Organizational Readiness Analysis for Enterprise Information Systems Implementation

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***Abstract*—The paper presents an approach for examining and improving organizational readiness for enterprise information systems implementation. The main benefits are given by the architectural framework of different views of the information systems from the activity perspectives (substantial, communication, control; informal, formal, technical) with the same structure as the organization. Social norms are identified and formalized to represent organizational infrastructure. The approach has been verified by the use of a real-world physician workstation system in a hospital.**

***Index Terms*—organizational readiness; enterprise information systems; organizational morphology; social norms**

I. INTRODUCTION

The last decades have seen the fast development of Enterprise Information Systems (EIS). It has been a trend that EIS is going to be deeply integrated with organizations, and play a critical role in modern organizations. The emerging requirements raise a critical question - "Is the organization ready for the coming EIS"? This leads to the "soft" problems in EIS implementation, that is, how to prepare an enterprise with organizational and social infrastructure to greet the technical innovations.

In order to answer that question, it is essential to first understand EIS and EIS implementation. EIS are complex socio-technical systems [1]. EIS implementation starts from understanding and proceeds with re-shaping the organization. The organization should have a proper predisposition before adopting an EIS. This indicates that if it can benefit the most from an EIS, the entire organization must have a sympathetic response to the EIS at the social level [2]. Implementing an EIS system is a complex undertaking [3], and may result in significant changes all over the organization. The process involves massive organizational and managerial preparation work. An obvious example is the job position change. Successful EIS implementation means that some jobs will be significantly changed. The management therefore needs to re-align user empowerment and user responsibility with the newly introduced systems, and adjust certain types of leadership styles. It has to be admitted that EIS implementation is a continuous process and big effort to prepare and rectify the organization for the coming EIS.

Information Systems, especially Enterprise Information Systems are the related areas to address this challenge. Some researchers have proposed methods to overcome the whole or part of the problem. Researchers like Davenport [4], propose a qualitative method to analyze enterprise preparedness, while other researchers like Stewart et al. [5] and Abdinnour-Helm et al.[6] are inclined to a quantitative method to obtain the evidence of an organization's readiness. Some other methods, dedicated to the organizational and social aspects in system engineering, like SSM [7], are not technically strong enough to provide guidance to EIS implementation. When attempting to combine the existing methods, it may become difficult to ensure the consistency and compatibility as the methods from different suites are with varied theoretical and methodological foundations.

In this paper, we present an approach to the organizational infrastructure preparation in EIS implementation. We start from the technical tasks required in the EIS implementation, and gradually shift our focus onto organizational and cultural dimensions. Based on organizational semiotics as the theoretical foundation, the proposed approach adapts the Problem Articulation Methodology [8], and provides a socio-organizational analysis framework consisting of an examination of structure, stakeholders, responsibilities, activities, and norms for the EIS implementation. Its result classifies different levels of readiness requirements from perspectives of technical systems, business processes, and organizational culture in terms of norms. The approach is beneficial for an organization to examine its preparedness and reduce the failure rate in the EIS implementation.

The rest of this paper is structured as follows. Section 2 introduces related work, which covers EIS implementation readiness analysis, Soft Systems Methodology and organizational semiotics. The approach is discussed in Section 3, with guidelines and steps in details. A real-world example is presented to illustrate the application of the approach in a hospital system in Section 4. Section 5 gives a discussion based on the experience and feedback gained from the application. The conclusion and further work are highlighted in Section 6.

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II. Related Work

Soft Systems Methodology (SSM) is one of the early methods that aim to solve the "soft" problems in social systems [7, 9]. Characterized by "soft systems thinking", SSM offers a set of guidelines for managing ambiguity and change in complex problem situations. Though it is not catered for EIS implementation, the awareness of soft problems and the essence of soft system thinking have shown considerable practice value, and inspired many subsequent methods.

Launchbury and Ptak devise a questionnaire of 25 questions, covering from personal psychology (e.g. Have you driven out fear) to organizational performance (e.g. Have you bench-marked your organizational performance with best-in-class practices by global leaders) to measure whether companies are ready for the new ERP systems [10]. According to the authors, each question is answered with a score range from 0 to 4, with the total score showing the organization's readiness. For instance, 90 points or higher means the organization is ready for EIS, while 50-70 points indicate the organization still needs significant work. This method provides a useful skeleton to examine the organization from the relevant questions about ERP, though it is slightly vague in exploring detail information.

Davenport describes the major elements of a rational approach to EIS implementation [4, 25]. There are two parts to this approach: preparing the people, and preparing the technical system. Preparing the people involves gaining support from future users of the system, training them how to use the technical aspects of the system, and familiarizing them with how jobs and processes will change after implementation. Preparing the technical system involves converting data from the legacy systems to the required formats, installing and testing the EIS software. However, the rational approach to organizational change has been challenged that the introduction of an EIS into an organization is a complex process that is not well explained by a simple, rational approach [6].

Raymond et al. propose a three-phase methodological framework for evaluating organizational readiness for EIS implementation in manufacturing SMEs [3]. Based on a four-dimension conceptual model, the method starts from the organizational context to align the organization's strategies and objectives with the EIS's objectives and functions. The method then evaluates the EIS readiness from the dimensions of organizational context, perception of ERP, and business processes. The third phase of the method is mainly about planning the ERP implementation. The method generates the final evaluation in three levels: "committed adopters", "uncommitted adopters", and "late adopters". As it is dedicated to SMEs, the method does not fit all types of enterprises.

Abdinnour-Helm et al examine the role of employee attitudes in ERP implementation effectiveness, and provide preliminary evidence supporting the importance of assessing employee attitudes throughout the ERP implementation process [6]. By studying the factors that influence attitudes toward an ERP system in the pre-implementation stage, the result shows that length of time with the firm and position had a greater impact on attitudes toward ERP capabilities, value, acceptance and timing than high levels of pre-implementation involvement. The research shows interesting results, but did not provide a methodological way to change or enhance employee attitudes.

Stewart et al. propose a research program to develop an organizational readiness benchmark for EIS implementation using a multimethod approach [5, 11, 12]. Through clarifying the concepts of organizational culture, user empowerment and change management, the authors discuss organizational culture and user empowerment's impact the EIS implementation, and also link EIS implementation with change management to improve organizational practices. The authors' work is inspiring and insightful, though a methodological framework is missing.

Stamper proposes the seminal work of organizational morphology [13]. This method exposes the fundamental architecture of an organization and it is thus called as "organizational morphology". Kolkman elaborates this idea within Problem Articulation Methodology (PAM) [8]. According to the authors, concerning the macro-structure of an information system, problem articulation starts from a vague or soft problem and finds the appropriate words and other signs, as well as exploring the cultural and physical constraints within which to frame the norms. The total system is partitioned into a network of small systems by a process of articulation which isolates systems of norms with the same broad goals. Liu et al. improve the organizational morphology, and use it to understand the organization and help its modeling [14].

III. Organizational Readiness Analysis for Implemenging EIS

This work is mainly built on the Problem Articulation Methodologies (PAM). The ontological underpinning of this methodology is that an organization is socially constructed by agents in a rich organizational setting. Agents participate in a course of action, and produce and re-produce the social system by its action courses [15]. We adopt Giddens' structuration theory as the epistemology. Crucial to the idea of structuration is the theorem of the duality of structure, which refers to rules and resources. Rules are not only constraints, but also enablers of activities of human agents [15].The social systems in which structure is recursively implicated, on the contrary, comprise the situated activities of human agents. The structuration of social systems means the modes in which such systems, grounded in the knowledgeable activities of situated actors who draw upon rules and resources in the diversity of action contexts, are produced and reproduced in interaction [22].

Taking such a theoretical foundation, PAM views the world in a way that responsible agents perform meaningful actions by following (or breaking) social norms (we use this term as a synonym of rules). The

norms, formal or informal, explicit or implicit, define a culture or subculture of an organization [16]. From this point of view, the whole organization is treated as a system of social norms determining actions to be carried out by responsible agents. Agents, responsibilities, actions, and social norms, lying as the soft infrastructure of organizations, lend themselves to examine the readiness of an organization for implementing an EIS.

Adopting PAM's framework, the method consists of four techniques- unit system definition, stakeholder analysis, organizational morphology, and norm analysis, which will be discussed in the ensuing sections.

A. The Concept of Unit Systems

To treat the implementation as a total problem and to understand it, PAM first seeks a structure for the problem from systems perspective. The strategy is to subdivide a complex problem into small and manageable units. Each unit, defined as a unit system, is a collection of organized activities performed by people or automata to achieve a set of objectives [14]. An activity can be a simple task carried out by one person or a complex set of tasks by a group. Unit systems usually have their definite purposes, and a set of functions.

Unit systems can be identified by various ways. One is to use the unit system's lifecycle as a guidance to recognize and organize activities, the result of which is called a collateral structure. In the collateral structure, 5 sub-cycles consisting of 16 collateral systems have covered most essential activities in supporting the unit system in question [16]. For instance, the operating cycle includes the environment, input, focal, and output systems to deal with running environment and prepare data for the EIS in operation. The input and output systems can be further decomposed by the functionalities or components of the EIS [17]. The definition of unit systems delimitates a scope, and acts as a context for agents and activities.

B. Stakeholder Identification and Responsibility Analysis

Stakeholder identification attempts to structure the EIS implementation from the agent perspective. It accords with the agent-action philosophy of PAM to view an organization as a social system of situated activities of knowledgeable agents. As a segment of the whole organization, a unit system needs to identify stakeholders together with their activities. The activities carried out by agents are captured and represented by responsibilities.

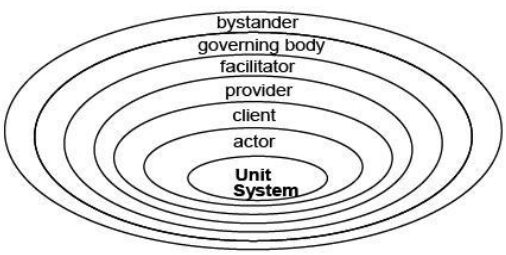

Figure 1. Recursive Organizational Morphology [13]

A structure with 6 categories of roles has been outlined to categorize stakeholders and their responsibilities, as shown in Fig 1. Actors are those agents who directly participate in the activities, with the responsibilities of carrying out the activities to make work done in a unit system. Clients are beneficiaries of the unit system; they consume products or services of the unit system. Providers are the agents who provide supplies for unit systems, responsible for supplying materials and preparing conditions for the unit system. Facilitators are the agents who aid the actors to perform activities smoothly and successfully, mainly in charge of coordinating activities and solving conflicts. Governing bodies are decisions and rules and regulations makers, the responsibilities of which are to monitor, examine, and guarantee the work is done as required. Bystanders watch and learn about the situations; they are the sole group who do not take direct responsibility. Each group exerts an impact on the information systems.

A unit system can be represented via stakeholders as:

Unit system= {stakeholder, role, responsibilities}

So far, we have recognized the first key elements in unit systems, - the stakeholders. As our objective is to examine the readiness of an organization in EIS implementation, the stakeholders' responsibilities identified above can act as one aspect of the readiness analysis. Only when these responsibilities have been assigned to the stakeholders can the unit system functions properly as required.

C. Organization Morphological Analysis

Organizational morphology aims to set up a structure for a social system from the action perspective. It is worth mentioning that all activities should center around the EIS implementation, with the aim to inspect organizational readiness from operational perspective. As a unit system has been viewed as a field where agents perform actions, and with the list of stakeholders and core activities, it is time to flesh out those activities, and organize them into an integrated system. The organizational morphology technique, as illustrated in Fig 2, compensates the activities to accomplish the system goals, as will be detailed below.

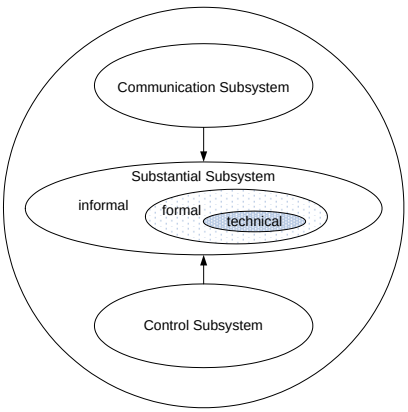

Figure 2. Recursive Organizational Morphology, adapted from[8]

This technique starts with substantial activities within a unit system. The substantial activities, falling into a substantive system, are the essential and core activities happening in daily work, and directly contribute to the

achievement of the goal of the unit system. For input and output systems discussed above, all the activities of actors, clients, providers, facilitators and governing bodies identified in stakeholder analysis are substantive activities. The substantial activities do not have to take place in, though possibly facilitated by, the coming technical innovations.

Organizational morphology then identifies essential symbolic activities in unit systems. One type of the symbolic activities is labeled by communication activities, which cope with message passing between agents in the organization. As the substantial activities may take place across time and space, it is thus necessary to co-ordinate the temporal and spatial use of resources for substantive activities inside a unit system. For input and output systems discussed above, it is normally a must between substantive activities to inform related agents of relevant facts, such as work procedures to execute, when and by whom. The analyst therefore needs to examine the conditions and consequences of substantial activities, and link one substantial activity after another through essential communications. Although may be supported by EIS and may not, effective communication is one of the most noted contributions of EIS to improve the efficiency of the organization.

The second type of symbolic activities, labeled as control activities, belong to control systems. The control systems aim to guarantee the required work executed in the anticipated way. That is, the substantive and communication systems should function as required to accomplish the unit system's objectives. For input and output systems discussed above, the control system usually consists of rewards and sanctions exerted by a supervision agent via monitoring and examining substantive and communication activities. Similar to other types of activities, the control activities can take place outside or inside the coming EIS.

Table I represents a summary of the three systems. It provides a guidance to identify the core activities of a unit system. With these activities we can see a consistent picture of what is happening surrounding an EIS in an organization.

TABLE I.
A MORPHOLOGICAL VIEW OF EIS IMPLEMENTATION

	Substantial Systems	Communication Systems	Control Systems
Unit systems	Activities of actors, clients, providers, facilitators	Operational procedures, business processes, rules and regulations	Organizational culture, goals, strategies

These three classifications can be recursively applied to a unit system. It allows the analyst to continually drill down on each category whenever necessary. For example, a communication or control system can be further decomposed as substantive, communication, and control systems, as shown in Fig. 3. This classification tree should be stopped when the analyst is confident that all the remaining communication and control work that are not handled over to a substantive system are manageable and controllable.

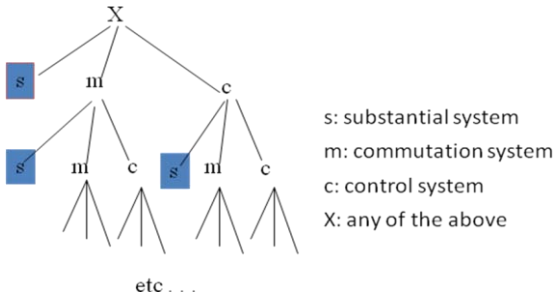

Figure 3. Recursive Organizational Morphology [13]

Once identified, the activities should then be allocated to different type of agents. For this purpose, another technique, organizational onion [13], is drawn upon to zoom in a substantive system. The main benefit is to reveal two hidden information systems that surround the most aware technical system, that are informal information systems and formal information systems. The three systems together form a unit system and even the entire organization. The organizational onion offers a handle to extend the EIS implementation from technical focus to organizational awareness. Inspired by this idea, the activities in substantive systems thus can be handed over to formal, informal, and technical systems.

Some of the substantial activities, which are fully formalized, will be handed over to technical systems. The technical systems execute IT-supported business functions, and provide IT capabilities to business. For actors' activities in the input and output systems, it is straightforward to see the automated business functions in different modules, components, or functionality groups, performed by machine agents. The analyst needs to delimitate the scope of such technical activities, and identify formalized functions and processes. The preparation for the organization includes checking the input and output, converting data format, and assigning human supervisors to the technical systems. The requirements in the from the systems vendor's user guideline is the minimum set of readiness criteria in EIS implementation.

Some substantial activities, typically established procedures and predefined processes, depend on both human agents and machine agents. They fall in the category of formal activities. To accomplish the formal activities, the human agents need to follow step-by-step guidelines to operate their work. This kind of organizational knowledge normally includes standards, rules, and guidelines, in the form of regulations and manuals [20]. For the actors' activities in the input and output systems, it is a requisite to identify operational procedures and business processes within this unit system. It is worth noting that not only identifying processes, but it is also adjusting business processes. The massively discussed business process alignment takes place in this phase. We are not going to re-invent the wheels and hinge on those techniques. Such work involves process changes,

job position changes, and staff trainings. Only these preparation efforts succeed can the innovative technical systems get seamlessly integrated with the organization. It is a critical step to achieve the readiness in formal systems. As a super set of technical system, the formal systems reflect the business capabilities. In general, the industry best-practice can be treated as this level of readiness criteria in EIS implementation.

The other substantial activities are labeled by informal activities, including the organization's unwritten practices. Organizational culture or sub-culture exerts direct or indirect influence upon agents' behaviors when they conduct activities. Social conventions also fall in this category. The informal systems, performed by human agents, reflect an organization's experiences, current practices and wishes. For the actors' activities in the input and output systems, it is needed to identify organizational cultural and conventional activities in this unit system, such as core culture, goals, strategies and policies. Note again, more than purely recognizing, sometimes it is also an opportunity to re-shape the organizational culture. It is an advanced step to prepare organizational culture in the informal systems level. As an even super set of formal system, informal systems are extremely important, and reflect organizational capabilities. The successful recommendations can be treated as this level of readiness criteria in EIS implementation.

Table II represents a summary of the three layers. It provides a guidance to explore the bureaucracy of a unit system. With it we can see a broad view of what is happening surrounding an EIS in an organization.

TABLE II.
A MORPHOLOGICAL VIEW OF EIS IMPLEMENTATION

	Technical Systems	Formal Systems	Informal Systems
Unit systems	Business functions	Operational procedures, business processes, rules and regulations	Organizational culture, goals, strategies

To complete the morphological analysis, the pre-conditions and post-conditions of an activity are captured to judge when it is carried out. The activity's deontic attribute (obligated, permitted, and prohibited) should also be analyzed to decide if it is a must when the pre-conditions are satisfied.

If categories of substantial, communication and control activities helps to identify the essential activities in unit systems, the rest analysis – organizational onion, conditions, and deontic attributes – moves the readiness examination forward to reveal norms in a unit system.

D. Norms Analysis and Specification

Social norms play a crucial role in social systems, widely considered at a central place in both sociology and organization studies. In the PAM method, the introduction of norms provides a means to expose the infrastructures of an organization, and also a way to explicitly rebuild an EIS-adapted organization. Moreover, as social reality is constructed by knowing agents, norm lends itself to capture and represent organizational knowledge, thus acting as a bridge to the social aspect of information systems.

As above, three types of information systems, which has been defined in the organizational morphology, can be further specified by social norms. We adapt the four-step Norm Analysis Method to captures those norms [16]. The techniques discussed above can be drawn on to compose the norm specification. Unit systems are employed as the context as a norm always attaches to a context. The stakeholders and responsibilities analysis have identified the agents and part of the activities, while the organizational morphology discovers other activities, as well as their conditions and deontic operators. The format of a norm construct is as below [24]:

Whenever <context>
If <condition>
Then <agent>
Is <deontic operator>
To <action>

As an important type of infrastructure, norms and their availability indicate another aspect of readiness analysis. Having these norms set up and followed by stakeholders, is the essential requirements for the organization to run the EIS smoothly and successfully. Norm analysis checks the organizational practice with the target norms, and then tries to find the gap between the current and ideal sets of norms. By this way it examines the readiness of the organization.

IV. AN EXAMPLE: PHYSICIAN WORKSTATION SYSTEMS IMPLEMENTATION

In this section we take an example of physician workstation in hospitals. Physician workstation system is a typical hospital information system, covering many clinical activities and workflows. Its complex implementation project calls for a careful examination of the hospital's current level of preparedness. As an illustration, we will zoom in small part of the total system – appointment management, and address a readiness analysis for this particular part.

A. Unit System Definition

The total system of implementing a physician workstation system contains a list of unit systems. At the top level is the project's goal - the physician workstation in operation. Collateral structure lends itself to identify input, output and other collateral systems [17]. The input and output systems include interactions between the environment and the workstation system when the latter is running. These interacting activities can be further grouped by its functionalities, such as making an appointment, prescribing, registering, and testing.

For making appointments, the input and output systems contains a collection of organized activities, including making an appointment of an outpatient for a visit, and pre-admission of an in-patient. It also deals with transactions the other way around, that is to cancel the appointment or pre-admissions due to error in the information or the decision not to admit patient at all.

B. Stakeholder Identification

Stakeholder analysis identifies agents and their responsibilities in unit systems. Different roles are involved in the input and output systems. Following the stakeholder analysis structure, the reception staff has been identified as actors, whose main work is to make appointments with a doctor when receiving an appointment request. The patients play the role of the clients; they raise an appointment request with a doctor at a certain point. Doctors are the providers for the input system; they provide time slots for the appointments. Facilitators are outpatient department managers, responsible for coordinating activities, and resolving conflicting. Hospital top management acts as the governing body, who makes rules and regulations, monitors and examines the appointments in the unit system. Nurses and non-clinical departments fall into the category of bystanders. Though they hold indirect stake in the workstation system, their opinion may exert impact on the system.

The stakeholders identified in the six categories are the key elements of the unit system. They are one aspect of readiness analysis. To prepare for the unit system, these stakeholders must be assigned in the right positions with proper responsibilities. The corresponding responsibilities are the target state for the hospital to achieve, when the hospital can be regarded as ready for the EIS. The responsibilities required have been summarized in Table III. Besides the responsibilities, the management also needs to empower the stakeholders to perform these responsibilities.

TABLE III.
A MORPHOLOGICAL VIEW OF EIS IMPLEMENTATION

Unit systems	Stakeholder	Role	Responsibilities
Input of making an appointment	Reception staff	Actor	To receive an appointment request To make appointments with doctors for patients To manage appointments
	Patients	Client	To raise an appointment with a doctor To cancel an appointment
	Doctors	Provider	To provide open time slots for receiving patients
	Outpatient managers	Facilitator	To coordinate daily activities To resolve conflicts
	Hospital top manager	Governing body	To make rules for hospital staff To monitor and examine reception staff and doctors To reward and punish reception staff and doctors
	Nurses	Bystander	-
	Non-clinical department	Bystander	-

C. Organization Morphological Analysis

The stakeholder analysis has identified the stakeholders and their responsibilities, which can be further extended with other support activities through organization morphology analysis. All the activities recognized in the stakeholder analysis the substantial activities for the input system: an outpatient raising a request, reception staff booking an appointment, doctors managing available time slots, and so on. They are the essentials to make the input system running.

In order to make things happen a good order, it is necessary to examine communication activities. In the input system mentioned above, for example, an outpatient should have a confirmation about the result of a booking request. Reception staff must notify the doctor once an appointment has been booked for her. Doctors need to inform the reception staff of any available time slots. Due to the large amount of communication activities, we will not list them all here.

Control activities such as rewards and sanctions are sometimes involved to ensure substantial and communication activities happen as required. In hospitals, there are assessment criteria to monitor and assess the actors' performance. For instance, doctors must have a number of time slots for the outpatients, reception staff must process an appointment request within a certain interval of time, and so on.

Up to now we have identified the other type of key elements in unit systems- activities. To prepare for these activities, they need to be examined carefully, from the angles of responsible agents, pre-conditions, post-conditions, and deontic attributes.

All activities have then been allocated to a type of agents, either machine agent or human agents. For example, notifying doctor of new appointments and informing reception staff of available time slots are performed by machine agents. The appointment request processing may be completed partly by technical systems, like telephone voice appointment system, website or self-service machines, and partly by human agents. This reveals the readiness requirements for the unit systems, because it needs to align the formal preparation with the workstation system, including standardizing input and output data format, defining business processes and so on. Preparations should also be made in cultural aspect. For instance, doctors' time management may be dominated by both formal and cultural impacts. To make most use of the workstation systems, cultural alignment is worth a careful consideration and even integration.

The pre-conditions, post-conditions, and deontic attributes of activities are recorded in the morphological analysis. For example, the post-condition of an outpatient raising a request is that an appointment is made at a certain point, while its deontic attribute is "permitted". The pre-condition of reception staff booking an appointment is when a patient calls in for an appointment, and the post-condition is a doctor's time slot has been occupied for the patient. The deontic attributes is "obligated".

D. Norm Specification

In the norm analysis, we draw upon the preliminary results of previous techniques and formalize organizational knowledge. According the above analysis, the underlying infrastructure is partly captured by norms.

A technical and a formal norm have been selected to illustrate the results:

Whenever <input system of making an appointment>
If <an appointment is raised by telephone voice >
Then <an appointment placer>
Is < obliged>
To <key in identify number>

Whenever <input system of making an appointment >
If <an appointment request is raised >
Then <reception staff>
Is <obliged>
To <process this appointment request >

It is always beneficial to keep an eye out on the rich social setting behind even a simple activity. As informal aspect is a huge area, it can extend endlessly in theory. we capture only the key ones in practice. For example, doctors have the freedom to manage her time when the workload is not heavy. For capturing this knowledge,

Whenever <input system of making an appointment >
If <patient visit capacity is not full>
Then <doctor>
Is <permitted>
To <arrange flexible time slots for outpatients>

Norm analysis is a critical step for organizational readiness examination. By investigating the unit systems, some norms are already there, but others are not. The hospital therefore needs to set up the missing norms to fit for the workstation system. From three visions specified by norms, the hospital has to put itself in the workstation system to make the most of the new system.

V. Indication and Discussion

During the application of PAM in the physician workstation system implementation, one of the most encouraging sides is that the method relates itself to multi-areas in the organization, starting from technical systems, via formal systems, and finally reaching the cultural systems. The organizational morphology helps understand the essentials of an organization. An analysis of this kind is also the understanding of the business and organization.

As there is always an implication that the organization will be formalized – some kind of bureaucratic system with some automation to support an organization, especially the technical determinism, in this sense, it is beneficial to scrutinize how the technical systems take over the job of formal systems. As PAM assumes a social setting of the bureaucracy and culture in an organization, this method encourages to push back the frontiers of bureaucracy unlike the majority of rationalist methodologies which tend to encourage more and more formalization [8]. That is to say, it may be possible to move a piece of work back from technical to formal, or from formal to informal, as the organization designer may get interested in the balance and efficiency between the formal and informal of work. With the method of morphological analysis the analyst can explicate the relationship between economic values to ethical principles. Therefore, from this point of view, the implementation of EIS is not only an attempt for business process re-engineering, but also an opportunity for the organization re-designing.

With the introduction of norms, this is a natural way to transform formal to technical, informal to formal. Social norms are a powerful means for capturing and representing operational knowledge. It models knowledge in a natural way and helps to align organizational model with the programs in computers. By constructing organizational knowledge that is scattered in processes, it reflects the nature of organizational operations [19, 21]. Although this way seems clumsy at the first glance, however, it has a deep philosophical background. That is, the society is constructed by social norms [18, 23]. Once uncovering these norms, the analyst has obtained the essentials of the organizations. From now on the analyst has fully understood the information systems and organizations, although she might not have realized this point.

More than aiding understanding, the norm-based model eases further work if any of the formal parts is to be transformed into the technical ones. It makes the EIS implementation method more consistent and reliable than others. The norms function as a specification of one aspect of the organizational infrastructure, and therefore is an output of the readiness analysis for EIS implementation.

VI. Conclusion and Future Work

This paper addresses the organizational readiness analysis for enterprise information systems implementation. It has provided a methodological framework to extend organizational readiness analysis from technical project towards organizational awareness. With a complete review of those elements of enterprise information systems implementation, an organization morphological viewpoint is used to understand the structure of the systems implementation and the organization. Attentions have been drawn to the culture and bureaucracy in the organization. An example in physician workstation systems has been shown to illustrate the approach. It has shown the ability to extend from business process engineering to other related areas, and prepare the organization for the coming enterprise information systems.

There are also some limitations of this research. As the project is still ongoing, it is a first step towards EIS implementation readiness analysis, and just opens a door in this direction. We have focused on the infrastructural elements identification and readiness goal setting, but leave aside the work of how to prepare the organization for the coming EIS. Another limitation is the method lacks a set of criteria to measure the organizational readiness so far. A maturity model is missing in the current PAM method.

Future research will extend infrastructure from norms to resources. The allocation of resources, including materials allocation and user empowerment, is essential

to the preparation of the organization. Secondly, the evaluation of employee attitudes towards the EIS is also incorporated in the research plan. It is believed user acceptance is an important aspect of EIS implementation readiness. The third task in our plan is that a PAM CASE tool development is under consideration. This is to guide the analyst and facilitate the use of this method. Furthermore, more cases are needed to show the validity and usefulness of the PAM method.

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