Six Degrees of Success or Failure in ERP Requirements Engineering: Experiences with the ASAP Process

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Abstract

In this paper, we build on previous work inferring lessons learnt from five years of experience in using generic off-the-shelf requirements engineering (RE) processes in Enterprise Resource Planning (ERP) projects [7].

We identify and discuss six ways that the application of a generic RE process model can succeed or fail. The distinction between success and failure is not always immediately evident.

Experience

1. Introduction

Current trends in RE for ERP solutions focus on the concept of applying packaged off-the-shelf process models made up by proven and reusable RE practices to produce the business requirements for the project. Such a process is standardized by the ERP vendor so that it can be repeated in an efficient and well-understood manner. ERP vendors pick up these so-called best practices not because they have precisely quantifiable values, but rather because successful ERP project organizations commonly use them in RE. A generic process is also supported by a combination of standards, procedures, and tools [29] that enforce those standards and procedures. The standards represent solution patterns that have impact on the final RE deliverables and that enable the best practices making up the model. Successful use of a generic process means that the following RE process goals should be met:

1. On-time and within budget definition of the business requirements;
2. Expected architecture design is delivered;
3. Efficient use of project resources;
4. Happy process stakeholders.

But achieving this is rare. Bringing the process in is not enough; as it arises out of a sophisticated process model, its application requires some planning and thinking, at least if one expects satisfactory results [7].

This paper rests on results of experience studies [4,5,6,7] that sought to contribute to understanding the issues organizations face when adopting a generic model. Based on what we learnt from five years of experience in deploying a standard ERP RE process model in a Canadian telecommunication company, we attempt to identify what distinguishes a more successful instantiation of a standard process from a less successful one. Our objective is to come up with categories of success and failure that reflect the various degrees of the capability of a RE process to provide value to the adopting organization. The motivation behind this paper is to understand if a distinction between success and failure is immediately evident and if so to what extent. The experiences reported here have been collected in the context of conceptualizing solutions based on the SAP package, a leading product in the ERP software market.

The paper is structured as follows: the next section provides the background information on previously reported results that we used as foundation for this paper. Section 3 reports on positive and negative patterns experienced in practicing the generic SAP process. Section 4 defines what we mean under the terms success and failure. Section 5 describes the success/failure categories from an integrated perspective in terms of outcomes, typical scenarios, reasons, and process visibility. Section 6 reviews related work and section 7 concludes the paper.

2. Background

2.1. Sources for the Analysis Method

Our success and failure analysis method is based on four types of sources:

- value-based software engineering concepts [2] integrating value considerations into the existing and software engineering principles and practices, and frameworks for evaluation of the value-added benefits from IT investments [25,32] and, also, for analysis of the overall success and failure of IT projects [1] that helped us keep the global understanding of the ERP RE process and its usefulness in large,
- existing theoretical and empirical work on RE processes assessments [11,12,13,18,22,30] which

provided useful insights into the mechanics behind successful and less successful RE processes,

- our own experience in assessing maturity aspects of SAP RE processes [5,6] and deriving lessons learnt from five years of practice in ERP RE [7].
- methodologies for building lessons-learnt architectures [14,31] that guided us in the process of documenting, packaging and analyzing our own RE experiences in our ERP projects.

2.2. The Experience Base

Our experience was collected and analyzed in the context of 13 SAP projects completed between 1997 and 2002 in a wireless telecommunication company. The generic model we adopted in the context of our ERP projects was the AcceleratedSAP (ASAP) RE process. It is a project-specific process, engineered and standardized by SAP, and provided to clients by ASAP-certified consulting partners. The ASAP process has been extensively elaborated in [28] and, for the last five years, applied at both American and European companies [3,8,9,20,26, 34].

The practical settings for our 13 projects have described in detail in [7]. In summary, they included the following: To manage implementation complexity, each of our projects was broken down in a number of subprojects reflecting the number of components to be configured. For example, the first project had to implement six components and was broken down in six subprojects. The total number of our subprojects in which the standard ASAP process was instantiated was 67.

For each subproject, there was a dedicated RE team. This is a group of individuals who are assigned to a specific subproject, contribute time to and run the RE cycle for this subproject, and deliver the business requirements document for a specific SAP component. Each RE team consisted of one or two SAP consultants who provided in-depth knowledge in both the ASAP implementation process and the SAP components, and a number of business representatives, the so-called process owners. They were department managers and subject matter experts who contributed the necessary line know-how, designed new processes and operational procedures to be supported by the SAP modules, and provided the project with the appropriate authority and resources. All process owners had above average level of experience with IT-projects in their departments and, before starting the projects, attended a three-hour training session on the ASAP process. Next, we considered our consultants as an even mix of experts, new hires and novices. Each expert had at least 5 years of configuration and integration experience with a specific SAP functional module. Most experts had ASAP RE experience. Our consulting partners provided evidence that their less experienced staff-members completed the standard training courses on both the ASAP process and the corresponding SAP modules. However, none of the consultants had any experience in the telecommunication sector; they were unaware of the requirements principles in this domain and were supposed to carry out RE activities under novel and challenging conditions.

All the teams were supported by a process architect responsible for architecting the solution, sharing process knowledge and consulting on ongoing basis with the teams on SAP reuse, process methods, and RE tools. The architect was the only resource the teams shared.

Our 67 teams worked separately and with relatively little communication among them. This allowed us to consider and include 67 process instances in our assessment study. For the purpose of our ASAP process studies [5,6,7], we used the definition of process instance given in [11]: this is the "singular instantiation of a process that is uniquely identifiable and about which information can be gathered in a repeatable manner".

2.3. The Scope of the Success/Failure Analysis

To get understanding of what happens when making the ASAP model a live process, we systematically assessed the process instances that we observed in each project by means of a standard RE maturity framework, namely the Requirements Engineering Good Practice Guide by Sommerville and Sawyer [30]. The framework is based on three maturity levels, Initial, Repeatable and Defined, showing how an organization uses and follows RE practices classified by three types: basic, intermediate and advanced ones. A process assessment based on this framework represents a client-friendly, transparent and easy way for (i) showing conformance with the standard ASAP RE cycle [5,6], and (ii) capturing information about ASAP RE practices that worked, those that did not and those that still remained to be practiced. The maturity assessments along with the challenges and the methods used in deploying practices at higher RE process maturity level have been carefully analyzed. Most of our business representatives and consultants shared observations about how their RE processes went and how they felt about the resulting products. This was needed to derive some lessons learnt [31] regarding (i) the practices that have been most neglected during RE, (ii) the practices that have tended to be skipped because of business concerns, (iii) the practices that have been avoided because of consultants' concerns, and (iv) the impact of skipping ASAP activities on the quality of the final business requirement, the so called blueprint.

Furthermore, we analyzed some completeness and consistency aspects of the requirements documents delivered in the process instances [5,6]. Completeness was tracked by evaluating the rates at which new and unanticipated requirements came in the remaining phases of our 13 projects. Next, consistency was defined as the

percent of the initial requirements that we found to be in conflict with other subproject's requirements or with high-level requirements.

After analyzing this information to understand and characterize common points of success and failure, we also identified what should be done to make sure the adoption of the standard RE process achieves its goals [7].

3. Patterns of Success and Failure

The four tables included in this section present the results of our analysis and report on the positive, negative, best and worst experiences from practicing the ASAP process. We present only those patterns that we found in more than two process instances. The last five columns in the tables show data as a percentage occurrence of a pattern in a group of processes. There are five groups of processed that we refer to as to (a), (b), (c), (d) and (e) in Tables 1-4. Group (a) includes process instances that missed the deadline for the RE cycle, had higher costs than originally planned, or led to rework in the later project stages. Group (b) covers processes in which the requirements were with decreased consistency and completeness or that did not deliver a correct architecture design. Group (c) consists of processes in which the RE teams skipped more than 50% of the ASAP standard practices. Group (d) includes processes in which process owners remained unhappy with the process results. Group (e) covers processes that achieved the four goals stated in the Introduction and every RE team member saw it and considered that the advantages the process brought to the project were used to the fullest. For example, in Table 1, the first pattern, namely Leverage existing RE practices occurred in 0 % of the processes of group (a), 20 % of the processes of group (b), 15 % of the processes of group (c), 56 % of the processes of group (d), and 78 % of the processes of group (e).

The row data in Tables 1-2 allows us to associate positive patterns with the processes of group (e) that demonstrate achieved process goals, and, thus, qualify to be considered as successful processes. Tables 1-2 show that 5 out of 10 positive patterns and 8 out of 10 best patterns have not been observed in the group (a) processes that failed in terms of goals.

	Percentage of groups				
	(a)	(b)	(c)	(d)	(e)
Leverage existing RE practices	0	20	15	56	78
Develop data dictionary	0	0	10	41	87
Maintain a small number (up to four) requirements traces	0	10	12	37	98
Introduce standards at the beginning of the process	16	70	28	52	100
Understand dependencies between process and tools	83	50	50	96	100
Systematically apply validation procedures	16	10	12	19	98
Use reference models	16	15	12	52	100
Document the rationale for the requirements	16	10	12	52	93
Address systematically controversial rqmtsb	0	6	19	19	100
Encourage non-hierarchical approach to ASAP knowledge	0	6	19	19	100

Table 1. Positive patterns in ASAP RE.

	Percentage of groups				
	(a)	(b)	(c)	(d)	(e)
Compliment validation walkthroughs with prototyping	0	0	0	52	80
Assess the potential of ERP RE standards	16	20	0	89	98
Evaluate and critique process designs before configuring them	16	10	0	37	98
Integrate the solution being built now with the solution that was built with the solution to be built in the future	0	0	0	7	98
Use architecture models to validate rqmts and architecture designs	0	0	0	7	100
Reprioritize rqmts to avoid customization	0	0	0	0	100
Document reasons for customization rqmts	0	0	0	14	100
Take actions to rewrite or eliminate unverifiable rqmts	0	0	0	0	100
Refine non-functional rqmts iteratively until these are implementable as a set of functional rqmts.	0	0	0	0	100
Set up a conversion and interface handbook	0	0	0	0	100

Table 2. Best patterns in ASAP RE.

Next, the row data in Table 3-4 allows us to connect negative patterns with processes of groups (a), (b), (c) and (d) that missed one or more of the RE process goals. Clearly, we can not expect that negative and worst patterns would not be observed in the successful processes, e.g. group (e) processes. But our experiences does confirm that the percentage occurrences of the negative and worst patterns in this group of processes is relatively low.

Moreover, the data from Tables 1-4 was used to characterize the modes of success and failure that are described in detail in Section 5.

	Percentage of groups				
	(a)	(b)	(c)	(d)	(e)
Rely on prototyping to negotiate requirements	83	80	50	3	0
Sporadic use of traceability policies	100	70	43	3	4
Skipping prioritization because of fears that implementers would restrict the project to must-to-have features	83	90	62	14	21
Skipping prioritization because no team member wants to admit that rqmts cannot get implemented	83	70	68	14	0
No process owners' interest in rqmts models means overseeing poorly specified requirements	83	90	75	19	23

Table 3. Negative patterns in ASAP RE.

	Percentage of groups				
	(a)	(b)	(c)	(d)	(e)
Exclusively rely on prototypes to negotiate rqmts.	67	10	38	0	0
No validation of reuse data control assumptions	83	90	38	22	2
No change impact analysis in place	100	100	100	100	17
No use of models	84	90	88	48	0
No data dictionary	100	90	59	69	13
No traceability policies	100	30	59	63	0
Introduce standards in the middle of the RE cycle	50	30	12	22	0

Table 4. Worst patterns in ASAP RE.

4. Defining Success and Failure

The RE process is a consultative one and, to achieve its goals, the RE team should ensure collaboration on technical aspects and collaboration on how the stages of the consultation will be carried out. As a consultative process, it delivers two kinds of value to client organizations:

- A diffuse, general value that is difficult to quantify and measure directly. This is the value resulting from the teams' exposure to good RE practices and sound engineering principles, as well as to predefined working procedures that can be repeated in an efficient and well-understood manner.
- Specific, concrete instances of value that can be measured with the metrics of reduced cost [8], precise cost estimates [3], optimized time to go live [23], or increased requirements completeness and requirements consistency [5,6].

We define RE process success by the degree to which overlapping goals are achieved, including requirements delivery in timely and cost-effective manner, correct architecture design, complete and consistent requirements, happy stakeholders.

We define failure as a situation in which there is a combination of the following: rework in the later project stages due to poor requirements, missed deadlines, budget overruns, decreased consistency and completeness of the requirements, increased client's dissatisfaction.

5. Types of Success and Failure

Based on our experience, we can reasonably classify the various modes of success and failure. We suggest six categories that address organizational, infrastructure, and process aspects to consider when analyzing live process instances. These are presented in Table 5 along with the percentage occurrences of the modes in our experience base.

Success/Failure Mode	Percentage
Catastrophic Failure: negative impact	3
Visible Failure: marginal value	12
Invisible Failure: imitates success	13.5
Invisible Success: mixture of sporadically and systematically applied practices	16.5
Visible Success: visibly achieved goals	41.5
Resounding Success: best-in-class processes	13.5

Table 5. Success/Failure types and percentage of their occurrences.

In what follows, each success/failure mode is characterized by the following descriptive attributes:

- outcome: this refers to the goals that were achieved or missed;
- typical scenarios: these are examples of situations illustrating how goals were achieved or missed;
- reasons: these give insight into why a goal was achieved or missed;,
- process visibility: it addresses if a success/failure is well identifiable for external project observers.

5.1. Catastrophic Failure

This is a failure in which the negative impact to a subproject rises above the costs of internal and external consulting resources utilized for running the ASAP RE process. The failure typically happens through some chain of circumstances that leads to bad decisions based on incorrect information. However, our experience suggests that very few processes fail in a way that has an impact exceeding the cost of the RE project stage.

We identified four catastrophic failure scenarios:

- Business requirements led to unnecessary implementation of complex functionality.
- RE teams overlooked critical technical issues like how many separate instances, or versions, of the system to install.
- Business requirements brought massive customization of the SAP components.
- RE teams underestimated change analysis impacts and, later, changes that turned out to be more complex than anticipated, took longer then estimated because more affected system components were found as changes got implemented.

Furthermore, we found the following reasons for catastrophic failures:

- insufficient validation efforts,
- failure to realize early enough the problem of conflicting business drivers, which challenged the team's ability to meet the demand for higher-quality business requirements and the need for better control in the early phases of the projects,
- failure to address the risks of having the customization of a standard package out of control versus the costs and the residual risks of each possible reuse handling option,
- clashes between process stakeholders,
- conflicts of people, time and project scope due to insufficient personnel.

5.2. Visible Failure

This is a failure in which there is at least one process goal that has been missed and at least one dominant and easily identifiable cause for the failure. Such a process either results in a delay or creates rework in the stages that follow. Alternatively, a visible failure process may end up with poor requirements specifications or major unresolved disagreements between the process owners and the external consultants.

There are five visible failure scenarios:

- The RE team rejects reuse options in favor of customization requirements with little or no up-front analysis.
- The business blueprint includes requirements from unofficial sources.
- The RE team skips data requirements analysis and modeling activities and, thus, impedes data conversion in later stages.
- The RE team skips process modeling activities and uses the "smallness" as an excuse for not taking advantage of the reuse-driven modellling practices.
- The business blueprint includes high percentage of uncontrollable unofficial requirements.

The reasons we identified for the visible failure mode included:

- Little awareness of the standard practices that are critical for the project success,
- Unawareness of or ignorance towards culture killers specific to the organization,
- Hesitancy about levels of business process and data flow standardization,
- Less-than average experience with integrated solution implementation projects,
- Average or less than average level of business process knowledge and limited competency in making decisions,
- Ad-hoc ways of working,
- Requirements leakages.

5.3. Invisible Failure

It addresses a slipping process that is characterized by more than one of the following:

- underutilization of the standard ASAP practices, tools, and standards;
- limited interest in the process on both process owners' and consultants' sides,
- process adoption without adoption of the RE support tools;
- limited or no use of RE standards; if used, it is associated with high cost;
- tendency to skip practices without having valid reasons for doing so;

- sporadic or no use of requirements validation practices;
- tendency to see the use of standards as limitation to people's creativity and freedom.

The process is bellow average but the RE team might think it is average or better. To the casual observer, the process may appear to be successful because it was completed on schedule, the business blueprint looked well, and all of the data and process requirements that were identified in the RE process are in place and basically work in the architecture design. The requirements may have been even effectively negotiated to the process owners and everyone may have read them and signed-off without any improvement suggestions. However, process owners do not return to the process after the initial spirit has worn off, do not show any enthusiasm about the prospect of repeating the process, and suggest other business representatives to take over the remaining stages of the project. The reasons for this lack of interest can be a combination of:

- the lack of a mechanism to consistently maintain win-win relationships between the process owners and the external consulting partners.
- the dominating understanding that any activity which does not seem to directly contribute to the deadline gets a lower priority;
- the tendency to see the activity to be applied in future enhancement projects;
- underestimation of the importance of certain practices;
- the perception for a practice as an unnecessary overhead;
- poor understanding of the role of standards and policies;
- inadequate training; it means that the team wanted to follow the practice but it was impractical in the short term to send staff for training.

Clearly, some of these symptoms are driven by underling causes, which include the lack of clear vision regarding how to balance people, infrastructure and process components in ERP RE or the lack of experience in coping with organizational complexity and inertia.

3.4. Invisible Success

This is a situation in which the process is a mixture of both systematic and sporadic application of standard ASAP practices with average to above average consistency and completeness of the business requirements and with no obvious resource or deadline problems. The RE team is above average but might think they are good or very good.

Casual observers may have difficulty distinguishing between an invisible failure and invisible success. Both process instances might have implemented similar practices and the quality of the resulting deliverables might be equal. The way to distinguish success from failure would be through analysis of metrics like clients' satisfaction [32], elements of business case analysis [2], costs of running the RE process and impacts of the requiremenets on the remaining project stages.

5.5. Visible Success

This is a situation in which the process succeeded in terms of achieved goals and many project team members know it. This does not typically happen by means of the acceptance to the ASAP process alone. A visible success usually:

- makes a difference in RE teams' working lifes by blending the standard procedures with the existing RE practice;
- involves the design and the use of new processes in support of the key ASAP activities of requirements elicitation, modelling and negotiation, so that no delays in the subsequent project stages would happen;
- establishes common understanding of the RE process with a focus on what counts;
- establishes a definition of requirements verification and validation;
- involves people with high learning potential.

All these capabilities result in correct architecture design, more consistent and complete requirements definitions, happy clients and met time and budget constraints. External observers can identify a visible success by measuring the extent to which the process changes the way RE team members conduct day-to-day activities or common tasks. A visible process would transform certain tasks, job roles and procedures. For example, in our projects, a reuse measurement process [3] became an integral part of the larger RE process; reuse was planned and planning was done as part of the RE process.

5.6. Resounding Success

A process instance is a best-in-class process if it brings significant benefits to the organization. This is when good practices are learnt and consistently applied where and when is needed in the RE stage of the ERP project. Such a process does not merely change tasks, job roles and narrow-scope procedures; it affects the entire large-scale implementation process. For example, the RE team consistently overcomes the tendencies to handle the suite of ASAP standards with little care and to skip change impact analysis activities.

To achieve this state, all the elements of the process mechanics must work smoothly. The RE process actors on board must have solid expert knowledge.

6. Related Experiences

Although the ERP client organizations are still in the middle of their evolution towards RE process maturity, many companies have already accumulated a large body of experience with standard off-the-shelf RE processes [15,16,17,19,20, 26]. However, most publications in both ERP and RE address issues different from the ones related to the application of a standard RE model as a live process. Esteves and Pastor were among the first who published results from comparative studies on ERP implementation processes [16,17] and, on the success factors [15] in using the ASAP processes in industry as well. In these papers, the authors explicitly address ERP process issues, and organizational and management factors important to the project success. However, their analysis does not rest on the same granularity as ours does. Whereas we look at the RE process level and investigate the mechanics of this process on practice-by-practice basis, Esteves and Pastor cover the end-to-end SAP implementation cycle, the methodology components instrumental to it, and the critical work packages at project level. Next, Hazerbrouck and Frerichs assess in detail experiences with the ASAP processes, but they do it from a business process reengineering standpoint [19] and place it in the larger enterprise-level context. Also, Holland and Light [13] investigate ASAP issues but focus on a number of implementation methodology components that should be present and do not address the mechanics of the RE process itself.

When comparing our patterns of success and failure with other findings discussed in the RE literature by both practitioners and researchers, we experienced disadvantages similar to the ones mentioned by others [21,22,24,30,33]. We uncovered the following RE patterns that appeared to be common for both ERP and non-ERP RE processes: (1) stakeholders' behaviour (e.g. commitment to the approach) determines to a large extent the outcomes of the process, (2) RE practices like validation and change impact analysis are the first to be neglected and require systematic efforts to make them work for the client's organization, (3) poor tool infrastructure and sporadic or no use of methods and standards makes the RE process impractical, (4) the client organization's IT-culture has a profound impact on how people would see the adoption of the standard process and its value.

7. Conclusions

In this paper, we provided initial insights into how to categorize situations for ERP RE process success or failure. The profound literature review and our previous experiences in applying the ASAP process in a telecommunication company are the background for the consideration of six categories of process success and failures in ERP projects. We found that RE process instances had their fair share of failures, but no more than any other category of IT processes for complex systems [32]. Nevertheless, RE practitioners should not underestimate the difficulty of achieving process success. They should realize that having a well-defined process is critical but it will only succeed if the organization permits it to. Some ERP RE process failures are harder to identify than failures in other kinds of processes. A large part of process value is intangible; therefore, a large part of failure to deliver value is also intangible. Process architects and RE practitioners should identify appropriate criteria to assist in distinguishing between success and failure.

Our analysis of success and failure modes provides initial evidence of what each of these looks like in terms of aspects referring to the process organization, the support infrastructure and the process itself. Yet more assessment studies are needed to corroborate our findings with results from other projects. Further work is required to define criteria that would help distinguish invisible success from invisible failure.

7. References

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