Supporting Introduction of Social Interaction in Business Processes

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Abstract. Organizations that implement BPM are constantly trying to improve and effectively manage their business processes. Taking into consideration that every business process involves a reasonable amount of social interactions, i.e., simple or complex collaboration between people that occur internally (within organization boundaries) and externally (as suggestions, feedbacks to consumed services or products, and other interactions); it is necessary to provide means for incorporation of social interaction into business processes. While the need of incorporation of social interaction in business processes is well recognized, there is a lack of simple supporting guidelines for supplementing traditional business process development approaches with incorporation of social software. Iterative and incremental social software integration approach proposed in this paper provides a set of methods and concepts that are organized across well known iterative incremental development approach. The proposed approach can be used as guidelines in social software incorporation into business processes for introduction of social interaction.

Keywords: business process, social software, social BPM.

1 Introduction

Business process management (BPM) and social software have received much attention in the academia and industry due to profound research potential and gained business benefits. Social software integration describes the homogenization of unstructured work provided by social software with the process-oriented activities essential in business process management.

BPM is a process-centric discipline which founds its roots in business process re-engineering methodology [1]. BPM provides a cross-functional collaboration. Hence, BPM is considered as a holistic management approach [2], [3]. The Association's for Information and Image Management (AIIM) survey results show that more than a half of enterprises benefit from implementing the BPM solutions [4]. According to Harmon & Wolf's reported survey every fifth of the surveyed organizations spent from 1 to 5 million in business process analysis, process management, monitoring, redesign, and improvement activities [5].

Organizations that implement BPM are constantly trying to improve and effectively manage their business processes. Every business process lifecycle step

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produces a reasonable amount of social interactions, i.e., simple or complex collaboration between people. These interactions occur internally (within organization boundaries) and externally (as suggestions, feedbacks to consumed services or products, and other interactions). it is common, that social interaction is more intensive in less automated processes. However, a business process that is less automated usually is also more unstructured and barely repeatable, and dependent on actor tacit knowledge. Hence, the evaluation and performance of less automated processes becomes a sophisticated task that has to take into consideration not only specific performance aspects of a process, but also human (actor) qualities such as competence, knowledge, collaboration skills, etc..

Social software is one of the ways how to support social interaction. Currently there is a lack of information available of how to systematically organize and lead towards successful social software integration within BPM. Therefore, the research work discussed in this paper is aimed at providing approach that gives an opportunity to incorporate software supported social interaction into business processes in the structured and guided way. The approach is developed by extending well known iterative and incremental development approach with the set of methods and tools for incorporation of social software into business processes.

The paper is structured as follows: Section 1 briefly discusses problems regarding the incorporation of social interaction in business processes and introduces the proposed approach. Further Section 2 to Section 6 describe the phases of the proposed Iterative and Incremental Social Software Integration (IISSI) approach. Section 7 provides the application of IISSI approach within the foreign studies planning business process. Section 8 amalgamates the contribution and provides brief conclusions.

2 BPM Social Interaction Problems and IISSI Approach

A number of issues are closely related to difficulties of social interaction handling within BPM. Some of the problems (lack of information fusion, information pass-on threshold) extend so called Model-Reality Divide phenomenon (deviation between the abstract business and the actual executed business processes), other (Lost innovation) relates to an ineffective or absence of the knowledge management activities [6], [7]. The Influence of New Communication paradigm to BPM is also discussed [8].

Lack of information fusion. The importance of involving all possible stakeholders into activities is known and has been the case for discussion continuously [9]. However, business process modeling process often lacks proper involvement from all important stakeholders, especially the business process performers. If there are no bottom-up, peer-to-peer communication channels established, performers are forced to adopt a designed process model delegated from the top management. Not every designed step is precisely followed, though. As the result, Model-Reality Divide phenomenon can be observed.

Lack of participation. It is believed that not all stakeholders are participating in the business process design and execution phases [6]. As the result, the time to plan and develop highly complex business process is increasing and hence it does conflict with the current requirements of agile enterprises.

Information pass-on threshold. The overly rigid controls on the information pass in the organization can stop users from sharing it. Moreover, excessive formalism of sent material (such as memos or letters) often creates unnecessary effort for the user. Furthermore, information processing and the decision making can also be not transparent enough to the stakeholders. These factors create an impression that message success is improbable. As users cannot share their ideas easily, potentially useful information might be lost and opportunities for business process improvement not realized.

Lost innovation. The process of identification and utilization of weak ties in the organization can have a significant influence on organizational agility and finding useful knowledge in the enterprise [10]. The existence of such knowledge, critical for possible improvements of business processes, is often unknown to the process owners. As a consequence, possible innovative ideas remain hidden.

The influence of New Communication paradigm. Powered by the web 2.0 technologies, the New Communication paradigm denotes uncontrolled communication patterns between company customers, partners, and employees. In particular, in business to client (B2C) relationship consumers are influencing all aspects of other consumer behavior and finally they are reducing their reliance on advertising as a source of information to guide their purchase decision-making [8]. Moreover, the New Communication paradigm enables faster information circulation. Hence, the environment becomes more dynamic and willing to change.

The discussion in Introduction and above-reflected problems show that it is essential to know when social software that supports mediation of opinions between people is needed in business processes as well as how to introduce it in business processes. To meet these needs at least partly the Iterative and Incremental Social Software integration - IISSI, approach is proposed in this paper. The approach is developed as a complex of diverse methodologies and techniques applied and aimed to organize and guide the integration of social software into business processes. IISSI enables participatory and social enactment improvements of BPM. By applying IISSI approach a business process becomes a socially enhanced business process (see Fig. 1). By social enhancement we mean any improvement provided by social software. Social software can be understood as any internet-based collaboration and communication tool. Socially enhanced business process is a business process enriched by one or many social enhancements. In general, the goal of IISSI approach is to provide simple supporting guidelines for successful social software integration into business processes. IISSI is relatively easy applicable as it incorporates iterative and incremental development (IID), BPM and social software related methods and concepts within a guided development flow.

The approach is based on IID that is a process that builds a system by a gradual increase in features during self-contained cycles of analysis, design, development and testing [12], [13]. IID roots in the work of Walter Shewhart, a quality expert at Bell Labs, in which he proposed to organize quality improvements in series of "plan-do-study-act" (PDSA) cycles [14]. In 1970's the idea was further developed by Harlan Mills, IBM Federal System Division employee, who proposed iterative development model in his work "Top-Down Programming in Large Systems". In the beginning of 1980's Gerald Weinberg published his book "Adaptive Programming: The New Religion" in which he articulates the main idea of IID – "build in small increments with feedback cycles involving the customer reach" [15].

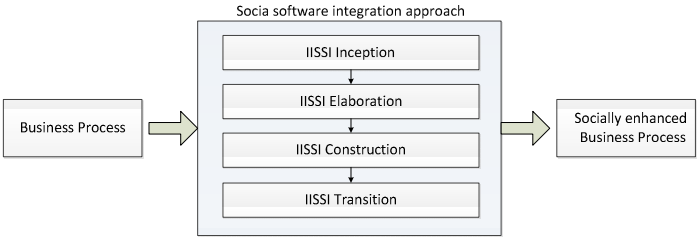

Fig. 1. IISSI approach

The IISSI approach includes four IID Unified Process phases: inception, elaboration, construction, and transition (see Fig. 1). The inception and elaboration phases constitute problem analysis and requirement gathering tasks. The construction and transition phases include iterative development cycles as well as incremental deliveries and deployment tasks. The phases are exposed with 11 IISSI tasks which are supported by several methods and concepts that were found to be helpful for fulfilling these tasks (see Fig. 2). Each IISSI phase and tasks together with the recommended methods and concepts are discussed in the remainder of the paper.

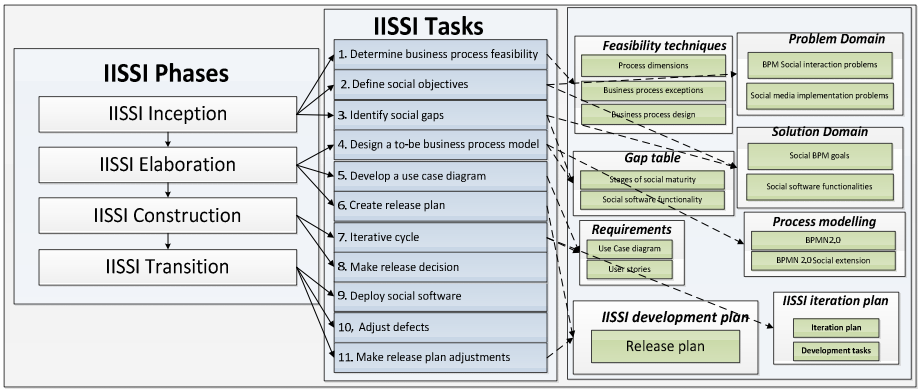

Fig. 2. Overview of IISSI approach (phases, tasks, methods and concepts)

3 Inception

The inception phase of the IISSI approach includes the following tasks (see Fig. 2 and Fig. 3):

- Determine the business process feasibility
- Define social objectives
- Identify social gaps

First two processes help to identify whether there is a need to integrate social software into the business process. There are the following cases when integration of social software might be cancelled:

- The targeted business process is not feasible for social enhancements
- Social objectives do not correspond to the BPM social interaction problems

Thus, inception phase includes two escape mechanisms which cancel the social software integration work (see Fig. 3).

Identify social gaps task is executed in order to determine the IISSI scope. The solution domain serves as a support reference model for the task. The IISSI high level scope is reflected in the gap table. The gap table is used further in the elaboration phase of IISSI approach.

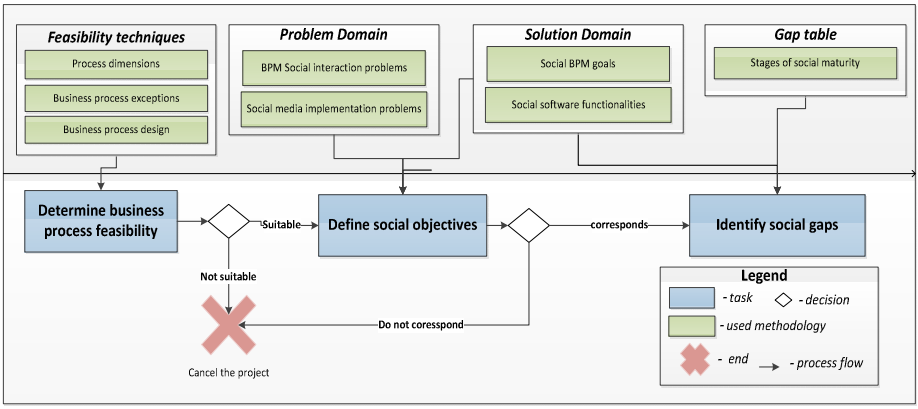

Fig. 3. IISSI approach: Inception phase

In ***Determine business process feasibility***, several methods can be used in order to understand the need of social software integration inside the business process, such as process dimensions, business process exceptions, and business process design. By applying listed methods the decision on proceeding or not-proceeding further with the social software integration should be made. If the feasibility analysis methods discover business process unsuitability to the proposed changes, it is advised to cancel the IISSI work. To apply these methods, usually meetings are organized where business process stakeholders discuss the matter.

When applying *Process dimensions*, the business process execution environment can be analyzed from two different dimensions: the level of role automation and the level of process control automation. The less automated business process (less supported by information technology solutions), the more tasks and flows are guided by actor tacit knowledge [3]. It is believed that less automated business processes are potential candidates for social software integration.

Process implementation environment dimensions model defines the degree for role and process control automation in the business process [3]. The degree metric is exposed as low, moderate or high [3]. The signal for the potential need of social software integration is the low level of role automation and process controls automation.

Business process design method is the way to analyze the business process through observing its design. Two main approaches can be mentioned [6], [16] - *assembly line* and *work station*. Four basic questions can be considered. How much predetermined

is the work order? More prescribed – assembly line, less prescribed – work station. Is human communication and collaboration encouraged in the process? Rather not encouraged – assembly line, rather encouraged – work station. What is the level of customization for the end product? Low customization refers to assembly line, high customization – to work station. How high is the process frequency? Rather high frequency – assembly line, rather low frequency– work station. If answers to the most of the questions show business process more similar to work station design, then a potential basis for social software is identified.

Regarding *Business process exceptions*, the aspect to consider is the regularity of process exceptions occurring when performing the business process. Business process exceptions are not often prescribed and lead to the unstructured, spontaneous communications and problem solving [16]. Therefore, potential social software integration need can be identified. The following exception attributes can be considered:

- The occurrence rate
- The level of impact

Define Social Objectives: the social objective is the way how organization can formulate the ends that any potential social software integration enhancement should achieve. It is understood that, in general, the social software solves the motivational business process problems defined in the problem domain. Therefore, the social objectives should correspond to these problem descriptions. If defined social objectives are not suitable to the motivational problems, it is advised to cancel the IISSI work.

The IISSI approach defines *Problem domain* as the environment where the solution will be implemented (see Fig. 4).

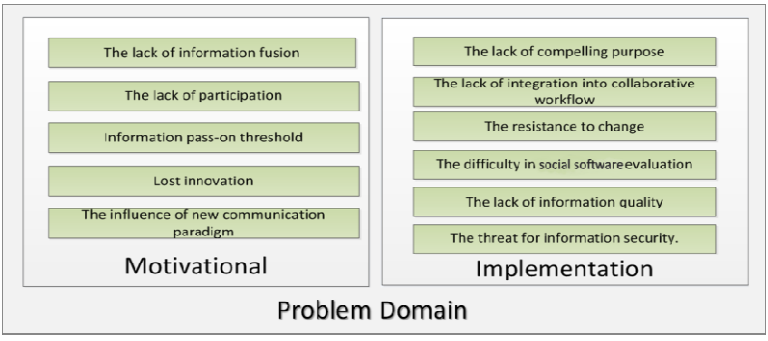

Fig. 4. IISSI Problem Domain

As shown in Fig. 4, the IISSI problem domain includes the following problem groups: (1) motivational – business process social interaction problems and (2) implementation – social software implementation problems.

Solution domain (See Fig. 5) defines the abstract environment where the solution is developed [17]. The IISSI solution domain can be used for defining social objectives and filling the gap table. The IISSI solution domain includes the following concepts:

- *Social business process goals* that concern the question, what potentially can be done in order to improve business process execution. For instance, the goal "to disseminate knowledge" for knowledge sharing can be defined in order to improve business process execution or the goal "establish social feedback" can be introduced to receive feedback from a broader set of actors with the aim to evaluate business process quality.
- *Social software* that concerns the question, how exactly is the social enhancement achieved. For instance, using formal messaging the message exchange from one author to one or several recipients is supported so that the decision distribution environment can be set for making decisions visible to the selected actors or actor groups.

To support the analysis, IISSI approach provides dedicated tables that show when specific goals can be stated, what types of the social software can help to achieve them, and what are known use cases for particular software types.

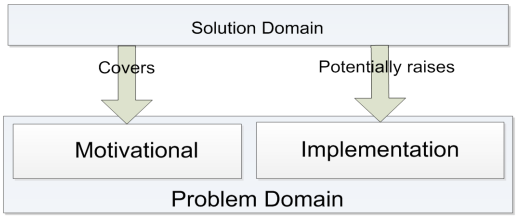

Fig. 5. Relationships between problem and solution domains

The solution domain is aimed to solve the motivational problems of the problem domain. At the same time, it potentially raises the implementation problems.

Gap table is designed to constitute the high level functionality scope of IISSI work. The rows of the gap table are filled until the project stakeholders decide that defined social objectives are fully supported. The gap table concerns the existing social software functionality and to be implemented social software functionality. The gap table is used further in the elaboration phase. The gap table's meta-information is provided in Table 1.

There are mandatory and non-mandatory factors in the gap table. The IISSI approach provides the means for filling the table using different additional tables on issues discussed in this section. One of the examples is the table about stages of social maturity [16] (see Table 2). This table helps to fill the gap table concerning two factors, namely, Social maturity stage (as-is) and Social maturity stage (to-be).

4 Elaboration

In the elaboration phase the social software integration project starts to take the form. The project plan and the architectural foundation are established. Functional requirements are described and transformed into the use-case model and user stories [18], [19]. At the end of the elaboration phase there is achieved a clear understanding of the functionality scope and technological foundation that will support the most essential use cases.

The elaboration phase of the IISSI approach includes the following tasks (see Fig. 6):

- Design a to-be business process model
- Develop a use case diagram
- Create a release plan

Table 1. Meta-information for Gap table

Factor name	*Mandatory?*	*Options*	*Description*
Unique Identifier	Yes	Number	A unique identifier of the gap.
Social objective	Yes	Textual information	Social objectives derived from the task "Define social objectives".
Social software	Yes	Textual information	Social software from the solution domain is depicted.
New	Yes	Yes / No	Identifies whether the social software functionality is new within the business process.
Business process task	No	Textual information	Identifies business process task(s) where social software is used.
Gap type	No	Quantitative, Qualitative, Redundant.	Quantitative – the social software was not used before in the business process. Qualitative – notates the needed improvement for the existing social software. Redundant – the social software is already present in the business process task (e.g., social software is picked twice for the same business process task).
Social maturity stage (as-is)	No	Stage 1, Stage 2, Stage 3.	Stage 1 - the social software is outside business process workflow and does not correspond directly to any of the business process tasks. Stage 2 - the social software is used as a process exception handler for a business process task or it is needed to change working environment in order to access the tool when executing the business process task. Stage 3 - social software is used in the business process task execution and it is accessible within one technical solution.
Social maturity stage (to-be)	Yes	Stage 1, Stage 2, Stage 3.	The same as for "Social maturity stage (as-is)".
Description	Yes	Textual information	Informal description of the intended functionality.

In the elaboration phase the defined gaps in the gap table are considered and BPMN 2.0 (recommended) notation is used for designing to-be business process model. Slightly modified use case diagram and user stories are used to define social enhancement functionalities. At the end, the release plan is created. The decision is made whether it is feasible to proceed further to the construction phase.

Design a to-be Business Process Model. The architectural foundation for the IISSI approach is the business process model. The non-executable business process model is suggested to be developed in BPMN 2.0 notation. The business process model exposes social software functionalities taken from the gap table. The social software functionality placement is the following:

- As a support functionality outside the process model – social maturity stage 1
- As a process model exception handler - social maturity stage 2
- As a process model task - social maturity stage 3

Table 2. Stages of social maturity derived from [16]

Stage	*Title*	*Description*
Stage 1	Isolated communities, outside the workflow	Bottom-up contributions of stakeholders (employees, clients, other actors) within communities free from existing organizational workflows. Low cost solution that does not require additional integrations.
Stage 2	Communities outside the flow, supporting a traditional process	Bottom-up contributions of stakeholders support a particular workflow that remains unchanged. These contributions compliment the workflow exceptions or change requests with necessary tacit knowledge. The users need to change between unstructured and structured environments which are not integrated into the common solution.
Stage 3	Socialized process	Unstructured and structured work is placed within one technical solution. Bottom-up contributions such as comments, ranks, shares, and status are integrated within the workflow. However, these collaborative workflows remain as isolated workflows. Supported technologies do not communicate with each other.
Stage 4	Integration of socialized processes	Collaboration services are unified together serving the multitude of social interactions. These processes are producing updates which are visible for every individual through a status update flow. Users are benefiting as they stay up-to date to the latest changes of processes. Processes are benefiting as users can instantly contribute (provide feedback, comment, or add information) to the process value chain.

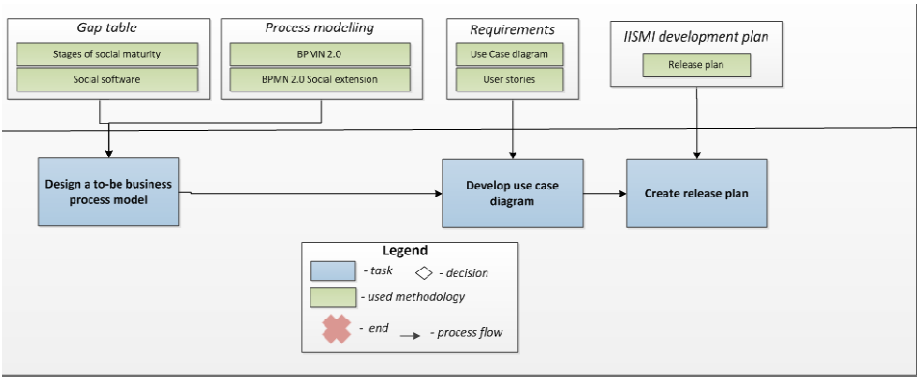

Fig. 6. IISSI approach: Elaboration phase

Social software functionality of social maturity stage 1 does not change the flow of the business process model. However, there is a need to incorporate social software functionalities within business process model in social maturity stages 2 and 3 (see Fig. 7). This is done by using BPMN 2.0 social extension notation [20].

Develop Use Case Diagram. Use case diagram is a simplistic representation of user's interaction with the system. In the IISSI approach the use case diagram is used with bit different user and system notations. The users of the system are business process model actors. The system is the business process. The actor and the business process interactions are supported by social software functionalities. The use case diagram should be enriched with the user stories that describe interactions in the more elaborated way.

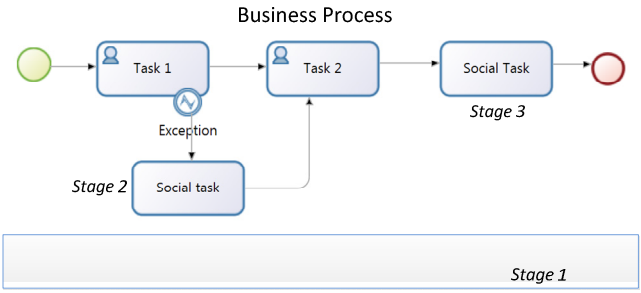

Fig. 7. Social software functionalities in the business process according to social maturity stages (Stage 1, Stage 2, Stage 3)

Create Release Plan. In IISSI approach the release plan consists of several release and iteration estimations. The primary goal of the release plan is to estimate realistically what user stories of the social software functionalities will be implemented in the first release, what will be implemented in the second release, and so forth [21]. The client decides which are the most important user stories that should be the first ones to be developed [22]. The project plan includes the following information:

- Number of releases with corresponding release dates
- Available resources for each release
- Number of iterations for each release – preferably iteration length should not exceed 3 week time period
- User stories with estimations included– the most important user stories come to the first releases

The release plan can be changed if the development speed in the iterations changes drastically. Then a release meeting is scheduled and the new release plan is created [23].

5 Construction

In the construction phase the high-level requirements are further analyzed. As the result, the detailed development plan (*the iteration plan*) is derived and the actual implementation can begin. The development is organized by executing several iterations that are part of a particular release plan (see Fig. 8). The release here is a stable executable version of the social software support which can be deployed into the operational environment [24]. Each release constitutes an increment – an increase of social enhancements in the targeted business process.

Develop Iteration Plan. The iteration can be understood as "a self-contained mini-projects with a well-defined outcome: a stable integrated and tested outcome" [24]. The notion of the "mini-project" helps development team and other stakeholders to focus on the most essential functionality first. Usually the iteration length is in the space of 1 to 3 weeks [25]. The iteration is a unique activity. Therefore, the iteration requires the iteration plan [24]. The iteration plan contains the list of user stories and corresponding development tasks [26].

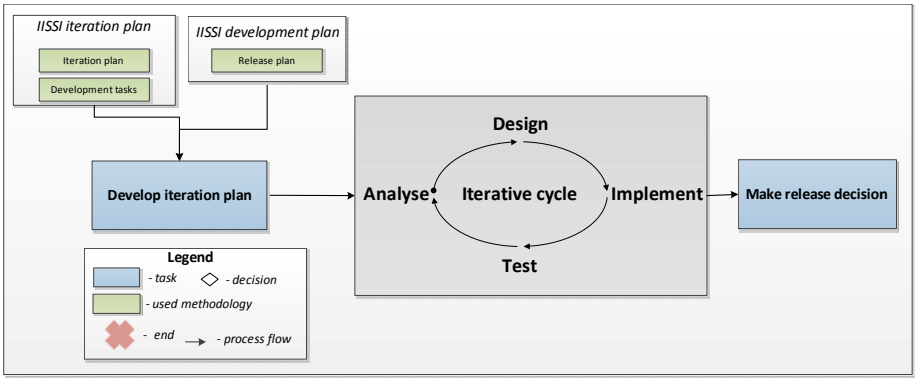

Fig. 8. IISSI approach: Construction phase

The iterative cycle of the IISSI consists of the analysis, design, implementation and test stages. Each iteration should result in better understanding of requirements (user stories), technical architecture, increased development knowledge and more complete implementation.

Make Release Decision. At the end of the last iteration in the release the decision over closing the release is made. If it is positive, the transition phase is launched. The next iteration cycle of the next release starts.

6 Transition

Transition is the final phase of the social software integration project done by IISSI approach (See Fig. 9).

Fig. 9. ISSI approach: Transition phase

The transition phase includes the functionality deployment to the production operating environment. Once the functionality is delivered, the additional defects are corrected; functionalities are adjusted to the specific user needs [19].

The transition phase of the IISSI includes the following tasks:

- Deploy the social software functionality to the production operating environment

- Adjust functionality defects
- Compile lesson-learned list

Deploy the social software functionality task incorporates all the activities needed for making social enhancement available for use.

Adjust social software functionality defects refers to making needed changes when some problems with implemented social extensions are found.

Make Release Plan Adjustments. The release plan adjustments are made in order to accommodate the user stories initialized from gathered feedback. Additional iteration can be planned or user stories can be incorporated within the scope of current release plan.

7 IISSI Application Example – Foreign Studies Planning

IISSI approach was applied for the foreign studies planning (FSP) process at Riga Technical University. FSP is an annual process in which the list of courses to be delivered in English is compiled for the next study year. IISSI approach was applied in order to decrease overall time spent in doing FSP work.

Main methods and concepts suggested by IISSI approach and discussed in previous sections are amalgamated in Table 3. The methods used in the application example are depicted in Fig. 10.

Table 3. Methods and concepts suggested by IISSI approach

Nr.	*Title*	*IISMI Phase*	*Usage*
1.	Business Process Model and Notation (BPMN)	Elaboration	Used to design the to-be business process model
2.	BPMN 2.0 social extension	Elaboration	Used to annotate the social media integration in the to-be business process
3.	Social BPM goals	Inception	Along with social software constitutes the solution domain
4.	Social software	Inception	Along with Social BPM goals constitutes the solution domain. Used in defining the gap table
5.	BPM Social interaction problems	Inception	Along with social media implementation problems constitute the problem domain
6.	Social media implementation problems	Inception	Along with BPM Social interaction problems constitute the problem domain
7.	Stages of social maturity	Inception, Elaboration	Used in defining the gap table and designing to-be business process model
8.	Release plan	Elaboration	Used to plan overall IISMI development
9.	Iteration plan	Construction	Used to plan IISMI iteration development
10.	Process dimensions	Inception	Used to plan IISMI iteration development
11.	Business process exceptions	Inception	Used to determine business process for social media integration
12.	Business process design	Inception	Used to determine business process feasibility for social media integration
13.	Development task	Construction	Used for transforming user stories into specific requirement text

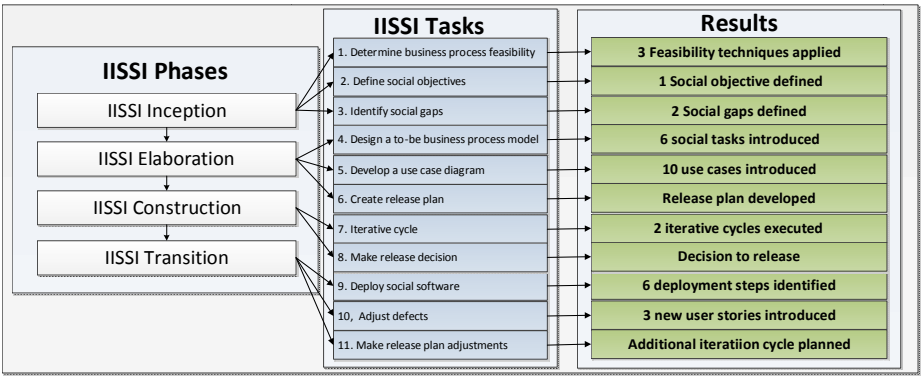

Fig. 10. Overview of application of IISSI approach

The information pass-on threshold and the lack of the information fusion as BPM social interaction problems were identified within the as-is FSP business process (see Section 2). The information pass-on threshold is denoted by "1" and the lack of the information fusion is denoted by "2" in Fig. 11.

As the result of IISSI inception and elaboration phases, the Wiki social software was proposed in order to handle the updates of the list of English courses within the centralized repository. Five process tasks were removed from as-is FSP business process model and 6 new social tasks were introduced into to-be FSP business process model (see Fig. 12).

As a result of IISSI construction and transition phases, the Wiki "MediaWiki" social software was configured. The overall time spent in preparing course list in the to-be business process was decreased as the course lists were not duplicated and aggregated (the lack of information fusion) and were not sent back and forth between process actors (information pass-on threshold).

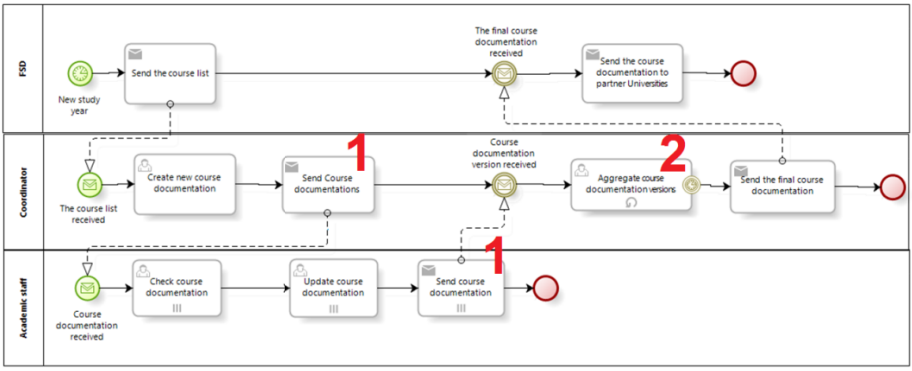

Fig. 11. As-is FSP business process

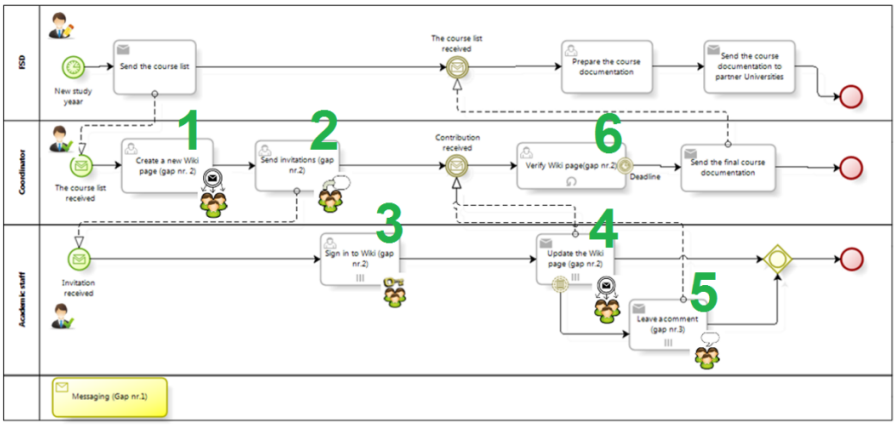

Fig. 12. To-be FSP business process

Thus the application of IISSI approach gradually successfully resulted in 6 socialized tasks in the FSP business process and the Wiki software was implemented at social maturity stages 2 and 3.

8 Conclusions

The IISSI approach is aimed at overcoming social integration problems in BPM and was tested on foreign studies planning process at the university. IISSI approach organizes different methods and concepts around the well known iterative and incremental development approach. It provides the following contributions to social software integration in BPM:

- Proposes logical structure for including BPM and social software related methods and concepts in a guided development flow. It is helpful as at the moment there is a lack of supporting guidelines for incorporating social software into the business process development.
- Encourages the domain learning and contributes to continuous quality improvements by using iterative approach. It is helpful as detailed social software integration requirements can hardly be established at the beginning of the social software integration effort.
- Suggests concrete escape mechanisms that stop the process of unfeasible social software integration at early development stages. Social extension is not always beneficial and can be excessive in cases where social interactions do not require additional management. Such cases are common within highly automated and repetitive processes.
- Shows how business process modeling can be used for annotating as-is and to-be processes and identifying activities where social software functionality can be incorporated.

Future work concerns further testing of the approach with respect to more social interaction problems and development of metrics, that can help to assess social software integration benefits in complex business processes.

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