Main Challenges and Potential Solutions to Overcome Some of the Problems in IS Acquisitions

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Abstract

In EU/EEA area, IS procurement process is based on general regulations on public acquisitions, which is arguably not well suited for selection of complex or unique systems, often resulting in IS projects with unsatisfactory features or excessive budgets. The topmost problem with public IS procurement projects is that requirements specification must be completed before the vendor selection (and depending on procedure, even before announcing the tender). Other identified challenges include stakeholder issues, lack of governance of procurement processes, information asymmetry, limited interest from vendors, conflicting socio-economic objectives (which seems to be less of an issue in the EU/EEA market), and evaluation of total cost of ownership. Based on limited literature review and experiences from a CRIS renewal project, prerequisites for successful acquisitions include managing the procurement process as a whole (including feasibility study and maintenance phases), stakeholder management (i.e. identifying roles and facilitating communication), training on requirements engineering, and preparation for external incidents (e.g. risk analysis). Other success factors include sufficient resourcing, attention to feasibility study (e.g. evaluating different implementation options, possibly taking enterprise architecture into consideration), and selection of a suitable tendering procedure.

1 Introduction

Information systems renewal projects are commonplace in all organizations. Manual processes call for automation, often enabled by new information systems. Changes in legislation or technical environment may induce unforeseen needs on relatively short notice. As the system gets adopted, the demand for user interface improvements or tighter systems integration intensifies. It can be even argued that if *any* system gets used and provides business value in the first place, different ideas for enhancements, bug reports, and security alerts arise – at some point to the extent that the scope of desired changes falls beyond routine maintenance. While IS renewal in general can be interpreted in variety of ways (e.g. restructuring or rewriting an existing system, accommodating or tailoring an open source system, or commercial acquisition), the focus in this course was in public sector IS procurement processes and challenges related to it. The domain is of specific interest, because all public acquisitions are highly regulated in EU/EEA area. The goal of the regulations is to keep procurement processes transparent and to give equal opportunity to different vendors.

In practice, however, it seems that the regulated process itself becomes a problem, at least with information systems that involve a substantial change process, large number of stakeholder, or otherwise complex domain. Numerous examples of failed or financially overblown public sector IS projects exist from Finland and elsewhere (Järvenpää & Kankare, 2013). Complaints to market court can severely delay the implementation[1]. Because of the lack of theoretical knowledge on IS procurements and considerable differences on IS/tendering

[1] http://www.hankintajuristit.fi/market-court-dismissed-cgis-last-complaint-in-the-case-of-apotti-patient-information-system/

expertise in procuring entities, project success seems to be largely dependent on performance and communication skills of key personnel, relying more on situational and anecdotal knowledge than sound research results. Some of the problems can be attributed to well-known challenges related to software engineering projects in general (e.g. results delivered late or with lacking features), but public procurement regulations add an additional level of complexity to the process.

This essay highlights issues in public IS procurement processes based on four papers (Moe & Päivärinta, 2013), (Moe & Newman, 2014), (Moe & Sein, 2014), (Alanne et al., 2015), lecture slides, and other material. Challenges and some potential solutions are identified and described in Section 2. Section 3 concludes the essay with additional analysis and experiences from the CRIS (Current Research Information System) renewal project at the University of Jyväskylä.

2 Challenges and solutions

An extensive list of IS procurement challenges in presented by Moe and Päivärinta (2013). The classification is based on initial literature review followed by a Delphi study, where additional challenges were identified and prioritized from the perspectives of procurement managers, CIOs, and vendors, respectively. Although the experts participating in the Delphi study represented Norwegian public sector, the results seem to be generalizable to EU/EEA countries because of the similar regulations (i.e. public calls for tenders, specific competitive procedures, MEAT[2] criterion for selection) for procurements over a certain threshold[3]. The main types of challenges identified in the literature review and referred in other papers as well include:

- **Stakeholder issues**. Various internal stakeholders add to the project complexity and may have different priorities or even conflicting goals to procurement project. Moe and Newman (2014) bring out the general issue that public sector organizations that are subject to political rather than economic controls are likely to face multiple sources of authority that are potentially conflicting. Moe and Sein (2014) take the issue to individual level: end user groups or even members in the project group are not homogeneous but may have different interests. Line management may have different interests, depending on the functional area they represent. Stakeholders' relative preferences may vary over time – resulting in changing requirements.
- **Governance of procurement processes over time**. This class was derived from a study of 4 ERP procurements in private sector (Poon & Yu, 2010) featuring a conceptual ERP procurement process model (pre-implementation phases) and lessons learned from the cases. Critical success factors include the importance of forming a cross-functional acquisition team representing all essential stakeholders that are affected by the ERP system, and preparing a comprehensive list of evaluation criteria. The decision-making strategy should account for the fact that not all objectives of the organization can be satisfied simultaneously and not all relevant information is available – and still aim for the "best fit".
- **Information asymmetry**. Vendor (or vendor's consultant) has knowledge of the system being evaluated, whereas the procurement entity has knowledge related to the specific problem that the information system is supposed to solve. Surprisingly, information asymmetry was not identified as a relevant issue in the Delphi study (with the possible exception of *Vendors tend to oversell*), but based on my experiences, this is an essential challenge apparent in both requirements specification and implementation phases: on one hand, requirements might not be realistic without sufficient understanding of the system and on the other hand, implementation (e.g. customization of the system by the vendor) requires exact understanding of the customer's problem. Domain knowledge on both sides, as well as negotiations or competitive dialogue alleviate the issue, but even with the relatively well standardized and constrained domain of research information systems there are national and university-level requirements that may not be well understood by vendors even if referred to in the tendering documents.
- **Limited interest from vendors**. Smaller companies do not necessarily have resources to participate in large-scale IS procurements because of the complexity of the process and the cost of participation (especially if negotiations or competitive dialogue are applied). The issue might not be limited only to vendor interest but also to pre-qualification on the procuring entity's side (i.e. demand multiple references

[2]Most Economically Advantageous Tender

[3]https://www.tem.fi/kuluttajat_ja_markkinat/julkiset_hankinnat/kynnysarvot

or solid financial standing from the vendors). Framework agreements of IT consulting may also end up limiting competition if vendors are pre-selected by a national procurement entity[4]. Interestingly, the issue with framework agreements with regard to selection of best vendors for application development has been acknowledged by the national audit office as well (Lahdelma, 2015).

- **Conflicting socio-economic objectives**. This may be more specific issue to US than EU/EEA market. Many states in the US have criteria related to promoting the efforts of small businesses, women, and minorities when choosing contractors which may cause conflict if the leading product is supplied by a large, multinational company. In the Delphi study the experts (representing mainly big national vendors, which, at least in Finland, have sometimes been criticized[5] of their prominent role in some public procurements) did not identify this is a problem, which is somewhat in line with the previous point related to vendor interest. In addition, project goals in general may be ambiguous (i.e. not just generating revenue) in the public sector.
- **Specifying requirements before announcing the tender**. Probably the number #1 issue with failed IS acquisitions (and software engineering in general if a waterfall-like process model is used). Moe and Newman add that even "borrowing" requirements lists from other similar projects does not solve the problem because they still have to be fitted to a particular organizational context. If this is not done, the specification might involve unnecessary or unsuitable requirements, increasing project cost.
- **Cost issues**. Selecting the system based on initial procurement costs may still result in higher life cycle cost (total cost of ownership) due to increasing maintenance costs[6] or additional customizations. If the system is successful, it will most likely be utilized longer than the time frame specified in initial procurement contract. In the case of unavailable interfaces of other vendor lock -like issues, the system might have a long life cycle even if considered unsuccessful. Contextual changes (supported technologies, legislation, security) may necessitate rapid action. The evaluation of TCO becomes even more complex if there is an option of in-house development, or utilizing open source.

The expert panels in Delphi study defined a total of 98 challenges divided to 13 categories: requirements specification, change management, cooperation among stakeholders, competence, competition, contracting, inter-municipal cooperation, governmental management, procurement process, rules and regulations, technology and infrastructure, vendors, and IT governance. Top 19 issues were collectively identified and ranked by each panel. Not surprisingly, the top theme common to all stakeholders was related to requirements, although there was a subtle change in emphasis: vendors were mostly concerned with *feasible* requirements, whereas internal stakeholders were primarily concerned with *clear* requirements. In addition, procurement managers seem to have slightly higher concern for *complete* requirements compared to CIOs.

There was a clear correlation between procurement managers' and CIOs' rankings. Both emphasized clear requirements, assessment criteria and concern for integration/compatibility. The highly ranked issue *lack of coordination and standardization* may in this study be related to Norwegian inter-municipal procurement networks, but applies quite likely to all projects where multiple procurement entities (e.g. a consortium) or multiple organizations on the vendor's side (e.g. integrators or other consultants, cf. Järvenpää & Kankare, 2013) are involved. Procurement managers actually ranked *change management of work processes and benefits realization* as the top challenge, which Moe and Päivärinta considers surprising as the change of work processes starts after the responsibilities of the procurement personnel are finished. The role of procurement manager was not clearly defined in the paper, but to ensure successful completion of the project it should be reasonable to assume that the staff participating in the procurement – and most familiar with features of the system and overall goals of the acquisition – are present in the implementation phase as well. Vendors' ranking emphasized issues related to feasible requirements, lacking opportunities to show their unique qualities (due to too much focus on features explicitly defined in requirement specification), benefits realization, and cooperation between different stakeholders. The top identified challenge was, perhaps understandably, too much focus on costs on the customer's side.

Other papers in course material consisted of case studies: Moe and Newman (2014) and Moe and Sein (2014) both analyze a procurement process of an electronic health record system in Norwegian municipality, but from different perspectives: the former focuses on process analysis highlighting critical incidents – aspects

[4] https://web-ostajanopas.fi/2016/01/27/julkishallinnon-it-ostaja-harkitse-tarkkaan-hanselin-puitesopimuksia
[5] http://www.image.fi/image-lehti/tieto-voittaa-eli-suomalaisten-julkisten-it-hankkeiden-surullinen-tarina
[6] E.g. http://www.tivi.fi/CIO/2013-02-08/SAP-vahvistaa-hinta-nousee-my%C3%B6s-Suomessa-3198395.html

of the project that proved difficult, or that involved conflict to some degree, and which changed the outcome of the project. The latter combines dialectic theory with stakeholder theory to identify contradictions between goals of different stakeholders. Alanne et al. (2015) provide a disturbing account of a procurement project in Finnish municipality where different stakeholders were initially happy with the requirements and preparation, but the implementation was plagued by unexpected technical problems and lawsuits. Most of the challenges highlighted in the papers can be found in the earlier literature, but the cases have somewhat more emphasis on vendor issues and internal conflicts between stakeholders – and overall lack of know-how in the acquisition process by procurement entities. Cases bring out several points that are critical to the success of IS procurement projects and affect multiple "smaller" challenges. Notable ideas include the following:

- The need to **manage the procurement process as a whole**. Project leader should be involved from feasibility study to the end of implementation (Moe & Newman, 2014). My position is that the perspective should be even wider: prior to preparing the laborious requirements specification and other tendering documents, attention should be shifted to feasibility study (e.g. determine different implementation options and find the distinguishing features of competing systems, if the organization chooses to go on with tendering). Similarly, the implementation and maintenance phases are important as the constraints and capabilities of the system and realistic outlook of development is known only with a live system. The system starts to provide business value only after it is in production, which should be accounted for when resourcing maintenance after the completion of the actual procurement project.
- The need for **stakeholder management** in highlighted in all case papers. In stakeholder theory, the stakeholders involved have traditionally been considered only on organizational level, or the analysis is restricted to specific stakeholders (Alanne et al., 2015). Stakeholders should be described with sufficient detail and analyzed with additional techniques for better understanding. For example, dialectic theory helps to uncover conflicts and contradictions (Moe & Sein, 2014), whereas the *roles in networked activities* -framework referred in Pekkola's slides would make the actors (and their expected role in the project) visible and would possibly help to identify potential gaps or hindrances in stakeholder interaction.
- Since preparing requirements specifications is identified as the topmost challenge related to procurement (Moe & Päivärinta, 2013), any means that facilitate the requirements -related activities should obviously be considered. Moe and Newman note that there is very little literature on development of requirements specifications in the context of public IS acquisitions. I find this surprising considering that **requirements engineering** is an established subfield of software engineering with considerable existing literature[7]. Procurement managers would most likely benefit from RE-related training. Moe and Sein promote negotiation procedure as the way to resolve (possibly questionable) contradiction *Following regulations vs. satisfying system needs*. Moe further generalizes in course slides that tendering with negotiations or competitive dialogue are suitable selection procedures for complex or non-unique systems. Early dialogue with the vendor, and – if possible – testing the system in advance, certainly reduces the information asymmetry, and may even clarify the customer's *own* understanding of the requirements needed. However, regardless of how much effort is taken to analyze the requirements (with or without the vendor) up front, this does not negate the fact that requirements tend to change over time.
- In one of the lessons learned from the case study, Alanne et al. point out that the acquisition project has to be **prepared for external incidents**. Change management, in all possible forms, and risk management practices have to be in place. This is indeed one way to counter the changing requirements, but it is somewhat unclear how this is realized in practice in contracts – is it possible to include some *force majeure* clause (i.e. collapse of a particular mobile ecosystem) that could lead to cancellation, even if the requirements have been satisfied per se? A practical difficulty is that these kinds of incidents are difficult to anticipate. Procuring entities would benefit from a risk-driven approach, akin to Boehm's spiral model (2000): directing the development (or specification) efforts such that the overall risk is minimized, and using milestones that can be used to determine whether the project can proceed or be discontinued.

It seems that typical practices of public IS procurement are still somewhat undeveloped: success or failure depends on the personal characteristics (e.g. combination of technical, communication, and domain skills) of the persons involved in the procurement, in particular the project manager (Alanne et al., 2015). Therefore, the

[7] E.g. `http://www.requirementsassistant.nl/references`

simplest generally applicable person-level solution would be improving the technical or procurement expertise by training – and ensuring that the procurement project is adequately resourced, preferably with full-time employees. On organizational level, finding ways to ease communication and streamlining decision making would increase the probability of a successful acquisition. Another suggestion of organization-level improvement (referred in Pekkola's slides) included adding activities to feasibility study prior to procurement project itself, such as viability check (evaluating the proposition), provide check (mapping potential vendors), and EA check (evaluating the potential system from the enterprise architecture perspective). While this would likely lead to an informed and justified decision (e.g. model dependencies between systems and business processes and prioritize between development projects), the problem is that even if the enterprise architecture is described (which is in principle implied by Information Management Governance Act of 2011), it turns out the EA has not been explicitly referred in majority of Finnish IS procurements as late as in 2015. In addition, there are differences in interpretation of model elements, modeling detail, and the overall EA process in different administrative sectors (Lahdelma, 2015). Solutions for successful enterprise architecture adoption have been identified, but are highly context-dependent (Seppänen, 2014). Obviously, changing the organizational culture or applying enterprise architecture to decision making are beyond the scope of a single procurement project and needs long-term commitment from the top management.

3 Discussion

In a general level, problems with the procurement process can be alleviated to some extent by selecting a suitable procedure for tendering (i.e. framework for selecting procedure referred in Moe's slides) based on domain (non-complex vs complex requirements) and system (unique vs non-unique) properties, with the addition of newest procedure type "Innovative procurement", resourcing the project (considering also the feasibility study and maintenance phases!) with members with sufficient skills (e.g. requirements engineering) needed in procurement, and fostering organizational culture with transparent communication and risk awareness such that potential problems are identified and reacted on early. Newest version of JHS166 National recommendation of terms and conditions of public IT procurement (2015) takes into account agile development and open source software, but it is yet unclear how this will affect future procurement projects. In the CRIS procurement project at JYU, tendering with negotiations was selected as a procedure and at least in this case Moe's framework has turned out to be valid (i.e. negotiation procedure was applied to select a complex and non-unique system). Tendering and preparation process – especially including the feasibility study (Miettinen et al., 2013) – was rather lengthy: negotiations with vendors were conducted in January 2015 and initial requirements were revised based on negotiation data. The selection phase was carried out in October 2015 and contract was completed in December 2015. At the time of writing, the implementation project[8] is in progress.

Based on experiences related to developments project at the JYU it is clear – at least from developer's point of view – that feasibility study and maintenance phases are at least as important as the procurement project itself. Implementation options have considerable effect on project management and cost model, and obviously on the adaptability of the system. In the CRIS case, identified renewal options included re-engineering the legacy system[9], procuring a commercial system, or adapting an open source alternative (Nurminen, 2014). After assessing the comparative benefits of different options – and after preliminary interviews and live demos from the vendors – tendering was selected as the primary implementation option. Other cases, e.g. in the study information system sector, involve different kinds of available development models, such as consortiums[10], development companies[11] owned by research institutions, or other collaborative projects[12]. Strategic alliances[13] and other structural development[14] will most likely have a profound effect on IT and other support services and, consequently, on decision making of procurement projects. In-house development still remains as an option, but to a lesser extent since the needs of different universities are increasingly similar – this remains as a challenge for organizations with a tradition of successful development. From the maintenance point of view, a

[8] https://www.jyu.fi/yliopistopalvelut/str/erityistoiminnot/tietohallinto/cris-kayttoonottoprojekti
[9] http://tutka.jyu.fi/
[10] E.g. http://www.peppi-konsortio.fi/
[11] E.g. http://blogs.helsinki.fi/otm-hanke/2016/02/10/funidata-oy-perustettu/
[12] E.g. https://confluence.csc.fi/display/TT/TIPTOP
[13] E.g. U5: Univ. of Eastern Finland, Univ. of Turku, Univ. of Tampere, Univ. of Oulu, Univ. of Jyväskylä
[14] E.g. https://tampere3info.wordpress.com/

system developed commercially or by a separate development company does not necessarily imply lower total cost of ownership, but a change in development focus: instead of directly developing new features, more effort is directed to configuring the system, data integration, and negotiating about new features with the vendor. In the case of a customized system based on open source, additional effort needs to be taken with synchronizing the customizations with upstream updates. Effectively the in-house developers need to become part of the wider development community.

Dialectical reflections and contradictions presented by Moe and Sein seem somewhat generalizable to different procurement projects, but the conflicts are identified in post-project analysis. What if a larger collection of typical conflicts (and a roadmap for synthesis) could be identified and referred to, while the project is *still active*? The synthesis could be used to resolve conflicts and steer the project. The result could possibly be compared to organization-level design *patterns* where an identified, recurring problem is described with a known context and conflicting forces – constraints or issues that must be addressed by the solution (see e.g. Bennett et al., 2006). At least technical and organizational *anti*-patterns (Brown et al., 1998) (e.g. analysis paralysis, mushroom management, vendor lock-in) seem to be quite applicable to "challenged" procurement projects. In the CRIS case, I can identify the contradictions *Change vs. persistence* and *Revolutionary change vs. incremental change*. On one hand, the legacy system is aging and cannot easily accommodate all new requirements, on the other hand, as a system developed in-house, existing processes and data transfers have been optimized and it is considerably easier to implement new (small-scale) features. In addition, there are numerous examples from software engineering history that point out risks[15] and even strategic-level mistakes[16] related to replacing (vs. refactoring or re-engineering) existing systems – especially if the new system is developed from scratch. As succinctly put by Ross[17],

> There has been plenty written about the problems with software rewrites. [—] The general consensus from each of these articles is to *never rewrite software unless you really have to.*

The same issue applies – albeit to a smaller extent – to "off the shelf" or tailorable systems as well because it is highly unlikely that a new system will support the same feature set as a legacy system that the users are familiar with.

There seems to be a kind of disconnect between the practice of preparing requirements specifications in procurements and the existing body of knowledge on requirements engineering. Should this be attributed to general lack of IS capability in the public sector, or are the lessons of requirements engineering simply ignored? It's even possible that the popularity – and indisputable success – of agile methods has done some disservice when confronted with public procurement since the stature of requirements analysis is somewhat downplayed in agile philosophy[18] over more immediate user stories. One possible explanation might be that requirements engineering has been perceived to be a part of the *development* process as an activity of the implementing (and not the procuring) organization. Still, Boehm's spiral model (2000) with its original version presented as early as 1986 seems to be quite applicable as a guideline (e.g. concurrent analysis activities, revisiting decisions, using prototypes, applying risk analysis with possibility of cancellation in milestones) to the procuring organization as well. An additional benefit of the spiral model is that it spans the entire life cycle of the system. Regardless of the development model, an important issue – in all phases of the process – is to provide sufficient information and a feedback channel for end users to propose new features and improvements to the system. At the JYU, Kalermo (2014) has suggested a model for user-centered design process (especially applicable for in-house development), but the process becomes more complex when an external vendor or multiple partners are involved. In the CRIS case, the issue has been resolved with a communications plan, and a reference group with representatives of different stakeholder groups.

Even though qualitatively a different case from acquiring e.g. hardware or well-defined services, IS acquisition in the public sector is forced to a rigid process where complete requirements about the future system should be known in advance. Waterfall-like approach to software development has been largely abandoned with the advent of agile methods – requirements tend to change as new needs (internal or external) arise and understanding of the problem domain (as well as potential and constraints of the system itself) increase. It is even quite likely that the vendor organization does agile development internally with possibly rapidly changing available features. If the procurement process turns lengthy, the original requirements specification might

[15] http://www.luckymethod.com/2013/03/the-big-redesign-in-the-sky/
[16] http://www.joelonsoftware.com/articles/fog0000000069.html
[17] https://timross.wordpress.com/2010/03/15/if-you-must-rewrite/
[18] http://www.agilemanifesto.org/

be obsolete both from the customer's (=new internal needs or changes in legislation) and vendor's (=feature changes) point of view at the time of implementation. This puts pressure to the feasiblity study, requirements engineering skills, and calls for a holistic approach (e.g. adopting enterprise architecture or a spiral model -like process). What are the implementation options for IS renewal? Is tendering needed in the first place? Who are potential collaborators? Could some of the goals of the future system be realized with present system, utilizing e.g. process changes? Is it possible to divide the project to more manageable parts, at least in the implementation phase? Constraints of the available systems – if any – should be evaluated (with end users involved) as early as possible with demo versions and interviews. Should critical features (positive or negative) be discovered early on, this might justify a direct award contract.

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