities we state the requirements of growing IS model as:

a. Usability oriented, means that growing IS model should fit the characteristic of needs and requirement.
b. Could be used in improving development flexibility according to continuous changes of requirements.
c. Capable to integrate business oriented development using system and user requirements.
d. Incremental, which guides the users to be growth together with the system.

5. Laboratory Experiments

From the experiments conducted in Information System Laboratory, we found that concept of "role" and "task" could be used to serve as IS Organic Constructor (ISOC) (12). The ISOC could be used to represent growing IS concept and further to build an IS application. The experiment conducted to test the research question and lead to the answer that we could define a model for growing IS. Using the concept of ISOC we could test second research question and lead to the answer that ISOC could be the basic component of growing IS model, and could be enhanced and modified following changing functional requirements and user's need requirements.

In the laboratory experiments, we used case of Help Desk system to test our concept of "role" and "task". In Help Desk system we have some Jobs related to certain Business Process (BP); each Job done by certain Agent. The main idea of this Help Desk system is the concept of ISOC represented by Role and Task. In our experiment, we test that changes of activities trigger by change of functional requirement could be modeled by role and task-handling. Changes in Agent and Role could be accommodated by Task which composed of User-tasks and System-tasks. Therefore flexibility and adaptability of the model following the changes happened using the concept of ISOC has been successfully tested.

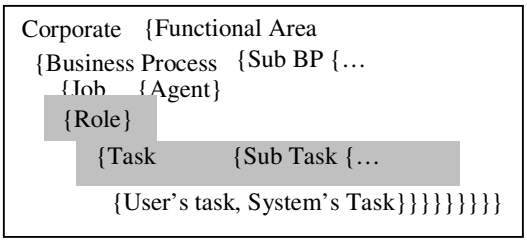

Figure 2. Schema of One Organization

As the results of our experiments, Figure 2 shows the schema of one organization in the view of role and task used shows the Position of ISOC represented by "role" and "task" in Growing IS Model.

Figure 2 shows how an organization defined as Corporate with some Functional Area, Business Process with its sub Business Process, and Role and Task represent for one Job which composed by some User's task and System's task.

The definition of the elements of GiSM described below:

1. Business Process (BP) is specific function defined as set of work steps or activities performed within one work system (WS). WS is part of functional area consist of one or more BP.
2. Job is defined activities assigned for one BP and to play certain role.
3. Role is meaningful contribution of the process to the whole system.
4. Agent active in performing some tasks and assigned by Job. Agents could be human user of the IS, group of human, or representative software components.
5. Task is a real world activity. Task typically changes something in the system and executed in a certain order. Complex task could be decomposed into smaller subtasks and the lowest of the task tree hierarchy are basic tasks represent real action of agent. There are two kind of tasks in this ontology, one is the task treated the real objects of the IS and the other are task treated the interaction between human agent and system agent.
6. User-Task/System-Task represents parts of one unit task to be executed by the human agent or by the computer software. In this ontology, we propose the problem solving and interaction task for each of the user-task and system task.
7. Object represents physical / non-physical entity specified by *noun* of the task model. Object could be treated related to the action specified by *verb* of the task model.

6. Analysis and Conclusion

From the experiments conducted in Information System Laboratory, we found that concept of "role" and "task" could be used to serve as IS Organic Constructor (ISOC) (12). The ISOC could be used to represent growing IS concept and further to build an IS application. The experiment conducted to test the research question and lead to the answer that we could define a model for growing IS. Using the concept of ISOC we could test second research question and lead to the answer that ISOC could be the basic component of growing IS model, and could be enhanced and modified following

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changing functional requirements and user's need requirements.

With common language "role" and "task" at both sides of IS and its environment, the model serves two advantages. First, role could be used to represent the idea of business process and functions of the organization as shared meaning, hence it is easy for the users to transfer their need to IS specialist, means communication barrier between users and IS specialist could be eliminated. Using role as basic concept an IS could be easily and flexible followed the changes of business functions. Second, task could be used to represent the decomposition of role and serve as user task or system task. It could be used to define the growing of IS automation level.

To use GiSM as new approach in IS modeling in ISD methodology, following the way of working of this model (not presented in this paper), the organization needs to support with defining the role of every function following provided guideline and define classification of roles and tasks to represent real IS in its environment. Once the role has been defined and followed by composing with appropriate tasks, then certain IS could be developed using the concept of GiSM.

In future research, concepts of role and task composed in the concept of ISOC could be used to configure desired IS in one organization and to define component base of IS application and GiSM could be used to realize organic approach for growing IS in emergent organization. Growing Information System (GiSM) as new paradigm in ISD methodology could be fruitful in the context of IS design for the future.

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