Baltic J. Modern Computing, Vol. 10 (2022), No. 4, 754-775
https://doi.org/10.22364/bjmc.2022.10.4.09

Post-Merger Information System Integration Decision Framework

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Abstract. Mergers and acquisitions (M&A) are frequently used as an approach for organisational growth and expansion. One of the crucial phases of M&A is post-merger integration (PMI) when practical integration of selected organisations is implemented. This phase is intended to create a new future organisation, which will be capable to achieve the goals selected for M&A. For this, PMI should implement aligned changes in all enterprise architecture levels from business to information system (IS). However, in practice, changes on business level and IS level are frequently misaligned, which leads to IS integration related decisions made with no sufficient knowledge of M&A context and requirements for future IS architecture. This research explores how existing requirements engineering (RE), enterprise architecture (EA), and knowledge management (KM) disciplines can contribute to PMI IS integration process. PMI IS integration should be based on the comparison of IS architectures in merging organisations and focused on the required atomic decisions about consolidation of IS with similar goals. It should consider the M&A context and be applicable in the PMI context with high time pressure and limited explicit knowledge.

Keywords: PMI integration, IS integration, PMI IS integration, M&A integration, Requirements Engineering, Enterprise Architecture, Knowledge Management

1 Introduction

Consolidation of organisations or assets through mergers and acquisitions (M&A) is one of the strategies for how organisations can grow (Hossain, 2021). M&A can help grow faster and on a larger scale. With increasing competition and market expectations, more and more organisations choose to grow using M&A (Galpin, 2021).

However, given the benefits that M&A can offer, many M&A initiatives fail to achieve their stated growth goals (Peta and Reznakova, 2021). Although many research groups are focused on M&A failure reasons and potential solutions, no improvements have been noticed in statistical data of M&A results (Marrone, 2013).

One of the main reasons for M&A failure is an unsuccessful integration phase (Teerikangas and Thanos, 2018). The integration phase, often called Post Merger

Integration (PMI), is part of the overall M&A process, when a physical merger takes place. The main goal for PMI is to create a new consolidated organisation, which has all the properties, required for achieving goals defined for the M&A initiative, such as growing market share, strengthening resources, expanding product portfolio, and others (Bodner and Capron, 2018).

As an example, an M&A case can be considered when organisation A acquires another organisation B. Stronger product portfolio, higher revenues and lower operational costs could be the main goals for this M&A. Each of these goals requires some integration between organisations A and B. For instance, to decrease operational costs, more efficient manufacturing processes from one company can be applied to another company. Higher revenues could be achieved by merging marketing and launching cross-selling initiatives. A stronger product portfolio could be achieved by collaborating between creative departments and contributing to R&D activities. Such integration requires changes and transformation regarding different organisational aspects – organisational structure, processes, assets, information systems (IS), etc. Successful IS integration is mentioned as one of the enabling factors for PMI success (Brunetto, 2003; Baker and Niederman, 2014). The success of PMI IS integration can be seen as a sequence of successful PMI IS integration decisions made and the actions taken (Henningsson and Carlsson, 2011) (see Fig. 1).

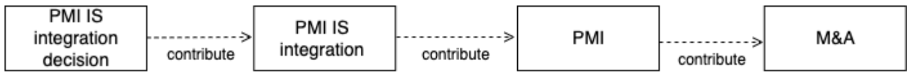

Fig. 1. PMI IS integration decision contribution to M&A

PMI IS integration decisions should be aligned with the overall PMI goals and changes on the business level (Carlsson and Henningsson, 2007; Henningsson and Carlsson, 2011; Henningsson et al., 2018). Additionally, PMI IS integration decisions should be realistic and efficient in the specific PMI context (Henningsson and Carlsson, 2011; Henningsson et al., 2018). But making decisions for PMI IS integration is not a trivial task. Difficulties related to PMI IS integration decisions are lack of PMI IS expertise (Henningsson and Yetton, 2013; Henningsson, 2015), lack of explicit knowledge about PMI goals and context (Carlsson and Henningsson, 2007; Wynne and Henningsson, 2018) and lack of time to get expertise and explicit knowledge (Henningsson and Kettinger, 2016; Henningsson et al., 2018) (see Fig. 2).

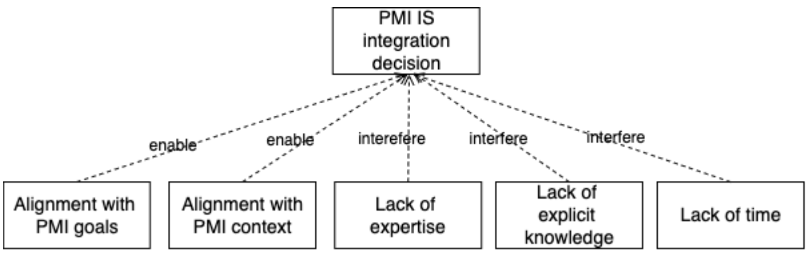

Fig. 2. Factors impacting PMI IS integration decision

This research aimed to answer the question of how PMI IS integration decisions in the context of not sufficient PMI IS expertise, lack of explicit knowledge and time pressure can still be aligned with decisions on the business level and consider the M&A context. The research results suggest that requirements engineering (RE), enterprise architecture (EA) and knowledge management (KM) disciplines can contribute to PMI IS integration. This paper is the extended version of the research paper exploring EA contribution to PMI IS integration (Lace, 2022). In this paper, recommended RE, EA and KM practices are incorporated into PMI IS integration process and represented as data and process models that can be applied to PMI IS integration process organisation and management.

The paper is organised as follows: in Section 2 research questions are stated and research objectives defined. In Section 3 related state of the art is explored for PMI IS integration, RE, EA and KM domains. In Section 4 the proposed PMI IS integration decision framework is described. Finally, in Section 6, research summary and conclusions are provided.

2 Research questions and objectives

As stated before, the main research question is how PMI IS integration decisions in the context of not sufficient PMI IS expertise, lack of explicit knowledge and time pressure can still be aligned with decisions on the business level and consider the M&A context. The research aims to answer what changes in the standard decision process should be incorporated to support PMI IS integration specifics. The following research sub-questions are defined:

- How to address the lack of PMI IS expertise so that non-experienced professionals can achieve the same results as experienced professionals?
- How to organise the decision process in a way that IS changes are aligned with PMI goals and context?
- How to identify and make decisions with insufficient explicit knowledge in tight timelines?

To answer the research sub-questions, we should understand how decisions are made, i.e., model PMI IS integration decision process. The model was created using an analogy with the rational model of decision making (Al-Alshaikh et al., 2020; Uzonwanne, 2020) and is shown in see Fig. 3.

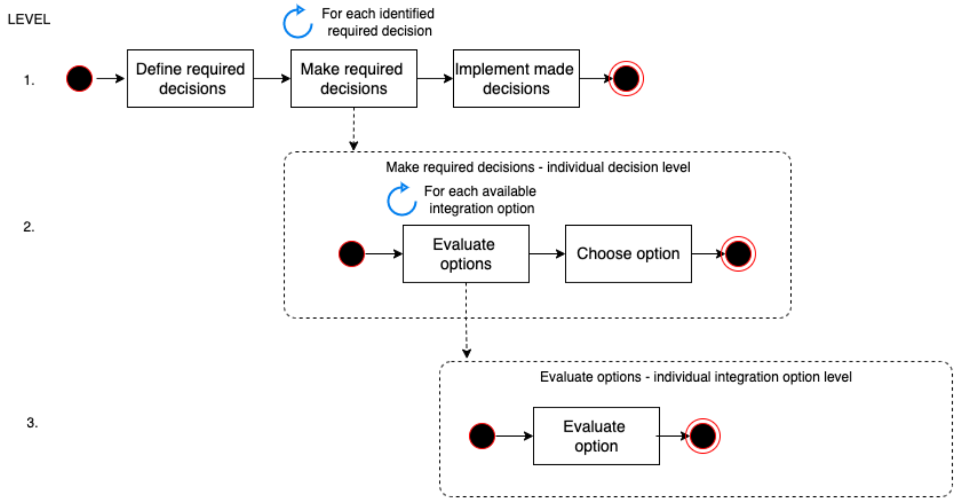

Fig. 3. Levels of PMI IS integration decision process

To find the answers to the stated research questions, the PMI IS integration decision process was divided into three levels:

1. Overall PMI IS integration decision process with the primary goal of identifying required decisions for IS integration, as well as making and implementing required decisions.
2. Atomic IS integration decision process with the primary goal of choosing between different possible IS integration options.
3. Atomic decision option evaluation process with the primary goal of evaluating individual IS integration option.

This paper is focused on the first PMI IS integration level and has the goal of defining the overall process for PMI IS integration decision identification, decision making, and decision implementation.

3 State of the art

This section summarizes research in the related domains – PMI IS integration, EA, RE, and KM. For each domain, the current state of the art is described, as well as how it can contribute to this research. We can observe that all four research domains have overlapping areas and cross-domain research works. However, there is no existing research which would holistically bring all four areas together in the context of PMI.

3.1 PMI IS integration

As M&A is perceived as the arrangement between several organisations leading to the restructured architectures, enabled growth, and strengthened capabilities (Bodner and Capron, 2018). The first M&A initiatives were recorded already in the 19th century (Cartwright et al., 2012). However, active research in this field was initiated only in the 1970s (from the financial perspective of M&A performance) (Mirc et al., 2017). The research was focused on finding the success factors for M&A. Later M&A research has evolved and expanded in several perspectives (Mirc et al., 2017) – psychology perspective, HR perspective, marketing perspective, and process perspective. However, even with a comprehensive research volume over decades, it is still criticized for contradicting results and controversies (Thanos et al., 2019).

Process related M&A research emerged in the 1980s (Cartwright et al., 2012). This research area is based on the assumption that overall M&A success is strictly related to PMI execution. PMI is perceived as a critical tool allowing organisations to reconfigure resources, product lines, and business units to achieve M&A goals (Bodner and Capron, 2018). The majority of process-related research papers review possible integration strategies – preservation, symbiosis, holding, and absorption (Angwin and Meadows, 2015). Nevertheless, there is no existing research proposing detailed PMI processes and potential process configurations for different PMI cases.

IS integration gets increasing attention in the research of PMI success factors (Lace and Kirikova, 2020). In the latest research the impact of PMI IS integration decisions on the overall PMI and M&A is studied (Henningsson et al., 2018).

As one of the reasons for PMI failure is mentioned misalignment in integration decisions on different integration levels (Baker and Niederman, 2014; Henningsson and Kettinger, 2016).

Additionally, we can see that in the same PMI IS process the same IS integration decisions can lead to different results in different contexts (Henningsson and Kettinger, 2016). Based on this observation we can assume that the decision context has an impact on the decision outcome. Moreover, we can see that the M&A context can affect overall M&A success (Henningsson et al., 2018).

3.2 Requirements Engineering

PMI IS integration decision process can be perceived as a special case of the RE process. Both processes have similar goals to define the difference between the current and desired states and define a solution required for the change. For almost five decades, RE related research was focused on the question of how to organise the process more efficiently. Several major research streams were formed, each of them defining requirements for engineering practice with incorporated potential solutions (van Lamsweerde, 2000). Findings in these streams could be used for PMI IS integration decision-making support.

RE as a research discipline appeared in the 1970s, but more actively started to evolve in the 1990s. This discipline is closely related to IS development and was impacted by research trends in this area (van Lamsweerde, 2000; Ambreen et al., 2018). Despite the initial relationship with software engineering, RE was researched in many other contexts and RE principles can be generalised to other application domains (Ambreen et al., 2018).

RE has a goal to define stakeholder goals (why?), map required system features (what?) and specify how these features should work to achieve stated goals (how?) (van Lamsweerde, 2000). More than 20 years ago RE activities were defined (Nuseibeh and Easterbrook, 2000). These activities were practically applied, tested and improved during the last 20 years (Ambreen et al., 2018). Nowadays several standards exist on the RE process organisation, stating the main steps, such as eliciting requirements, analysing requirements, documenting requirements, accepting requirements and managing requirements (Schneider and Berenbach, 2013). These standards, in this research, were used to identify RE practices applicable for PMI IS integration decision-making.

3.3 Enterprise Architecture

To keep PMI IS integration aligned with other integration levels, PMI IS integration should be treated as part of overall organisational transformation during PMI. Organisational transformation is the main concern of the EA discipline (van de Wetering et al., 2021). The concept of EA first appeared in the late eighties. This discipline emerged as a potential solution to the problem of misalignment between IT and the business. This discipline is dedicated to the alignment between different organisational levels – from strategy to execution. This makes the use of EA promising potential solutions for achieving better PMI results (Gampfer et al., 2018).

ISO/IEC/IEEE 42010:2011 standard defines the EA as: “The fundamental organisation of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution”.

EA can align all integration components towards integration goals, as well as support integration decisions with full-fledged models of the current and future states. EA also can help to define and implement additional required transformations after the PMI process is finished, so that long term strategy can be achieved (Henningsson and Toppenberg, 2020).

3.4 Knowledge Management

With PMI context impact on PMI IS integration decisions, it is important for the organisation to learn the PMI domain as such and the specific PMI environment. Organisational learning is the ability of the organisation to acquire, accumulate, process and transfer knowledge (Handzic, 2017). For PMI, thus, organisational learning should be established across all involved parties that are in the scope of a specific PMI initiative, and, also, across several sequential PMI initiatives. Organisational learning can be supported by integrating the KM practice into the PMI IS integration. However, PMI KM should be able to address the PMI specifics – high uncertainty and time pressure.

KM research started in the 1980s and was focused on best practices on how to apply knowledge as a competitive advantage for organisations (Wiig, 1997). Research topics under consideration were, cultural aspects, organisational learning, as well as strategic aspects, and KM related technologies (Rao, 2002). The most influential contributors and founders of the KM phenomenon were Nonaka, Takeuchi, Davenport and Prusak (Rao, 2002).

One of the KM research areas is related to effective knowledge sharing practices in big, cross-border multi-language organisations (Becker-Ritterspach, 2006; Castellani et al., 2022). Practises for knowledge transfer and alignment proposed in these studies could be applicable to PMI initiatives (Becker-Ritterspach, 2006; Angwin et al., 2015; Castellani et al., 2022). There is dedicated research for Architecture KM aiming to frame this research topic as such and state some best KM practices for architecture-specific knowledge (Edwards et al., 2003; Farenhorst and de Boer, 2009; Edwards, 2022). There is also KM research directly related to M&A and PMI (Oliveira et al., 2001). This research is focused on the KM for synergy and innovation, enabled by mixing old and new knowledge through knowledge integration activities (Lu and Feng, 2010; Mirc, 2012), as well as on the investigation of what factors can contribute to better knowledge transformation (Ensign et al., 2013).

4 Research methodology

The applied research process is presented in Fig. 4.

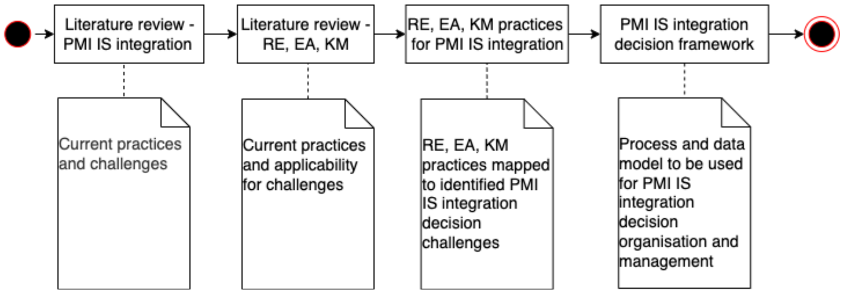

Fig. 4. Research process

The research started with a literature review related to the current practices and challenges of PMI IS integration and PMI IS integration decision-making. “ScienceDirect”, “SpringerLink” and “ResearchGate” databases were used. Keywords “PMI integration”, “M&A integration”, “IT integration”, “PMI IS integration”, “PMI IT integration” and “PMI integration decisions” were applied. Initial time frame for the research papers was set 2010 year or later. But full research history was explored for the authors whose papers were closely related to the research topics. As well as, during the research review, closely related references were included into the literature review scope. As the next step, state of the art for RE, EA and KM was explored. The same literature review approach was used for key words “Requirements engineering”, “Enterprise architecture”, and “Knowledge management”.

Based on findings about PMI IS integration challenges, solution practices in RE, EA, and KM were identified. Proposed practices were integrated into the PMI IS integration decision process and the PMI IS integration decision framework was proposed as a data and process model combination, which can be used by professionals involved in PMI IS integration decision-making for specific PMI process organisation and management.

5 PMI IS integration decision framework

This section describes PMI IS integration decision process. We sequentially considered applicable RE, EA and KM practices and define the required adjustments for PMI IS integration decision process modelled in section 2.

5.1 Requirements Engineering perspective

As the first step, we defined the process with sufficient granularity so that the responsible for PMI IS integration decisions could execute it without additional assistance. As was mentioned before, this research is focused more on the support of professionals who are less experienced in PMI. To decrease the learning curve, number of errors, and increase acceptance, the process must be formulated using familiar concepts (Marks and Mirvis, 2011; Weber, 2015). PMI IS integration task is often assigned to IT specialists, specifically business analysis and requirements engineers (Morrison and James, 2002; Ahmadzai, 2020). They are used to work in software development and apply standardised RE practices. Fig. 5 shows how PMI IS integration steps can be mapped to the RE phases.

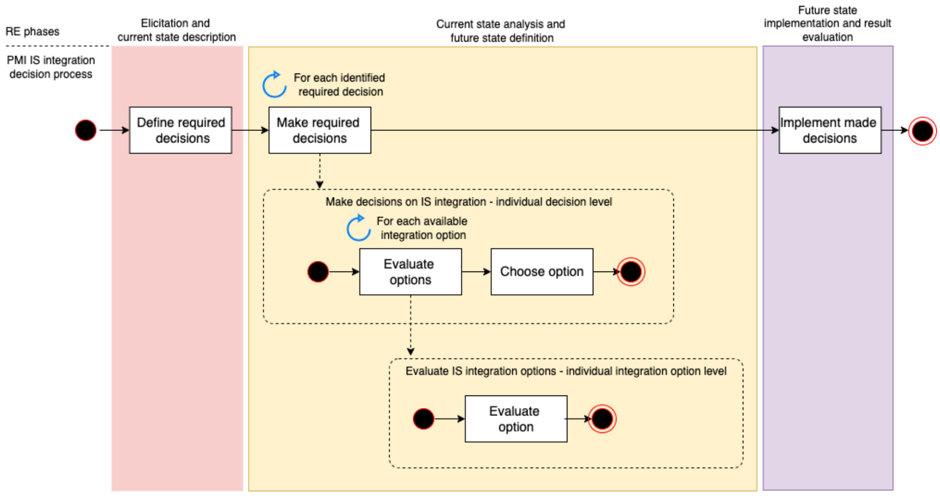

Fig. 5. PMI IS integration decision process mapping to RE phases

"Define required decisions" can be mapped to "Elicitation and current state description" as in both cases during this phase, we elicit knowledge of the project's high-level vision, the current state and the gap between future vision and current state. For PMI IS integration, this is based on the future needs for IS architecture and defining what in the current IS architecture should be transformed. Compared with a diversity of goals in standard RE projects, PMI IS integration is focused primarily on limiting similar function redundancy in the current IS (Land and Crnkovic, 2007; Jia et al., 2022).

"Make required decisions" corresponds to "Current state analysis and future state definition" when we need to define what exact changes in the current state are required. For PMI IS integration, it is making decisions on the specific changes required for existing IS. Required changes in RE could be very different – introducing new IS, adding functionality to the existing IS, changing already existing functionality, or even discontinuing usage of specific IS. For PMI IS integration, there are more homogeneous options to choose from depending on the extent to which specific parts of the existing similar functions will be used in the future IS architecture – all functions will stay, some functions will be used and others discontinued, different parts of the existing similar functions will be merged, and no existing functions will be used (Land and Crnkovic, 2007).

“Implement required decisions” corresponds to “Future state implementation and result evaluation”, where defined changes are implemented and we can evaluate if, with these changes, initially stated goals are achieved. For PMI IS integration during this phase, decisions about current IS changes are executed and future IS architecture is built. This phase usually is executed with a delay of time, as all changes planned in PMI should be in place and finalising PMI IS integration can take months or even years.

In the scope of this research, we focus more on decision identification and decision-making, and less on the decision implementation and evaluation. One of the reasons is that actual PMI IS integration decision implementation can be seen as a series of IS management initiatives, where comprehensive research exists. Another reason is that implemented PMI IS integration decisions evaluation is a complex and voluminous topic, which deserves separate scientific study related to PMI outcome and M&A results, which is located closer to management studies than IT studies.

With limited time resources in the PMI initiative, we should make sure that there are no low-importance process steps – each step brings some valuable result. To make the process more result oriented, we look at it through the created artefacts perspective. We compare standard artefacts in software development RE (International Institute of Business Analysis, 2015) with the ones required in PMI IS integration (Fig. 6).

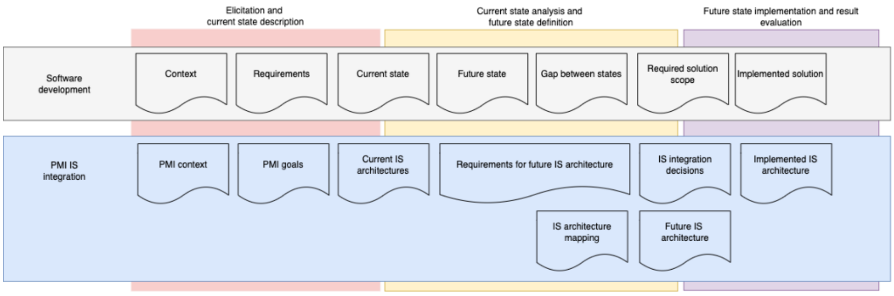

Fig. 6. PMI IS integration decision artefacts mapping to RE artefacts – 1st iteration

Software development “Context” is equal to ‘PMI context”. In this artefact is gathered all relevant knowledge about the initiative that can impact or be impacted by the project.

“Requirements” are similar to “PMI goals”, stating the need, justifying required changes and stating the vision. However, PMI goals are formulated on a higher level than standard requirements for software development projects.

“Current state” describes the existing context and the current solution which needs to be changed to satisfy requirements. For PMI IS integration, it would be “Current IS architecture” for each of the merging organisations depicting all ISs currently used.

“Future state” usually describes the future changed context where the adjusted solution should be incorporated. This context sets the scope and constraints for solution changes. In the scope of PMI IS integration, it would be some sort of “Requirements for future IS architecture” helping to identify which of the currently used ISs should be changed. IS architecture should support business architecture and IS changes should support changes on a business level. This means that “Requirements for future IS architecture” should define planned business changes triggering the need to change IS. We will discuss how these requirements can be described in the next section of this paper.

“Gap between states” defines the difference between current and future states, clarifying what part of the current state should be changed to achieve the future state. In PMI IS integration we want to optimise redundancy in the current IS functionality. For this we should understand the similar functions in the current IS architecture. These redundancies are described as groups of similar goal ISs in “IS architecture mapping”. As mentioned before, IS changes should be triggered and scoped by business changes. This means that similar goal IS groups should be defined based on the business changes described in “Requirements for future IS architecture”.

In software development, “Required solution scope” prescribes all required changes in the current solution that are required to enable changes between current and future states, as well as details future solution as part of the future state. This can be perceived as a software development project scope. For PMI IS integration, we define changes as decisions for specific IS in the same goal IS group – which IS will be used, which will be discontinued, etc. These decisions are summarised in “IS integration decisions” and used to define “Future IS architecture”.

As many changes can occure during solution implementation, changes practically implemented are usually documented after the development project as the “Implemented solution”. This artefact can be used in future development projects for the current state definition. The same applies to PMI IS integration and actually implemented IS changes can be depicted afterwards as “Implemented IS architecture” and used for future PMI initiatives.

We define the PMI IS integration decision process through gradually detailed data and process perspectives. Data perspective depicts all artefacts created and the relationships between them as a data model. Process perspective, as a process model, depicts how artefact creation can be achieved. For data perspective, UML Object and Class modelling notation is used, for process perspective UML Activity modelling notation is used.

The proposed data model can be seen in Fig. 7.

To minimise required effort, IS architecture for the organisation is defined as a set of current ISs used in the organisation without functional decomposition. For the same reason, gathered knowledge about PMI context and PMI goals is linked to IS architecture as such, without dividing it per specific IS. Requirements for IS architecture are not directly linked to IS as well, but they are indirectly used to identify similar goal IS groups.

The process model can be seen in Fig. 8. It mainly follows the sequence of artefact creation from Fig. 5.

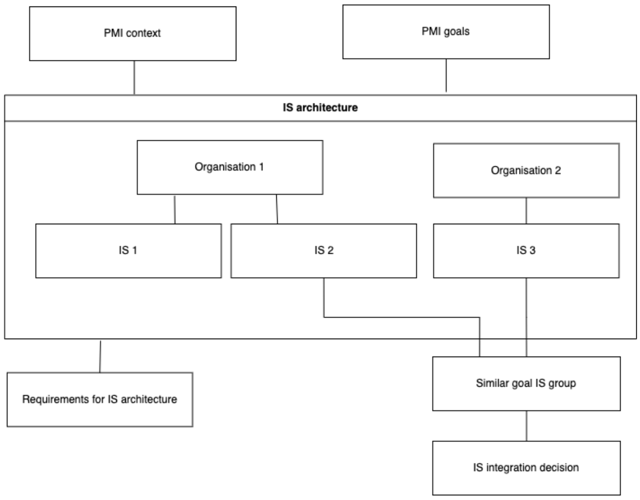

Fig. 7. PMI IS integration decision data model – 1st iteration

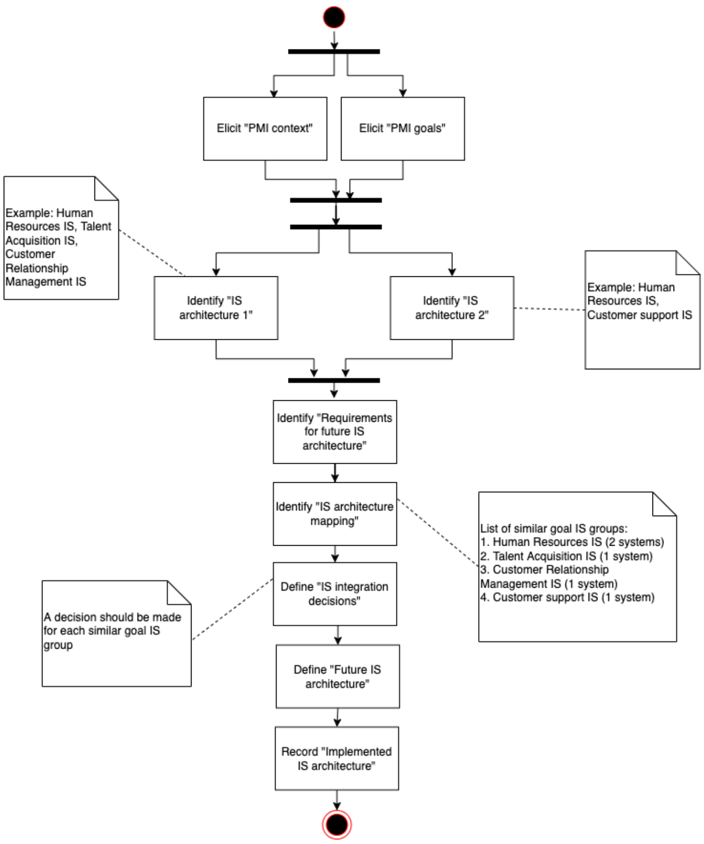

Fig. 8. PMI IS integration decision process model – 1st iteration

We start with eliciting PMI goals and the context. Based on the acquired information, we identify IS architecture for each organisation involved in PMI. After that we identify requirements for future IS architecture in a format of related business change. And, for IS related to planned business, changes we perform IS architecture mapping as grouping together ISs with similar goals. As the next step, we decide on integration for each of identified IS groups. Made decisions form the basis for future IS architecture definition. With many changes arising during the implementation, implemented IS architecture is documented after PMI IS integration decisions are implemented.

5.2 Enterprise Architecture perspective

IS changes in the scope of PMI should be linked with business changes and support overall PMI intentions (Wijnhoven et al., 2006; Mehta and Hirschheim, 2007; Baker and Niederman, 2014). In the previous section we introduced the artefact “Requirements for future IS architecture” as summarising business changes related to required IS changes. Linking together business and IS changes helps us to see PMI related changes across different organisational levels and align these changes. With this we extend PMI IS integration scope and should consider not only IS architecture but also business architecture in the merging organisations. A combination of IS and business architecture can be perceived as EA (Gampfer et al., 2018). In this section we explore how “Requirements for future IS architecture” can be decomposed into more granular artefacts representing PMI business changes. Changes in PMI IS integration are depicted in Fig. 9. Changes in current artefacts or added new artefacts are highlighted in green.

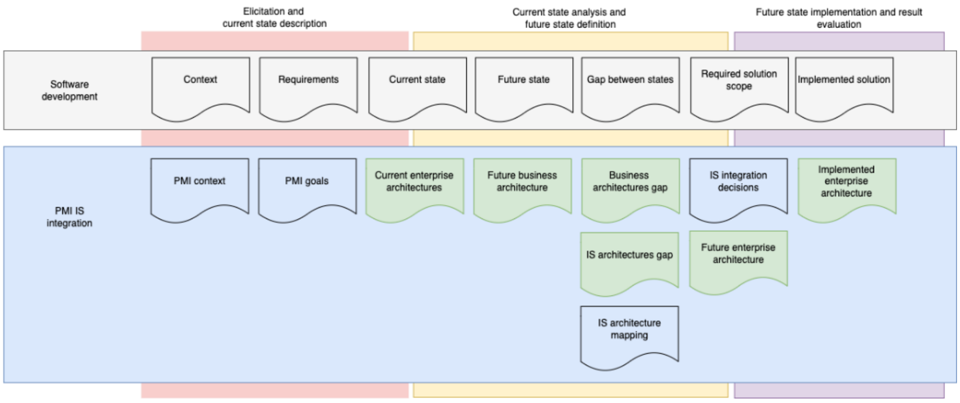

Fig. 9. PMI IS integration decision artefacts mapping to RE artefacts – 2nd iteration, adding business and enterprise architecture

If we look at “Requirements for future IS architecture” as related business changes describing future state, we can replace it with “Future business architecture” as future state context for which we should consider IS changes. We also should define the gap between future business architecture and current business architecture in newly added artefact “Business architecture gap”. To compare future and current states in business architecture, we require to know current business architecture – “Current business architecture”. We can then use “Business architecture gap” to identify “IS architecture gap” as a part of “Current IS architecture” related to a part of “Current business architecture” which will be changed. To relate business architecture to IS architecture we combine “Current IS architecture” and “Current business architecture” artefacts in one artefact “Current enterprise architecture”. We integrate business architecture also in the required and implemented solution descriptions – “Future IS architecture” and “Implemented IS architecture”, and replace these artefacts with “Future enterprise architecture” and “Implemented enterprise architecture” correspondingly.

Adjusted data model is shown in Fig. 10. Added business architecture is highlighted in green. To save resources, we propose to define business architecture through the organisational structure perspective – as a set of business units. Information about organisational structure usually is easier to gather as it is one of the common artefacts created for any organisation (Niemi and Pekkola, 2017), as well as PMI integration decisions on business level often are made for specific business units (Toppenberg et al., 2015; Henningsson and Toppenberg, 2020). We add the relationships between business units and supporting ISs. Requirements for future IS architecture are replaced with future enterprise architecture, specifically regarding changes on business level. Relating business units in the future organisation with business units in the current organisations is left out of the model and is expected to be identified using tacit knowledge of a responsible for PMI IS integration.

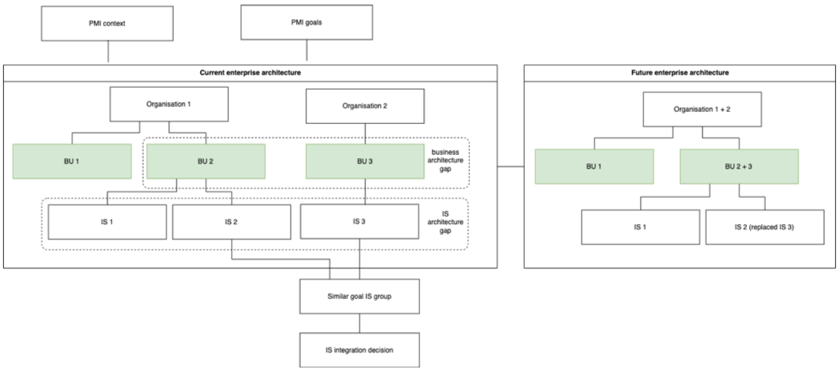

Fig. 10. PMI IS integration decision data model – 2nd iteration, adding business and enterprise architecture

Adjusted process model can be seen in Fig. 11 (examples in this model are limited to Human Resources unit integration). Instead of current IS architecture, we create current enterprise architecture for all organisations. Similarly, we define future and implemented architecture not only for IS, but also on the business level. After current enterprise architecture is defined for each of merging organisations, we define business level of future architecture and apply it to identify business architecture gap as the impacted business units in the current business architecture. After that we identify IS architecture gap as ISs supporting these business units. Similar goal IS groups are defined only for ISs included in IS architecture gap.

Incorporating in PMI IS integration decision process knowledge about current and future business architectures, as well as dependencies between IS and business architectures, supports better alignment with overall PMI goals and promotes synchronisation between business and IS integration initiatives.

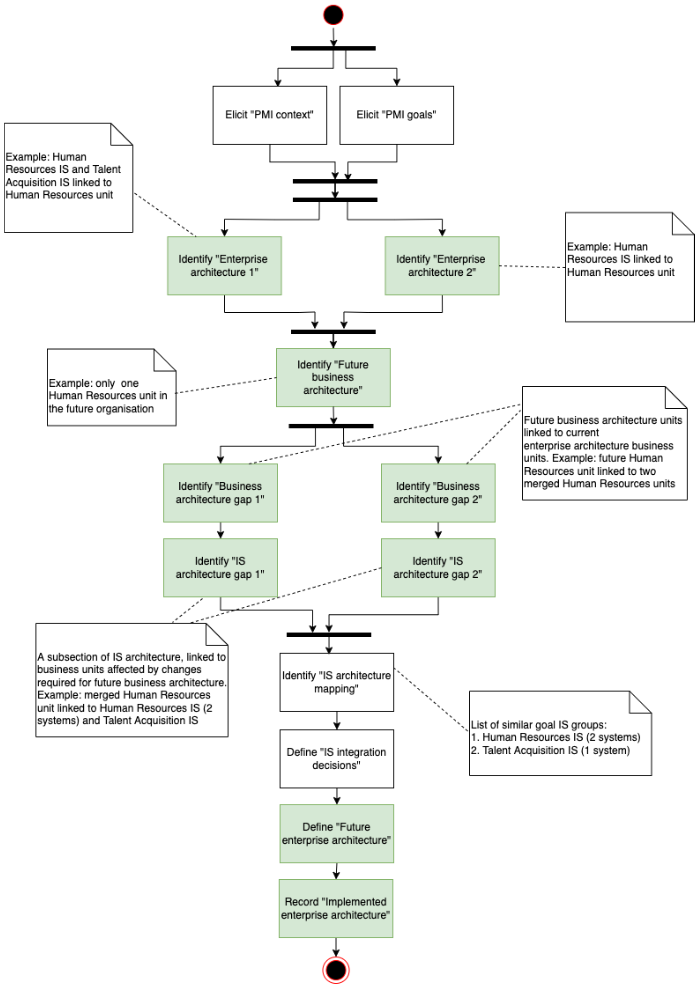

Fig. 11. PMI IS integration decision process model – 2nd iteration, adding business and enterprise architecture

5.3 Knowledge Management perspective

As an input for the next process activities in RE, explicit knowledge acquired in the previous steps is used (International Institute of Business Analysis, 2015). With high time pressure in PMI IS integration activities, we need to remove any additional effort, including creation of explicit knowledge if we can proceed further with just tacit knowledge. We propose to change ratio between explicit and tacit knowledge created and applied during the PMI IS integration. It is assumed that the minimum required explicit knowledge for IS integration decision making is “IS architecture mapping” and “IS integration decisions” artefacts.

Limiting explicit knowledge requires additional mechanisms for more efficient tacit knowledge management (Sutcliffe and Sawyer, 2013; Al-Alshaikh et al., 2020). We propose to replace explicit knowledge with information about stakeholders, who can be involved to get their tacit knowledge. This can help us to optimise knowledge management not only for artefacts created during PMI IS integration decision process. We can replace explicit knowledge about PMI goals and context with information about stakeholders knowledgeable in these topics. To make it more granular, we can link relevant stakeholders with specific business unit or specific IS and simplify knowledge acquisition related to specific part of business or IS architecture. Information about stakeholders can be added to the "Current enterprise architecture" and stored as explicit knowledge. Explicit and tacit knowledge artefacts are depicted in Fig. 12. For PMI IS integration project, we identify three artefacts that should be represented as explicit knowledge – "Current enterprise architecture and stakeholders", "IS architecture mapping" and "IS integration decisions". We assume that all other required knowledge can be gathered by involving relevant stakeholders.

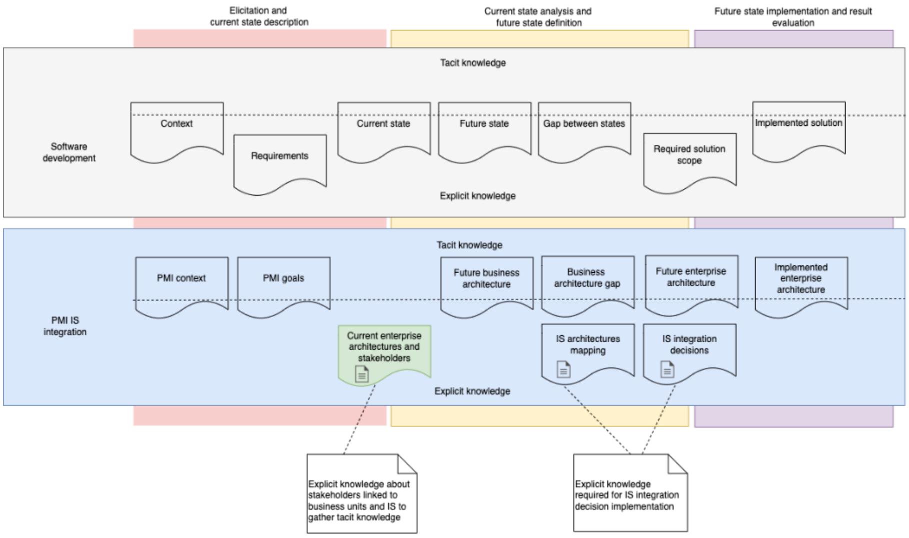

Fig. 12. PMI IS integration decision artefacts mapping to RE artefacts, 3rd iteration, dividing explicit and tacit knowledge

Relevant changes in the data model can be seen in Fig. 13. We explicitly define stakeholders, who have some tacit knowledge about the specific business unit or IS in the current enterprise architecture. We did not include PMI goals and PMI context, but it is assumed that stakeholders have tacit corresponding knowledge about business unit or IS they are related to.

Relevant changes in the process model can be seen in Fig. 14. Main changes are related to the current enterprise architecture definition where we define not only the architecture itself, but also link stakeholders with related knowledge. Additional significant changes are related to the type of knowledge we use for artefact creation – we document explicit knowledge only for "Enterprise architecture and stakeholders", "IS architecture mapping", and "IS integration decisions" artefacts. This leads to additional changes of how we acquire required knowledge for each process step – additionally to all explicit knowledge we also involve and consult relevant stakeholders.

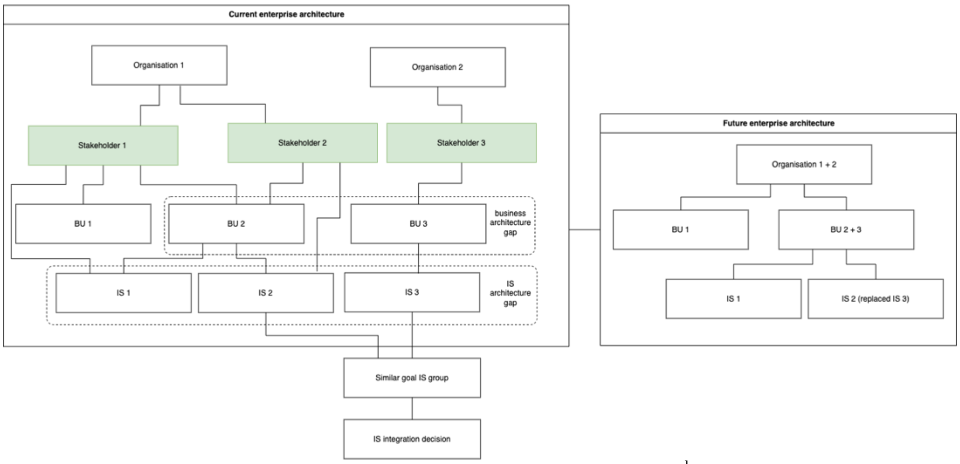

Fig. 13. PMI IS integration decision data model – 3rd iteration, dividing explicit and tacit knowledge

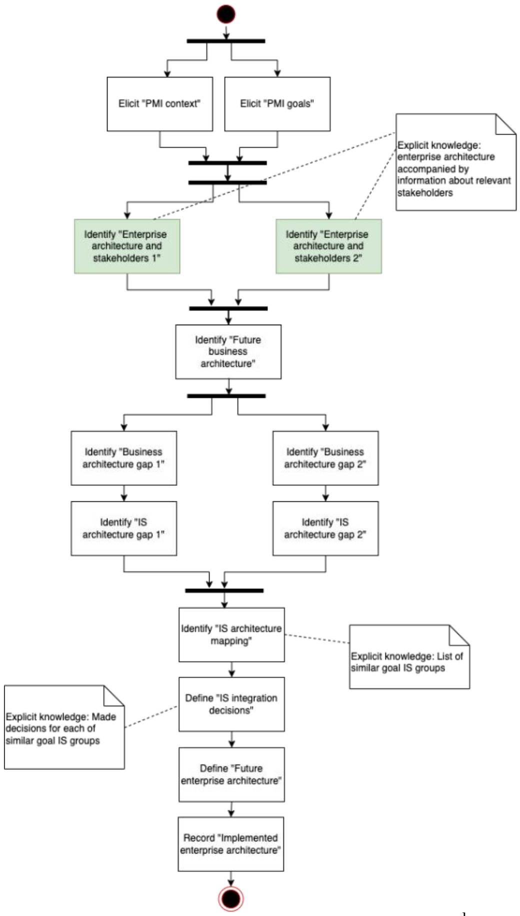

Fig. 14. PMI IS integration decision process model – 3rd iteration, dividing explicit and tacit knowledge

5.4 PMI IS integration framework

In this section we propose final version of PMI IS integration decision process framework. Final data model is represented in Fig. 15. This model is extended to include also future and implemented enterprise architectures. It also indicates classes defining IS architecture, business architecture and enterprise architecture. Multiplicities are added to indicate how many entities of each class can participate in the relationship. Additionally, classes related to explicit knowledge are marked with a special icon.

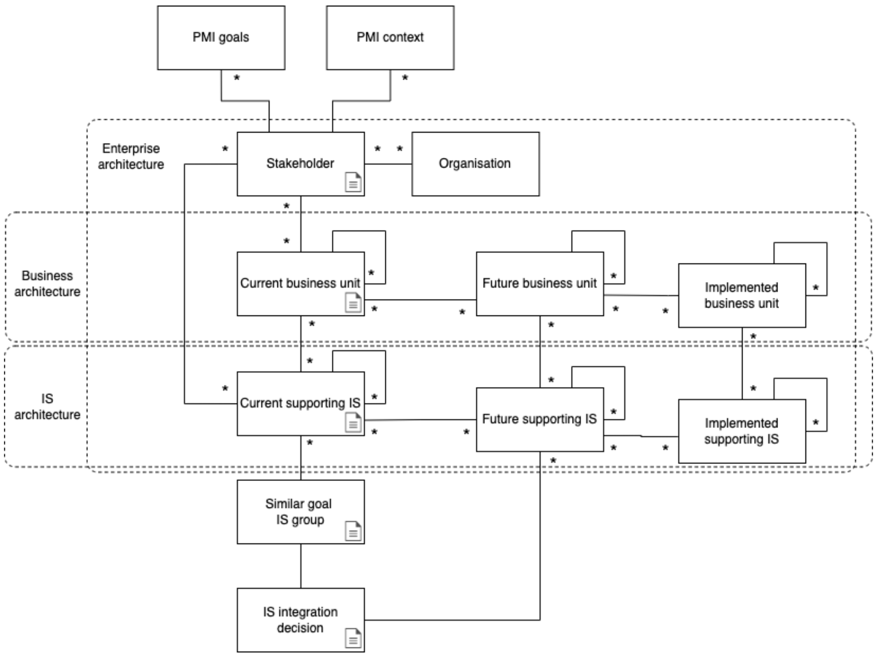

Fig. 15. PMI IS integration decision data model – final version

Final process model is given in Fig. 16. This model additionally supports two different options of how PMI IS integration decision process can be initiated. One of the options is “top-down” direction, when IS integration is required for the business unit or even whole organisation. In this case process is executed as previously defined – first current business architecture is defined for all organisations, then supporting IS architecture is linked. It has to be respected that not always complete organisation business architecture is required if integration scope is limited with only one or several business units.

Another option is “bottom-up” direction, when integration is required for specific IS. In this case, first we need to identify related business architecture of the company where this IS is used, then we identify similar goal business architecture for other organisations, and only afterwards we proceed to the supporting IS architecture level.

Proposed PMI IS integration decision process framework is aimed to minimise required effort and be suitable even for very high time pressure. However, if more time ca be allocated, explicit and tacit knowledge ratio can be adjusted to document future and implemented architectures and reuse them in future PMI initiatives.

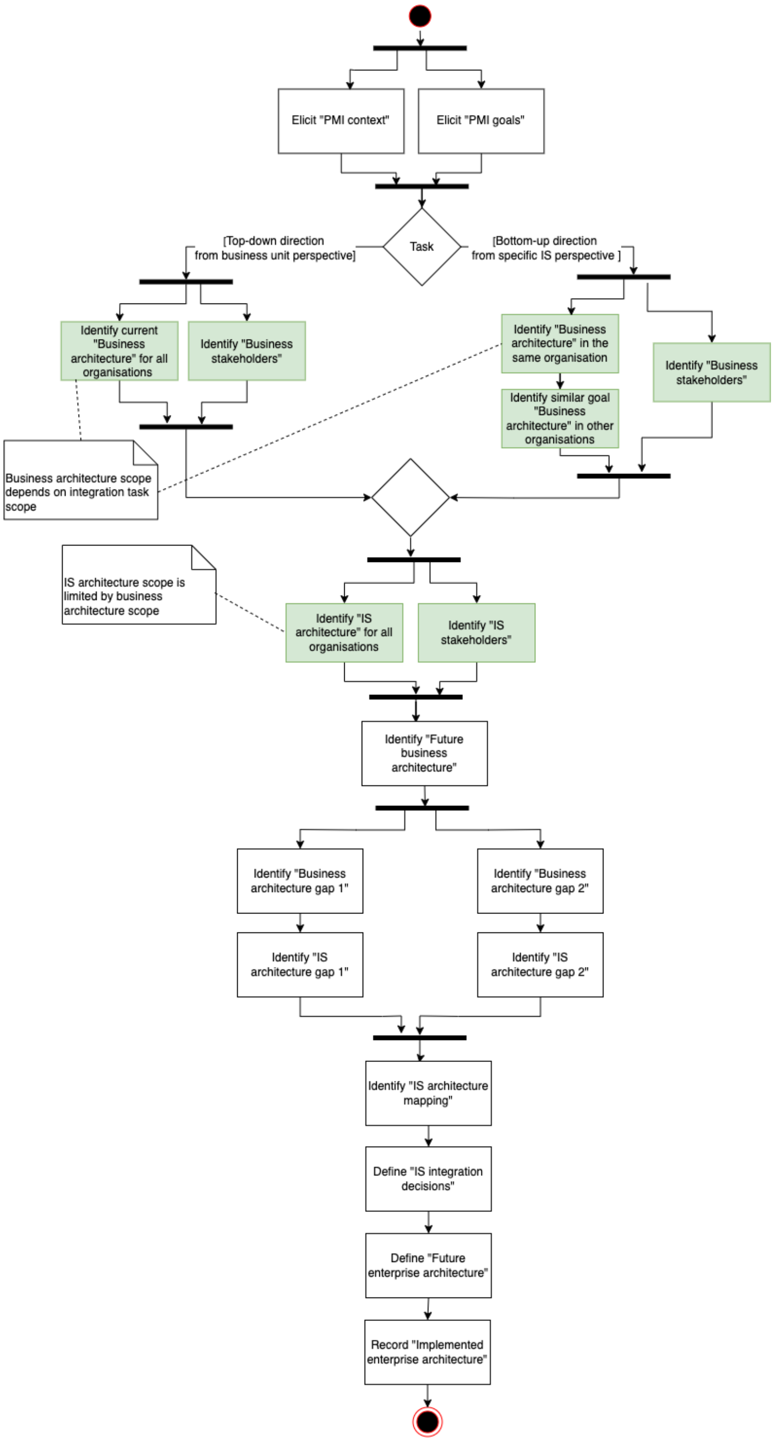

Fig. 16. PMI IS integration decision process model – final version

6 Conclusion

As the answer to the main research question, this research paper proposes a framework for PMI IS integration decision process, which is aimed at supporting an alignment between PMI IS integration and business changes in the scope of the PMI initiative. For this, the scope of the decision process is extended from IS architecture to business architecture and focuses on PMI IS integration decisions support for changes in overall enterprise architecture. The framework is adjusted to be used by professionals with minimum or no experience in PMI - the framework is based on requirement engineering for software development practices, which is familiar to IT professionals, who usually are responsible for PMI IS integration. To be used in the context of limited explicit knowledge, the creation and usage of explicit knowledge artefacts are limited by replacing explicit knowledge with the involvement of relevant stakeholders having tacit knowledge. To address aggressive timelines, any effort not directly related to the final result is reduced and the framework is described through the created artefact perspective. Additionally, to be applicable for different PMI IS integration cases – process adaptation options are incorporated.

The framework is defined through data and process models, specifying all required tacit and explicit knowledge required for PMI IS integration decisions, as well as decision-making process steps. This framework is ready to be applied in PMI IS integration projects by professionals with limited experience in PMI initiatives, and some of its parts have been applied in one company (Lace and Kirikova, 2021a, b; Lace, 2022). However, in the scope of this research paper, no overall framework simulation or validation took place. These activities are planned as the next research phase.

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Received November 14, 2022, accepted December 7, 2022