Process Ecosystem Perspective in Socio-Technical Change Handling

Katrina Dimitre and Marite Kirikova[0000-0002-1678-9523]

Riga Technical University, 1 Kalku, Riga, LV-1658, Latvia
katrina.dimitre@edu.rtu.lv; marite.kirikova@rtu.lv

Abstract. The paper considers socio -technical change, which is imposed by the external environment. Obviously a process ecosystem emerges around the technology change. Although there are many change management and technology adoption models available, they do not provide methods and models for explicit process ecosystem consideration in socio-technical change. Therefore, in this paper, an approach for process ecosystem aware change handling is proposed based on (1) the related work in process ecosystems and technology change management and (2) the information obtained in the practical setting of a motivating example from the healthcare industry. This approach prescribes the modeling of a basic change timeline process, relatively permanent As-Is and To-Be process ecosystems, and temporary processes as a related technology change process ecosystem, which can be represented and used to support socio-technical change handling.

Keywords: Process Ecosystem, Socio-Technical Change, Business Process

1 Introduction

Rapid innovation, globalization, digital transformation, and business competition are just some of the causes of socio-technical change that is faced in almost all areas of human activity. While the technology change is obvious, there is still a lack of generic models for handling this change from the perspective of business processes. Scientific reports on technology change management in different areas (e.g. innovation in emerging countries [1], technology change in media organizations [2], technology change in higher educational institutions [3]) emphasize the need to take into account a number of factors, such as values and knowledge of people, cooperation between departments and institutions, and institutional change management. They suggest also taking into account technology adoption models [3] and other systemic issues.

In this position paper an approach for the technology change is viewed from a business process ecosystem perspective. The assumption is that it is possible to identify an ecosystem of business processes relevant to a particular socio-technical change. Once the process ecosystem is identified, (1) a time line for a guiding (base) change process can be established, (2) the models for To-Be processes in the ecosystem can be created and (3) the change procedure for each process can be established.

The paper is organized as follows. Section 2 presents a motivating example from the healthcare domain. Section 3 generalizes the issues presented in the example and discusses the related work in process ecosystem change and technology change areas. Section 4 briefly introduces a proposed approach for process ecosystem aware socio-technical change handling and illustrates the initial steps of its application. Section 5 presents the conclusions and points to the directions of further research regarding process ecosystem aware socio-technical change handling.

2 Motivating Example

The motivating example concerns introduction of ISO 80369 standard in Latvian hospitals. For about 100 years, luer type connectors have been used due to their universal design, low cost, and simplicity. However, the all-purpose design of the luers increases the chance of healthcare staff unknowingly mating tubes from different applications [4] which has led to some tragic accidents [5]. To avoid such misconnection possibilities; in 2016 the International Organization for Standardization introduced ISO 80369. The new standard states that there are 6 main groups of connectors [6]. To handle this change the hospitals have to replace the current connectors according to the new standard, which is not a trivial task.

To execute this change the new connectors are launched into the market one by one. It all started with Enteral feeding (ISO 80369-3) connectors. This part was quite small and at the end of 2017 this change was successfully implemented. Next in line is the ISO 80369-6 Neuroaxial application. This is a much wider field. “Neuroaxial approach” means including every injection, catheter and syringe used in spinal anesthesiology, epidural anesthesiology, lumbar puncture and nerve blocks. Taking into account that every person undergoing a surgical procedure is exposed to anesthesiology, the number of patients for these procedures is much larger. Also, pain therapy, spinal fluid diagnostics and some oncology cases are exposed to this change. Thus, for the change to be done, many aspects have to be taken into account – the expense, new products, new tenders and specifications, connectivity with a hospital’s technological park, etc. Experiences in other countries have revealed the following risks for the complex process of changeover: (1) delay of care/ interruption; (2) new chances for misconnections; and (3) use and availability of adapters [6]. There is a guideline [7] for implementing the ISO 80369 series small bore connectors, and some German hospitals have made the change already. Based on their experience – the time to educate staff, get the new products and make the change – takes approximately 6 months. However, the As-Is situation in Latvia differs from that in Germany – German colleagues had all the data about quantities used for specific purposes and they went into the change well informed about products and manufacturers; and they also had the basic information about which department uses what kind of approach. The experience of other countries shows that an ecosystem of processes is affected [7]. In the Latvian case it is a complex socio-technical change because, for a proportion of items used every day, and, also in the current situation, there is no valid data about which items are necessary and how to approach this problem. For a hospital to implement these changes, many departments have to work together and approach the problem in an effective manner, because the malfunction of some process could mean that a patient would be lacking one of the components needed for him to receive the treatment.

3 Related Work

While there are many change models proposed, e.g. [8, 9], here we will consider the related work on only two issues: (1) changes in process ecosystems and (2) technology change.

The notion “process ecosystem” has been defined and used in various sources. In [10] the term “ecosystem” addresses the context of the business process: “the business process ecosystem consists of all the components that are required to develop, execute measure, manage, and optimize a business process”. Similarly, in [11] the term “process ecosystem” describes the management of an enterprise as an integrated network, in which all processes and related attributes are interconnected and are driving toward business success. In order to implement the process ecosystem, the following activities are suggested: catalog processes, standardize artifacts, map processes, complement processes, and deploy tools. The context of the processes is added in the “complement process” activity. In general, the term “process ecosystem” is rarely used in business process literature, although the need to analyze relationships between different processes is well recognized [9]. The term “enterprise ecosystem” is more common (see, e.g. [12]). In this paper, we view a “process ecosystem” as all related processes that are affected or created by the technology change. The context of the processes belongs to the ecosystem, but, actually, it is just its background, not a base element of the ecosystem. Those authors who refer to a process ecosystem claim that awareness of it helps in process change management. However, there are no particular process ecosystem change models available that could be applied in cases of technology change.

Socio-technical change requires a move from As-Is process ecosystem to To-Be process ecosystem. In a broader scope, there are research works that suggest approaches for gradual change of related processes [13]. However, when focusing on the scope of the problems addressed in this paper, these approaches do not make it possible to clearly see the processes to be addressed and their relationships. An exception is the dependency graphs described in [14].

With respect to the technology change, we considered several surveys and case studies which enabled us to identify the factors that have to be taken into account in technology change management. A detailed survey of information technology change barriers and coping mechanisms is reported in [15] and [16]. These sources suggest the following main coping mechanisms: (1) consultant support – to learn about and to plan the new technology; (2) education and training; (3) vendor support; (4) procedures; and (5) endurance. The authors of [15] and [16] also emphasize that the mechanisms are mutually related and impact one another. In [17] an integrated conceptual model for managing change in technology and engineering is proposed. The model is based on five chaos anchors: (1) time; (2) business space (characterized by information, knowledge, and people); (3) a system framework (referring to broad strategic, operational and integrative challenges); (4) a process (imagine, shape, deliver, support; – meant for continuous change management); and (5) an integrator (integrating all concepts and sub-models).

The issues discussed in the surveys also appear in the case studies. For instance, in [18] the time is considered as a relevant factor in regulatory imposed change management. And also in [18] the necessity to holistically consider cognitive, technological and institutional issues is pointed to. In [3], organizational and technological misunderstandings and the lack of broad-based support across departments are mentioned as main barriers in technology change. In [19], the necessity of understanding the system under study is emphasized. The authors of [19] suggest defining the system under study to set the boundaries for investigation, study the context in which the system is inserted, elaborate the related artifacts, and discuss future management actions and decision making.

4 The Proposed Approach

Taking into account problems explained in the motivating example in Section 2 and the findings of related work discussed in Section 3, we propose a process ecosystem aware approach for handling socio-technical changes. The approach is focused on a particular type of change, where it is imposed from outside and has a temporal character. The approach distinguishes between the enterprise process ecosystem before the change (As-Is process ecosystem) and a process ecosystem after the changes (To-Be process ecosystem). Both of these process ecosystems consist of: related organizational processes affected by changes; the context of each process that is involved, in terms of all enterprise objects related to the process; and the extended process context that includes elements outside the enterprise (such as vendors). The process ecosystem (that the socio-technical change has to be aware of) consists of abovementioned As-Is and To-Be process ecosystems and two more process groups, namely: basic change timeline process and temporal processes that are needed just to accomplish the change (see Fig. 1).

The process ecosystems aware technology change handling approach consists of the following activities:

1. Identify the basic timeline process (in the motivating example this process is the process of gradual equipment change).
2. Based on the defined basic timeline process, identify the As-Is ecosystem of affected processes.
3. Based on the processes identified in points 1 and 2, define (at least at a high level of abstraction) the To-Be process ecosystem.
4. Based on above obtained processes define temporary processes for getting from the As-Is to To-Be process ecosystem.

5. Refine and represent all process models and their relationships at the practically needed level of detail.
6. Proceed to planning and implementation of processes respecting the basic timeline process.
7. Regularly check whether the changes in the models are needed when their practical implementation is progressing.

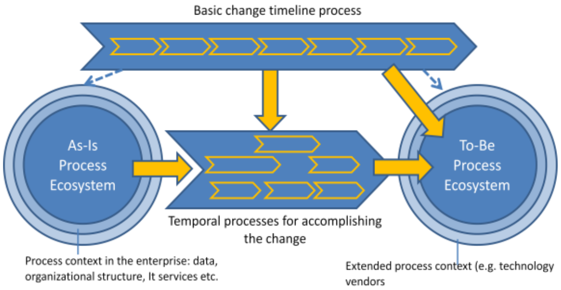

Fig. 1. Technology change process ecosystem (dotted line arrows – indirect influence, bold yellow arrows – direct dependency).

In the healthcare case discussed in Section 2, the gradual equipment change is a base timeline process that actually introduces 4 phases in the change process. The first phase concerns the approval of change that would be announced in the annual Anesthesiology congress, and this phase could take from 12-16 months from the start of this research. The second phase concerns “Announcement in EU” regarding the change and would take up to 4-6 months. During this period the educational questions should be addressed and some issues should be resolved concerning the devices and technical procedure descriptions that have to be changed due to the new standard. All of the documentation has to be prepared to implement the new standard in the regulatory system. The hospitals have to address problems concerning item values that have to be changed and also new equipment requirements. In the third phase, ISO 80369-6 should be accepted by the Health Ministry of the Republic of Latvia. In advance of this a strategy for education has to be developed, so that it could be implemented within this third phase. The main tasks for this phase are to educate the medical staff and register new methods in state regulatory institutions, and ensure there is information technology support for new processes. The final phase would be a changeover period. Here the practical changes of creating an additional stock of new items, adapting the anesthesiologist workbench, and starting to order the goods for the changeover date, should be determined. In this scenario all of the preparation work for change would be done in the previous phases, so the changeover itself in hospitals should take no more than 3-5 months.

To identify the As-Is and To-Be process ecosystems with respect to the base timeline process, it was decided to consider, first, the business ecosystem of healthcare in Latvia. It is represented as a Latvian healthcare ecosystem participant interaction map in Fig. 2. There are many information channels; for instance, financing is not done directly from patient to Hospital, but mostly through the Ministry of Health. This is so that the finance flows can be evaluated in the ministry and outside of the hospital itself. In the Healthcare business a lot of new technology information and medical staff training is coming from medical device distributors or manufacturers, because, in most cases, particular equipment requires knowledge of a corresponding procedure to handle it.

The As-Is process ecosystem of technology change concerns the current processes in the hospital that involve activities/processes of the departments using luers, administration, and the hospital pharmacy; as well as external processes for luer acquisition. There were no other processes identified to be directly affected by the change.

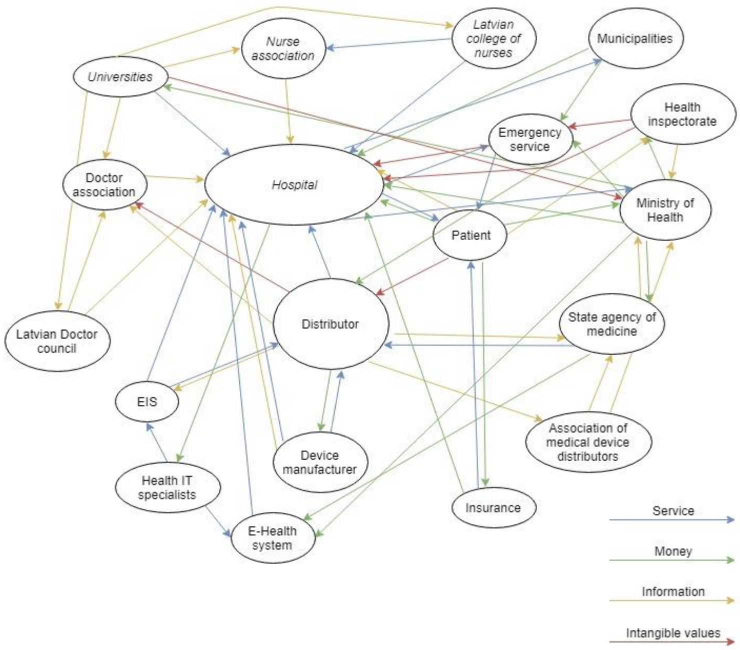

Fig. 2. Healthcare ecosystem (dotted line arrows – indirect influence, bold yellow arrows – direct dependency).

To-Be process ecosystem identification involved the development of new processes in the hospital that would be applied after the end of the change process. Also, the new processes regarding the purchasing of devices were identified. The models of these processes can serve as the sources of information systems requirements for new information technology solutions needed to support them.

The definition of temporary change processes showed that it is necessary to define a process change ecosystem separately for each phase of a base timeline process. The process ecosystem for the second phase of the base timeline process is shown in Fig. 3. For the sake of simplicity the links between the processes are not shown.

For each phase of the base change process the detailed processes for the hospital were developed. For instance, for the second phase there were 8 related activities/processes identified that have to be performed in the hospital; and in the third phase – 18 activities/processes were identified. The process models also allowed identifying main information flows and documents involved in the change process.

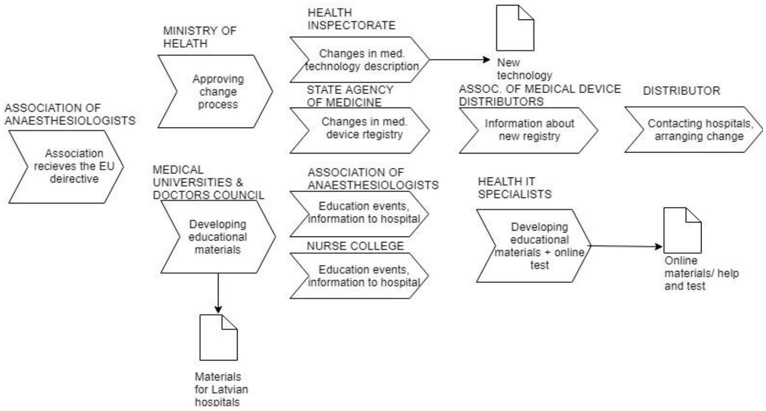

Fig. 3. Healthcare process ecosystem for the second phase in the basic timeline change process in the healthcare case described in Section 2

5 Conclusions

The approach for process ecosystem aware socio-technical change handling is proposed in the paper. The approach is developed on the basis of related work in process ecosystems and technology change management and by taking into account the practical setting of the motivating example from the healthcare industry.

This approach is in the initial stage of its usage; therefore, its applicability is only partly tested. However, it is already possible to derive the following conclusions:

1. It is important to have *a base timeline process* to monitor the process development and execution according to the time constraints of the socio-technical change.
2. It is important to distinguish between relatively permanent processes and processes that exist only at the time of embracing the socio-technical change prescribed by the timeline process.
3. It is essential to document relationships between entities participating in the change ecosystem.
4. If the base timeline process has several phases, temporary change process ecosystems should be defined for each change phase.

The future work includes (1) the refinement of the concept of ecosystems when referring to different types of systems of systems of processes; (2) further testing of the proposed approach; (3) testing the applicability of process dependency graphs in process ecosystem identification; (4) investigating how capability oriented approaches can contribute to the handling of technology change; (5) investigating how information logistics, with its timeline concept, can contribute the technology change handling; (6) refining the proposed approach and investigating other contexts of its application; and (7) developing software tools for process ecosystem modeling and process ecosystem aware socio-technical change handling.

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