Examining Knowledge Capture for the B2B Domain

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Abstract

The purpose of this research is to present a means of knowledge capture in the form of organizational patterns that are solutions to reoccurring problems for business-to-business (B2B) organizations. We argue that the pattern approach can present valuable benefits to organizations in the B2B environment through providing problem-solution oriented descriptions of best practices.

1. Introduction

Business-to-business (B2B) organizational success is heavily dependent on the ability to automate the business processes of high volumes of transactions in a global environment. This involves the integration of systems, process and their supporting data for supply chain management. Process integration across enterprises using exchange platforms such as extensible markup language (XML), allows organizations to have a standard method to exchange structured business data.

The time spent gathering B2B domain knowledge and translating it into business requirements is vital for organizations. Requirements serve an important role in managing risk. For example, clearly defined requirements avoid reinventing the wheel each time. As well as reuse of processes to improve quality is a possibility. In understanding requirements for the B2B environment we have collected a set of best practices in the B2B domain and presented them in the form of a pattern library for B2B transactions [1].

The patterns format for capturing knowledge pertinent to B2B transactions was chosen, because patterns help us in identifying, capturing and packaging new concepts, experiences, as well as proven solutions – in this case, capturing problems and solutions arising from the B2B data exchange. The aim is that organizations would improve by using the resulting collection of patterns to exploit B2B initiatives. In essence we are using the overall idea defined in [2] that a pattern is a proven solution (experience or expertise) to a common problem in a specified context. Since patterns rarely occur in isolation and should be grouped together to address a larger problem, such a collection of interlined patterns can be seen as a "pattern library". In one analogy, "*when a problem occurs once it is a data point. When it occurs twice it may be a coincidence but when it occurs thrice that is a pattern* [3]". He adds, "*In business-to-business trading communities, scenarios repeat between categories of trading partners and different forms of Information Technology (IT). A simple trading-partner taxonomy can simplify complex IT choices for B2B projects*". In this regard, the pattern library addresses key organizational concepts and structures in B2B transaction management that are required to make the B2B process a success. The objective of this paper is to is to report on the experiences of using the pattern approach to knowledge capture in the b2B domain as well as to demonstrate the set of patterns.

The paper is organized as follows, in section 2 we present patterns as tools for knowledge capture. In section 2.1 we present pattern definition and history. This is followed by a brief account of the state of the art in building pattern libraries in section 2.2. Section 3 presents the approach for developing B2B pattern language. In section 4 we present patterns for the B2B environment. In section 5 we present pattern evaluation results. Analysis and discussion is presented in section 6. Finally in section 7 we conclude the paper and discuss issues for further research.

2. Patterns as tools for knowledge capture

Organizations are eager to tap into the tacit knowledge laying in people's heads and experiences. However, the challenge is identifying ways of capturing and sharing the tacit knowledge. The pattern concept has been widely discussed as a means of knowledge capture. For example, [4] says: "*people have had patterns in their heads for as long as there have been heads. What's new is that we've started naming the patterns and writing them down!*. [5] add "*The really big opportunity for patterns and pattern languages, an opportunity for exponential growth, comes to light when we perceive patterns as an important part of a larger challenge - that of valuing, exploiting, and managing the knowledge available all around us, in both tacit and explicit forms, ripe for the picking.*" Such discussions show that the pattern concept can be an efficient tool for knowledge capture in providing an easy to comprehend format for documenting experiences. A

number of cases where patterns have been applied for the purpose of knowledge capture are reported in [1].

The aim of the B2B pattern library presented in this paper is to support practitioners that wish to capture and share their experience with other colleagues and/or organizations.

2.1. Pattern concept and history

A pattern is used to: "*describe a problem that occurs over and over again in our environment, and then describes the core of the solution to that problem in such a way that you can use this solution a million times over, without ever doing it the same way twice*" [2]. The original definition of patterns encourages a higher level of abstraction so that the patterns can be repeatedly applied. The pattern concept useful in one practical situation and will probably be useful in others. The detail and execution of a pattern in terms of specifications is left to system designers and developers. It is also worth pointing out that in many cases or organizational development the knowledge embedded in the patterns serves only as a suggestion or inspiration for the designers. I.e. the solution suggested by the patterns needs to be substantially customized and extended.

Since its inception in the 70's, the pattern principle of describing a reusable solution to a recurrent problem in a context has been adopted in various other domains such as software engineering, analysis and organizational design. E.g. [6] applied the pattern concept to object-oriented programming. In 1995, the Portland Pattern Repository used to publish computer-programming patterns was created. In information system analysis and design notable popularity has been reached by patterns reported in [7], commonly known as "The Gang of Four". Since then the pattern concept has been used for other purposes such as knowledge management, organizational learning and design.

2.2. Pattern libraries and structure

Collections of related patterns form a pattern library. Pattern libraries have proven to be a useful way for the purpose of documenting, representing, and sharing best practices [8]. Pattern libraries come in many forms determined by their respective purposes and environments. Some pattern libraries are specific to a particular application domain, for instance: The Gang of Four design patterns – for information system design, and pedagogical patterns that capture expert knowledge of the practice of teaching and learning. Other patterns are all encompassing such as the pattern almanac by [9].

Patterns and pattern libraries structural in nature exhibit different attributes in documenting their content. In fact one needs to decide on the pattern structure before they can document it [4]. Therefore, in our study we had to address the question of what pattern format is the most suitable for our audience. Literature review shows that pattern development communities agree on the common principles of structuring knowledge in a pattern form but that the actual structure of the pattern is for the pattern creator to decide [7]. This is the case because pattern libraries come in many forms addressing different needs. It is noted that no single form suits everybody and every problem domain [4]. The most commonly used elements of a pattern template are name, problem, context and solution. Motivated by [2] most pattern libraries use a consistent structure of naming the pattern, describing the problem, the context, and description of the solution. In this study we adopt similar common elements because we found that this format is the most easily accepted by our target audience. The structure of the pattern template used in this study is: title of the pattern, problem as the defect or undesired situation that the pattern intends to solve, solution to the problem that has proven to work, and motivation explaining the significance and implications of the pattern. In some cases, we use citations to emphasize the application aspect of the pattern and its empirical grounding.

3. Approach used for developing B2B pattern language

We utilized pattern development approach illustrated in [10] to develop the B2B transaction pattern library. Development of the EKP method started in the 1990s with Framework 4 ESPRIT Project ELEKTRA. This was later enhanced in framework 5 project HyperMedia and Pattern Based Knowledge Management for Smart Organization [11] and VINNOVA project EKLär [12]. The EKP approach supports the process of knowledge capturing, packaging, documenting, sharing, applying, transforming and innovating. Representation of the organizational knowledge in the form of organizational patterns is supported guidelines for participatory knowledge acquisition and application.

The EKP approach proposes a four step procedure to pattern development as follows: 1) eliciting candidate patterns, 2) evaluating suitability, 3) documenting pattern, and 4) pattern validation. The steps beginning with pattern collection were iterative, i.e. while we expected to go from 1 to 4, it was common practice to revisit previous steps (see figure 1).

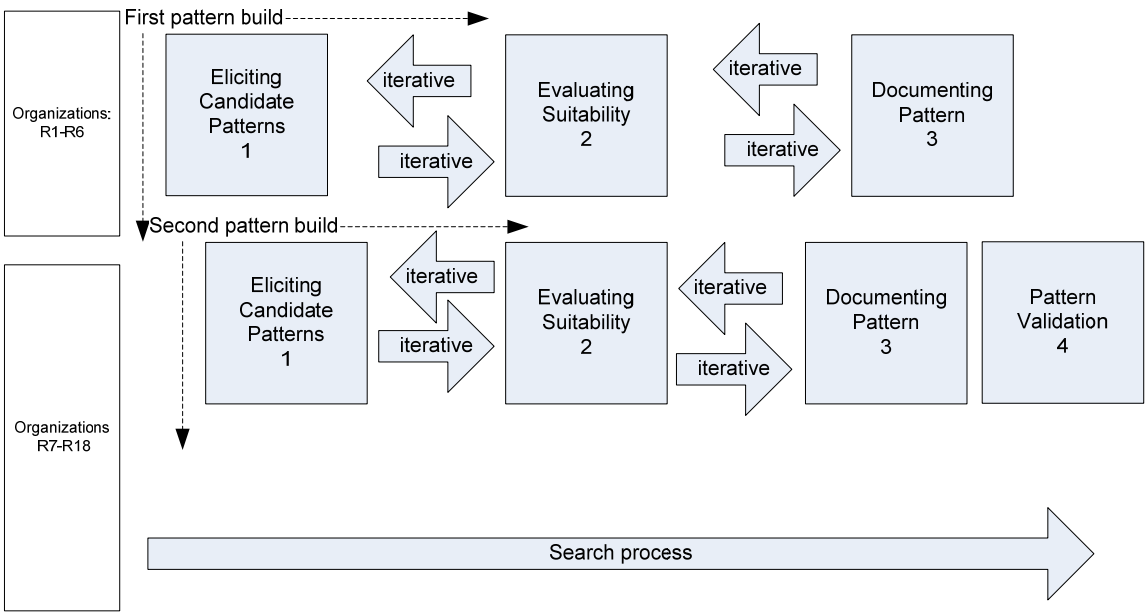

Figure 1. Pattern search process leading to the B2B pattern library

Patterns are inspired by analyzing multiple organizations and/or situations to find common problems [13]. Moreover, the idea of building a pattern library is that it needs to be improved over time. In our search process we choose a set of eighteen professional organizations as a case of mapping out the problem area. These are subdivided into six for first and second pattern build, for which we analyze another set of twelve organizations. The pattern library, in the first pattern build was a contributing force for the second pattern build. The library is increased with more patterns from eight patterns in the first pattern build to twenty-five patterns at the end of the second pattern build. The original eight were also improved in the second pattern build with revised names and refined problem-solution description.

4. Example patterns for the B2B environment

In this section we present example patterns and their relationships. The Tables 2 to 8 present the patterns dealing with different problems as shown in table 1.

Table 2. Single platform

Problem: Organizations face difficulty in keeping up with transaction-oriented standards (i.e. difficulties in gaining cross-functional cooperation) because of lack of agreed conventions for implementation. Everybody has their own standards and standards can be interpreted differently by different organizations. Furthermore, those with little technological expertise develop standards. So standard information is typically too complex to implement and use on a regular basis. This causes B2B connection obstacles arising from problems with streamlining cross trading partner processes. E.g., an order fulfillment that requires collaboration between distributed platforms across multiple trading partners.
Solution: Build B2B solutions that are driven by expert and industry based standards. E.g. firms can develop and apply automated standards based procurement policies including the use of XML for order processing. Furthermore review trading partner business practices, for informational purposes to create standard based platform that works for all. Industry standard bodies like ASC X12 can assist with the creation and maintenance of standards to store source code and documentation for easy retrieval as well as a simple packaging process. Process model allowing leverage of information include: Centralization of trading partner information in a repository that is both accessible and secure, Centralization of associated formats (Mechanized and Non-Mechanized), Centralization of services Automation status updates across all trading partners, Process management Quality controls. The idea is to convert data that exists in several sources either by migrating all data at once or gradual migration of a trading partner at a time. Regardless of the approach, data conversion is required for a single platform.
Motivation: Organizational communication standards such as X12 are important because they are about not only norms, but also adding credibility, focus and critical mass in markets for new technologies. Standardization of processes and transactions is a method, since co-operation is simplified if the same

types of standards are used. Integrating cross trading partner business process standards in an inter-organizational system context is an emerging phenomenon on several business fronts. The practice is viewed as an enabler towards solidifying B2B connections for global reach through standard access.

Table 3. Architecture and Integration Concepts

Problem: The B2B modules do not adequately facilitate interaction with each other (in-house) and across organizations (outsourced applications) with their trading partners such as expressed needs to determine how to integrate B2B systems to corporate data. For instance difficulties in integrating B2B applications with existing applications and systems causing lack of interoperability between B2B applications and those of trading partners (suppliers, customers, etc.). This sometimes stems from closed architecture.

Solution: Companies need to restructure module and/or content strategies to focus on interactivity and integration for trading partner needs. The extent to which the intra- and inter-organizational B2B systems are capable of sharing information with each other. For instance content should be addressed at multiple levels e.g. workflow improvements, flexibility for productivity, performance increases, package contents, and integration of modules. Reduce production costs by creating content once that serves to multiple devices. Add the combined functionality to load different information directly through the B2B system application such as request for parts with billing and payment information. Allow for information to be ported through system just like any other type of file. This would save time spent manually configuring and running the load of data.

The standard set of interfaces may include: a two way interface allowing to electronically send information for each approved transaction. In addition, accepts information from such as confirmation of receipt, payment information for each transaction that is paid and rejection information for any transaction that is rejected.

Another interface allows summarized domestic and international usage information to be loaded into B2B system. Summarized information provides the ability to compare internal summarized detail record data against documents received to ensure minute of use accuracy. This interface would consist of a standard flat file that can be fully documented.

The inventory interfaces allows higher level inventory data using a trading partner defined code. This interface, similar to the interface above allows the ability to verify, and analyze data. Depending on the type of data available, and the goals of the organization, one or both of the interfaces may be used. The Inventory interface can be XML based.

Motivation: Business integration and B2B projects will be beneficial to participating parties in aligning application to business process e.g. the integration of trading partner relationship management and B2B provides information instantly to trading partners. Company x system manager says *"Trading partners face issues of sending documents electronically that recipients cannot get because the systems are not integrated." "This causes the receiving companies to manually re-enter information which downplays the full benefit that could be achieved because of the manual factor."*

Table 4. Auto task assignments

Problem: It has become a significant threat that auto tasks will either not start or not complete due to errors, and sit in a frozen state for days without being noticed especially on non working days. Running auto tasks at the same time is a problem due to overlapping. Other problems include limited automated options such as the option to stop all jobs, option to start all jobs because if one has to stop all jobs, there is a strong likelihood of wanting to start all the jobs asynchronously as well. More related problems stem from information which is derived from MS Access databases that get stale very quickly (no automated reconciliation) which means that the reports that are provided to the trading partners are often inaccurate. Further more the mechanism that is used to provide this target information is an Excel file which contains all of the status for the entire B2B project thereby requiring trading partners to sift through data in order to find the information needed. Additionally, due to the number of ongoing B2B projects, the queue in the mailbox can get rather large and there is at present no automated sorting mechanism used to separate between the various B2B projects.

Solution: Create for the B2B system jobs to be able to self-diagnose its problems by allowing it to recognize, log, and potentially notify if a task/job fails to complete, fails to start, or just fails. Hence add functionality in the design of the auto tasks to accommodate for two way communication between system and the task functions. To monitor the status of auto tasks and notify/log occurrences of failures and/or non-completion, a threshold needs to be established for an 'acceptable period of time', in relation to the data being processed, that an auto task should take to complete a job. When the job does not return a status within this time, is unable to start or errors out, notification is sent or logged.

Motivation: This saves time and money. It also enables companies to extend abilities to receive files from trading partners that have been previously incapable of being received. Trading partners appreciate functionality which allows them to integrate more electronic media into their systems. Overlapping is hard to determine because the actual running might be unknown so even if they are spread out, this still should not occur. If the data is clean this would be a benefit for auto assignment of the transaction format. The benefit is that a greater share of the transactions will be automates and accuracy of processing will be increased.

Table 5. Contractual issues

Problem: Organizations deal with a lack of clear legal environment for B2B operations, so service level agreement problems with misapplied business rules arise such as altering B2B software that results in violations of maintenance agreements. Misapplied business rules typically result in additional steps required to process transaction for trading partner whereas not applying a business rule can result in bad

data being sent to trading partner.
Solution: Companies' need detailed SLA or trading partner agreement for business transactions that clarify roles and responsibilities in the business relationship e.g. the time from initial receipt of the business document to when the email is sent to the trading partner for acknowledgment should be included in the SLA. Clarify ambiguous points in the agreement for valid transactions processed and identify a win-win process in terms of parties concerned for executing the contract. Review contract details and identify areas for tightening and/or revisions. Companies can create custom deployable audit trail to meet specific trading partner needs to avoid violations of agreements by confirming that rules are working and that workflow modifications are unneeded. What process should the trading partners follow to submit requests for B2B service enhancements? Include the process for determining the priority of submitted enhancement requests. Trading partner should prioritize their requests (e.g. high/medium/low) when they are submitted. A technical support specialist would be responsible for reviewing the requests, identifying the issue, assigning a severity level, and assigning the support specialist to resolve the issue. Assignment of severity is based on contractual SLA and determines the priority of the issue. Concerns about the assigned severity level may be discussed with specialists or managers of technical support. Trading partner is to be asked to follow this process in accordance with maintenance agreements.
Motivation: The purpose of a detailed SLA document is to outline the process of managing electronic data files from receipt to final population within the process. By defining processes and responsibilities, companies are able to achieve efficient operations and increased trading partner satisfaction.

Table 6. Centralized data repository

Problem: Organizations experience data problems in disparate locations and scattered throughout the company therefore analysts are not able to easily adapt to pick up the work of other team members during outages to manage work queues, generate reports, and reconcile data from downstream applications. Also an instance where coordination has utilized separate databases for each entity to track status has resulted in a divergence of data in terms of the physical layout of the individual databases as well as the content.
Solution: Aggregate data in a single system for intelligent analysis of business information through Data extract:- retrieving data from badly structured data sources Data warehouse:- as repository of electronically stored data Query and reporting:- analyze data, to extract and transform for report Visualization:- graphic illustrations of information Dashboard:- real-time analysis as to how company is operating Alerting:- identify trends at a glance and drill down into data sets Statistical data mining:- extracting hidden patterns from data Systems that are seamless, multi-processor and multi-threaded intelligent applications can load various formats into one centralized database that improves internal communications and allows for better decisions faster. For this to happen, access to and coordination of disparate data sources is necessary to derive intelligence. Therefore, data needs to be available to all system users with capabilities of each interface having varying use for the data while managing and maintaining a single source of content. Furthermore, companies need to redesign the internal procedure to get uniform data and on an easy to reach platform. The objective of this is to have all the major drivers, feeding into the centralized repository.
Motivation: Centralized data repository and business intelligence will facilitate timely, well-informed decision-making. Company x President stresses that *"centralized product price information is really the ingredients that serve as the foundation for the B2B documents."* A data warehouse within the trading partner's backend system allows all divisions to pick the information and use one single version of the truth. The externals of the trading partner can use that same information to populate their web or if they have an extranet or portal, they can use it for XML point to point. The trading partners are of different size and capability. E.g., a two million dollar distributor may not be willing to invest in an expensive B2B system compared to a five million dollar distributor. For the distributor it makes sense to go for an option of fifty suppliers being tied up on his website and they all download the information. Company x President says *"That is not efficient but that is the way they do it. In today's environment capabilities are necessary to do all of this."* One supplier or manufacturer doing one-on-one with one trading partner is not very efficient because in any industry a distributor has several suppliers. This would need a distributor to visit the several websites extranets or portals. The impact would be enormous because having to manage several dozen sources of files for single trading partners requires a lot of time. It is noted that centralization and classification of trading partner information also allows electronic coordination to benefit from the information that is available with a common trading partner.

Table 7. Inter-Organizational factors

Problem: Organizations have problems of not acting collectively in creating networks. They create their own networks in an attempt to leverage buying power more successfully. In addition, there is not a consistent 'workflow' in place across the different units.
Solution: Organizations like company x can play various roles in building up the strategic viewpoint for their trading partners. Company x can take the mandate to direct the firms to a good solution that will meet there immediate needs but then provide some responsibility to the firms to answer internal procedure questions. Procedural questions such as enforce and build business relationships that go beyond company transactions and allow for flexibility of trading partners by using process as per standard based guidelines. Through this solution, trading partners can access data and create reports on transactions handled by trading partner, never losing touch with valuable network

information. Furthermore, enable the B2B system to utilize more than one processor across multiple organizations to enhance the cross cutting functionality capability of a multi-processor server. Therefore, companies should actively participate in industry forums and other industry seminars to keep abreast of format changes and the latest legislation regarding transaction reform.
Motivation: By selecting the inter organizational based approach, trading partners can be assured of implementing solutions that meet current requirements while partnering with visionary industry leadership that can anticipate and meet future needs. E.g. trading partners for company x come from firms, that provide automation solutions in form of business integration software. Other trading partners were originally using the traditional VAN approach.

Table 8. Reporting capabilities

Problem: Uncertain response of trading partners towards range of reports produced for output. For instance lack of an efficient reporting mechanism for describing file activity hence increased demand for analysis and reporting tools. There is a need to be able to find the dates a transaction has gone through each step and provide reports on these dates and the time games between each step. E.g. to track who submitted the business document, i.e. sent the document to transaction processing, who requires access to detailed business trend information, do they also require business document detail query capability? Also problems where the late transaction report not accurately identifying all the missing transactions, under reporting the dispute problems, and assistance needed to figure this out and to develop a work-around if necessary.
Solution: Acquire report engine that generates schedule and distribute reports periodically with structured data listing all transaction log entries with log search capabilities to the system for trending and analysis using interactive query tools. Also report engine should create follow up alerts for outstanding and late transactions with filters to retrieve all the missing transactions. Notification helps users know what transactions outstanding need their attention, with web-based reporting capability. Web portal provision should contain all source files processed with visibility to the manually entered transactions. The web site root must be the uniform resource locator that the trading partner uses to access the B2B system. If trading partner does not like any part of the notification text, it can be changed by request. Keep dispute contacts with appropriate contact information in B2B system for future reference.
Motivation: As is the case with many of these improvements, most trading partners would find a great benefit from being able to cut time spent on navigating logs and reports. Furthermore, reporting on file data has web-based management console options for executives, managers, and supervisors who need increased visibility and reporting to ease and expedite access to data. This saves valuable time and money by providing snapshots about progress and productivity at the desktop. Provide intuitive web interface that is easy to learn and use with visibility of details to manage operations from their office and dashboard for managing operations and streamlined search of transactions. Load times could also be compared to file size and performance trending can be analyzed. Companies benefit from being able to search the logs and the load lists for a specific set of characters. It would also assist the user if the business documents loaded electronically would populate the document receipt date and also if this field was mandatory for manually entered documents. If the document receipt is not populated because some file uploads do not provide the actual receipt date, the logged date could be used as this would be better than the lack of a date in the report. This would also assist the analysts as they process each business document without having to rely on system to the system to determine when a business document was received. Moreover providing access to back-end database tables that allow users to pull data out of system that is user-related for reporting. Reports should provide the formats needed by users. This can be an excel file listing according to user criteria.

The entire pattern language consists of 25 patterns, but in this paper we present only those patterns that address transaction formats and access as highlighted in figure 2.

A single platform advocating for inter-organizational communication standards provides files that conform to the standards. This is related to business intelligence because it works well with the concept of a centralized data repository. Trading partner can make changes to their format for the business document to be determined compatible, so they can send document. As in inter-organizational factors, if a document is determined to be in a non-standard format, trading partner can be asked to convert to another standardized media transmission option.

Architecture and integration concepts as the backbone are needed for a successful centralized data repository. Universal standards should also be used to support single platform for the starting point for integration. Media transmission options can set up trading partner preferences such as available transmission type and media types to facilitate integration.

Auto Task Assignments for task manager maintains tasks and their properties i.e. automation tasks - scheduling, FTP, encryption or decryption, zip or unzip. This contributes to business process initiatives plus architecture and integration concepts.

A centralized data repository promotes standardization for a single platform. The central approach relates to inter-organizational factors. A centralized approach creates enhancements for reporting capabilities and/or interactive performance.

The legal environment for contractual issues that must be in place to make sure the B2B system works and that all the partners understand their

rights and responsibilities works with inter organizational factors. Single Platform supports all players in the chain in fulfilling their roles for efficient contractual issues.

An external B2B pressure that cannot be handled by individual organizations is enhanced by collaboration as a direct result of single platform, centralized data repository and integration concepts. By automating the load of business document at the detail level, auto task assignments the B2B solution opens the door to additional reporting opportunities. This is directly related to reporting opportunities in terms of visibility and monitoring which enhances error handling and management.

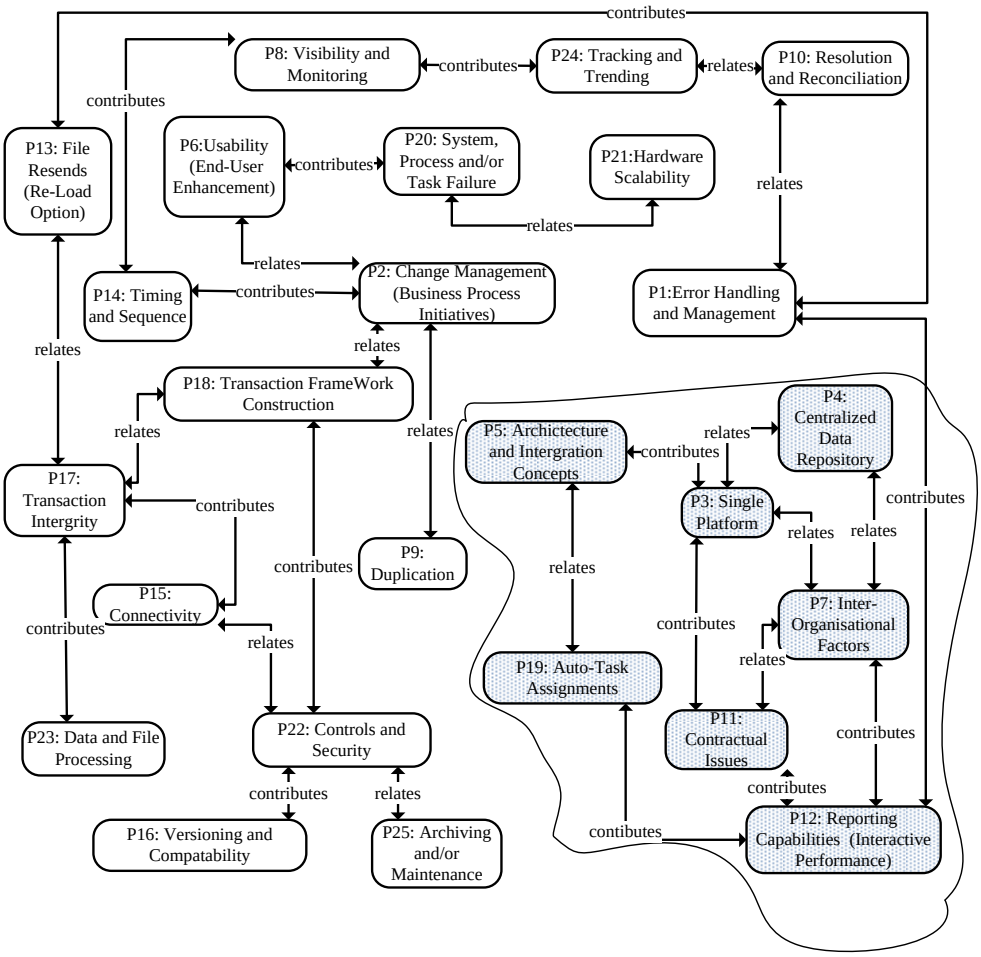

Figure 2. Pattern relationships

5. Evaluation results

This section presents our findings from evaluating the B2B pattern library, which have been partially reported in [1]. We examined the following features: (1) usefulness of the knowledge embedded in the patterns, and (2) the usefulness of the pattern format to knowledge capture. Evaluation was done after 25 patterns were developed and incorporated in the pattern library. To ensure the generality of the proposed solutions, a total of 20 evaluators from 12 organizations evaluated both features. The results are summarized in the graph shown in figure 3 below. The Y axis represents percentage of evaluators against X which represents the different criteria of feature 1 – the overall usefulness of the knowledge as follows: 1-usefulness, 2-relevance, 3-usability, 4-adaptability, 5-adoptability, 6-completeness, 7-coherence, 8-consistency, 9-perceptiveness, and 10-granulrity.

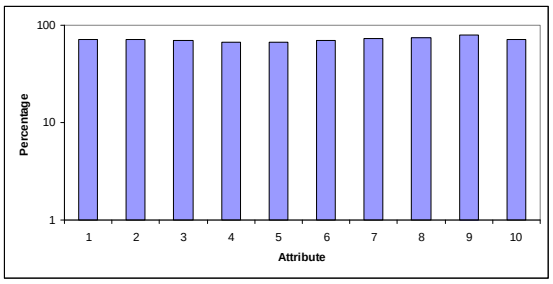

Figure 3. Feature 1. Evaluation results

The evaluation results reveal the consistency of the B2B transaction pattern library. Figure 3 shows an average approval rate of over 70% for the usefulness of the knowledge embedded in the patterns. The evaluators also found the pattern format as a tool for knowledge capture to be useful, comprehensive, rich and relevant. The pattern format is useful with regard to the pattern format being able to capture and convey the relevant knowledge for describing patterns. The majority (2/3) consider it comprehensive because the different elements of the pattern (e.g. problem, solution, motivation.) are adequate for understanding its purpose. Fifty percent of evaluators appreciate the library as a means to describe the different parts of a pattern one is expecting in such a description. Finally for most of the evaluators the conceptual primitives chosen are appropriate for expressing the respective parts of the knowledge embedded in patterns. These findings are in line with similar pattern validation cases reported in [8, 10, 12].

Pattern validation and feedback from potential users is needed in order to improve the usability of the patterns to improve them. In our study evaluating the suitability of the pattern, involved going back to the interviewees so as to determine the good and bad patterns. This complies with the principle of design science research [15] saying that multiple iterations of the design cycle are needed before contributions are output into the relevance cycle and the rigor cycle.

6. Analysis and Discussion

Organizational capabilities lie in its knowledge being structured coordinated and communicated [16] and patterns provide the means for that. Knowledge sharing and the generic nature of patterns, provides an efficient instrument for capturing various knowledge chunks such as best practices, work processes, organizational solutions, experiences, etc. Moreover, patterns help us understand organizations. Hence, in our study the B2B transaction pattern language offers an alternative and flexible approach that bridges between theory, empirical evidence, experience, and helps resolving practical problems of B2B organizations. In addition, organizational knowledge captured as patterns, make expert knowledge more accessible to non-experts [17]. The novelty of this research is in covering the B2B transaction domain from the perspective of knowledge capture and reuse, an area that has not been covered before to the best of our knowledge.

The success of the B2B transaction pattern library is measured with an understanding that development of a pattern library never stops because the pattern application creates new knowledge which can be used as feedback for improvements of existing patterns as well as for creating new patterns in the knowledge repository. According to [4] in his work of seven habits of successful pattern writers, pattern writing is an on-going process. Moreover, [18] add "*a pattern by itself is just a small piece of the entire design knowledge puzzle. Each pattern describes a proven solution to a problem in a certain design context. When all the pieces of the puzzle are put together, we can see how an entire body of design knowledge is unfolded. Understanding this puzzle is the long-term goal in pattern-research. It will show the paved roads of design, but it will also say when the road should be abandoned in search of new and innovative solutions.*" As designs evolve and technologies change that enable new solutions to emerge, the pattern library evolves as well. Therefore, to stay abreast of the ever-evolving landscape, the pattern library must continually be upgraded and enhanced. For example, Yahoo pattern library (http://developer.yahoo.com/ypatterns) uses an approach where their users check the library and give feedback. In some of the feedback the users suggest new patterns and help write or even review patterns. In addition, the patterns in the library have a comment box where users are free to add their own views about the patterns. Comments can come in form of suggestions to improve the pattern, remove outdated patterns, etc. When comments are made, other people can see them and it spurs discussion, which is valuable in contributing to the patterns. In the case of applying patterns for knowledge capture and sharing in health care [12] an organizational process and responsible roles were established to ensure the continuous influx of new knowledge.

Other related initiative for ensuring that the potential target audience has the possibility to influence the pattern content is writer's workshops used at PLoP conferences. The aim is to create a forum where authors of patterns have an opportunity to get feedback. It is important to understand that patterns keep evolving with numerous feedbacks [2]. One such feedback is a writer's workshop as a distinctive scientific method [19]. He says "….*use of writers' workshops is not*

simply part of a process of improving the presentation of pattern languages—though that is important—but is also part of discovering the best characterization of the pattern language...” The writer’s workshop, as a focus group involves a moderator facilitating a small group discussion between selected individuals who have read a particular pattern [14]. This confirms with qualitative approach, where the research process design can emerge as the study unfolds i.e. the conceptual approach is ‘path-based’. Where rather than attempting to define the pattern development process beforehand, the research focuses on providing a path for the pattern development process over time. This is because discovery of knowledge is an ongoing process in an organization.

Many pattern libraries use of conceptual models to document the solution which improves clarity of the solution but in the same time reduces the understandability for those without training in conceptual modeling. In our case we did not use models because of the variance in the B2B organizational setting, although we realize from the evaluation feedback that more visual representation is desirable.

The premise of the B2B transaction library was to use the target audience in designing for their environment. For example, in developing patterns for Yahoo they use incentives for participation for both contributors and management such as peer recognition of the most useful patterns, raffles, contests and performance evaluation for designers. This is aimed at having proper representation of the ideals of the Yahoo community for whom the patterns are being developed. Another interesting addition about, Yahoo’s case and the case reported in [12] that we could adopt for the B2B transaction library is the provision for a curator or librarian that oversees the pattern library. Responsibilities for this role should include managing entries in the pattern library, supervising the development by the individual pattern authors, collecting feedback from the users, identifying areas for improvement and needs for new patterns made.

In summary user feedback helps improve the usefulness of patterns once they have been developed and made available to the users. But before this the pattern creators have to ensure that the patterns are as good as possible. The three main approaches to be used are (1) joint pattern development or writers’ workshops, (2) qualitative validation involving domain experts and representatives of the target groups, and (3) formal evaluation based on quantitative data analysis. Approach 1 is mainly suitable when the knowledge is readily available and the main challenge is to package it in the right form. Approach 2 is suitable when the knowledge domain is relatively well-defined, but the best way of presenting the knowledge to the target groups might be unknown. This research has mainly been using approach 3, which is suitable when the knowledge domain is broad and unexplored thus requiring validation by a broad set of domain experts.

There is a general assumption that a pattern library can potentially be used for standardizing ways of working and organizational practices. [20] points out “*…we were then able to convert this library of patterns into a workable set of standards”*. The pattern library in a body of standards context would still be lacking in a B2B scenario as long as the B2B exchange and its trading partners is not on an equal basis.

7. Concluding remarks

The key to good partners is not just in the process but the ability to refine them over a period in the appropriate pattern community. Evaluation feedback leads to conclude that the B2B transaction community appreciates the knowledge embedded in the patterns as well as the pattern format of documenting knowledge. Findings of this research also suggest that the discovery process of the B2B transaction patterns is ongoing and therefore they will evolve after the usage feedback will be collected. Therefore, one could say that an equally important outcome from the B2B transaction pattern development was creation of a mechanism to capture knowledge. This is in line with conclusions drawn by cases of pattern application from other applications domains as well, e.g. [8, 12 and 21]

The B2B transaction pattern library developed in this study adds to a knowledge base of pattern libraries. Moreover, documenting and sharing the pattern approach supports the progression of the B2B field, it could establish credibility in the B2B industry with trading partners by increasing internal knowledge of the existing processes and communicating more effectively about them. For the decision makers in the B2B transaction, it is important to realize that relationship continues through the lifetime of the B2B service, and that the quality of B2B service directly impacts the length of that lifetime. The proposed pattern library can be used to take a trading partner-centric approach, with a genuine interest in the needs and concerns of trading partners to build strong relationships.

Directions for future research include a proposal for efficient representation where the B2B transaction pattern library will be represented in web-based knowledge management system which would improve efficiency of dissemination and feedback gathering. Using web-based tools could also allow reaching a larger B2B community and

hence contribute to a more comprehensive B2B transaction pattern library. Furthermore, we propose examining the potential of using social media tools for collecting feedback. Another area for investigation is establishing links between our pattern library and other relevant pattern libraries as well as linking patterns with best practices described in other formats, such as manuals and frequently asked question directories.

8. References

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