Building a Methodology for Context-Aware Business Processes: Insights from an Exploratory Case Study

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BUILDING A METHODOLOGY FOR CONTEXT-AWARE PROCESSES:
INSIGHTS FROM AN EXPLORATORY CASE STUDY

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Abstract

This paper describes the findings from an exploratory case study into the business processes at a leading Australian insurance provider. The business processes are frequently subjected to changes and deviations due to contextual events such as weather, financial conditions and others. In this study, we examine how context impacts business processes and how resulting business process changes are enacted. From our analysis, we suggest a methodological framework to guide organisations in the complex challenge of linking changing contextual factors with internal process design.

Keywords: Business processes, context, context-awareness, case study, change, adaptation
1 INTRODUCTION

The concept of Business Process Management (BPM) has emerged as a leading principle in the design and implementation of information systems (IS). In practice, BPM has led to significant improvements in business processes in terms of performance, operating cost, and compliance (Hammer & Champy, 2003). Organisations have committed large investments to identify, standardise, and document business processes with the intention to improve business performance or to enable subsequent automation through process-aware IS (Dumas, van der Aalst, & ter Hofstede, 2005) and workflow management systems (Jablonski & Bussler, 1996).

While the practice of BPM is widely established to date, typical approaches to process design, operation and change, such as Six Sigma and Total Quality Management, have mostly been inward looking, and focus on streamlining processes against internal objectives and constraints of the organisation. However, the scale of globalised operations in multinational organisations, and the emerging risks of a highly networked economy and tightly connected financial markets demand an increased consideration of external factors in the design of business processes.

We refer to the relevant external factors that impact a business process as its context. As an example, off-shoring and expansion into developing economies has increased the exposure to threats such as political change, natural hazards, terrorist attacks or trends in macroeconomic factors such as exchange rates and commodity prices, which defy control of the enterprise.

Situations like the examples above give rise to the question how existing process design methods can be extended to accommodate context in its different manifestations. This is important because awareness of external context in the design of business processes can significantly improve the adaptiveness and reliability of business processes. In this paper, accordingly, we explore the way context change affects a business process, using an exploratory case study. We believe that our case study findings, in turn, can make an initial contribution to the development of a method for achieving context-awareness in business processes. We identify the following research questions:

- What is relevant context of a business process?
- Where does context change affect the business process?

The paper is structured as follows. Section 2 discusses the research design underlying our study. Section 3 briefly introduces the conceptual foundations of the work, followed by a survey of the relevant literature in section 4. In section 5, we introduce an exploratory case study and discuss findings based on the qualitative data collected in the case site in section 6. These insights are summarised and put into the wider context of BPM and process design in section 7.

2 RESEARCH DESIGN

This study follows a case study strategy (Yin, 2003), choosing as unit of analysis a core process of an insurance provider that is subjected to changes due to contextual factors. The case study research method is a distinctive form of empirical enquiry that has found widespread application in IS research (Benbasat, Goldstein, & Mead, 1987). It supports the investigator in studying a small number of organisations if the purpose of research is to develop a deeper understanding of a phenomenon in its context through qualitative analysis (Gable, 1994), which is the case in our study. The case organization was selected on the basis of our classification scheme developed in earlier work (Ploesser, Janiesch, Recker, & Rosemann, 2009) and following replication logic (Yin, 2003). This approach was chosen to address the challenges inherent in case study research (Lee, 1989) and provide the basis for generalisability of the findings (Kerlinger, 1986) across both cases.

We defined a case study protocol documenting procedures for data collection and analysis prior to conduct to attend to known weaknesses of case study research (Benbasat et al., 1987). The data collection process used a combination of qualitative interviews (Rubin & Rubin, 2005) as well as other
sources of evidence (most notably process documentation and secondary evidence such as industry reports) to corroborate interview data. The interviews followed a semi-structured style, proceeded for 60-90min, and covered questions such as professional background and questions pertaining to the concepts developed in section 3. Interview data was subsequently transcribed, coded, and maintained in a case ‘database’ in order to maintain a consistent chain of evidence (Yin, 2003). In this paper, we present the within-case analysis following the guidelines of Miles and Huberman (1994).

The case study reported in this paper is embedded in a wider research project guided by the design science paradigm of IS research (March & Smith, 1995). This research project is organised in three interdependent cycles, covering the aspects ‘relevance’ (requirements gathering through case studies), ‘rigour’ (theoretical foundation) and ‘design’ (artefact construction and evaluation). However, a detailed discussion is out of scope of this paper.

3 CONCEPTUAL MODEL OF CONTEXT-AWARENESS

We regard business processes (and the organisations that ‘run’ them) as complex socio-technical systems that are tightly coupled with elements in their environment (Snowdon et al., 2007). We suggest that firms can benefit from a more holistic view of operations for several reasons: a) to consider the external reasons for business process change; and b) based on this understanding, to design more adaptive business processes. Our work is grounded in complexity theory (e.g., Holland, 1992) and system theory (e.g., Ackoff, 1973). Both kernel theories permit the explanation of emergent behaviour in complex, adaptive systems. Similar conceptions of organisations and business processes as complex systems can also be found in the literature on organisational theory (e.g., Brown & Eisenhardt, 1997) and BPM (e.g., Melão & Pidd, 2008).

System theory describes phenomena as interrelated wholes, systems, the behaviour of which is explained in terms of their role in a larger whole (Ackoff, 1973). Systems are ‘complex’, i.e., the actors in a system interact strongly with one another and with the natural world (Forrester, 1961; Sterman, 2000), and ‘adaptive’, i.e., actors in complex systems can change their capabilities and decision rules so as to recover some of the efficiency lost by changes in the system context (Ackoff, 1973). Furthermore, a socio-technical system such as an organisation is a ‘purposeful system’ (Ackoff, 1973) that directs its activities toward its own optimisation.

This understanding of business processes as complex systems informs three principal constructs of a framework to reason faithfully about business processes and context-awareness: 1) context elements, the representation of elements in the system environment; 2) process elements, the social and technological components within the system; and 3) goals, the intentions that determine purposeful behaviour of the system. Following systems theory, context elements and process elements are tightly coupled, i.e., context change may decrease or increase process element performance. Each process element contributes to the achievement of favourable states, i.e., goals that determine the purposeful behaviour of the system (customer satisfaction is an example of a process-related goal). A loss in performance in a single element may lead to a less favourable state in the overall system (an example is the effect of increased claims volume following a natural disaster on the call centre performance of an insurance provider). In order to compensate for this loss in performance, the system needs to adapt the functioning of its elements (e.g., by hiring temporary staff to accommodate for the increased volume) or alter its goals. Thus, context elements indirectly affect goals (i.e., they can be perceived by the organisation as positive or negative risk).

The relationship between the three constructs is rendered in the meta model shown in Figure 1. The proposed model is based on our earlier work (Rosemann, Recker, & Flender, 2008). It describes the structure for conceptual analysis of business processes underlying our framework (for a discussion of procedural aspects, see Ploesser et al., 2009). We make two propositions with respect to the contributions made by the framework. First, we expect the explicit consideration of the elements in the conceptual model to enable a more holistic description of a problem situation, enabling the construction of more complete representations of the business processes. Second, we expect the
application of the framework guidelines to improve efficiency and effectiveness of analysis and design tasks compared to existing process design methods.

Figure 1 Extended business process meta model based on (Rosemann et al., 2008)

Our conceptual model of context-awareness will be used in the exploratory case study to guide our investigation of the business process of an Australian insurance provider, and the types and impacts of contextual events on their processes. In doing so, we identify a number of research streams that guide our work, which we briefly discuss in the following.

4 RELATED WORK

Business process design usually employs semi-structured diagrams, business process models, to support organisations in developing a shared representation of business process knowledge and deconstructing organisational complexity. A substantial body of knowledge exists on the consideration of static contextual variables in contemporary business process modelling (e.g., Becker, Delfmann, Dreiling, Knackstedt, & Kuropka, 2004; Rosemann & van der Aalst, 2007). This work has considered, for instance, the impact of the industry sector, size or country on the configuration or adaptation of process-aware IS. The exploration of the impact of dynamic contextual variables such as market situations or weather on corporate systems, however, is widely absent in the related literature, leading to a lack of fit between the dynamic context of a process, and the ‘static’ techniques used to design, manage or perform these processes.

This is not to say that dynamic contextual factors have been disregarded to date. Scholarly work on process simulation, e.g., via queuing theory, for instance, permits the implicit inclusion of some contextual factors in simulation models by modelling them as demand variations (e.g., Kelly, 1975). Yet, an explicit consideration of a large variety of different contextual factors, or their direct and mediated effects on process change, is typically not considered in such models.

In the IS literature, context is often understood as the background in which design work is embedded. Leppänen (2006) introduces individual factors that have impact on the performance of methods in different environments. Commercial examples for the use of context in IS development include definitions of context models for managing the representation and use of business context information (UN/CEFACT, 2008).

In earlier work (Rosemann et al., 2008), we suggested four relevant types of context pertaining to the design of business processes ranging from process-specific factors to environmental factors. Yet, over recent years, the scholarly discussion of context has shifted from considering mostly static factors that determine IS behaviour (such as country, industry, and brand) to dynamic factors (such as weather patterns, pricing, and competitor action) (e.g., Hallerbach, Bauer, & Reichert, 2008). This comes as a result of changes in the operating environment of the modern firm, which is increasingly complex and dynamic and subject to frequent change (Sterman, 2000).
In the remainder of the paper, we will focus on the relationship between context elements and goals (relevant context) and context elements and process elements respectively (performance impact of context change).

5 A CASE STUDY OF CONTEXT-AWARENESS

5.1 Case study setting and approach

For the case study presented in this paper, we chose as unit of analysis the claims handling business process of the insurance arm of an Australian company in the financial services sector. Claims processing is part of the personal insurance value chain of the case, and encompasses the personal lines of Home and Motor insurance. The business process deals with the handling of claims over the phone, their assessment and settlement by repairers or vendors contracted by the insurance. After an earlier preliminary examination of this process (van der Aalst, Rosemann, & Dumas, 2007), we revisited the case site and extended the scope of the investigation to include additional roles and teams relevant to the process. This allowed us to achieve a broader coverage of the different stakeholders.

Six open-ended interviews with ten respondents in the organisation were conducted over the course of four weeks, to extend our knowledge of the case beyond the insights gathered and discussed earlier (van der Aalst et al., 2007). This particular interviewing style was chosen in accordance with the exploratory nature of the research (Rubin & Rubin, 2005). Respondents were selected on the basis of role (executive business manager, business manager, event specialist, and business analyst), associated responsibilities and business functions (lodgement, fulfilment). The interview data was corroborated with industry and company reports, as well as general statistical data obtained from the case organisation, procedural manuals, business process models, and other secondary evidence.

5.2 Case narrative

The claims business process can be partitioned into a lodgement part handling intake and lodgement of new claims, and a fulfilment part responsible for claims settlement, payment, and finalisation. Responsibility for process operation lies with two different lines of business with separate reporting lines, the areas of lodgement (responsible for claims intake and call centre operations) and fulfilment (responsible for managing assessors, repairers, and claims settlement). The strategic planning processes of (brand) portfolio management, pricing, and policy design set the objectives and service levels of claims processing. The support processes of recruiting; real estate; and assessor, repairer & vendor management complement the operations of the business process.

In general, the claims process follows the following sequence of steps. Claims are received by a lodgement consultant over the phone, who runs the customer through a set of questions regarding policy coverage, loss cause, and extend of damage (i.e. the itemised scope of work). If approved, the lodgement consultant then lodges a claim and triggers the assessment of the claim by a fulfilment consultant in one of several ways. Based on a triage matrix, the consultant estimates the scope of work and may demand additional proofs of damage or ownership based on the claims estimate. Next, the consultant creates a repair or replacement “job” for each line item. The fulfilment consultant routes the claim to either pre-approved repairers or vendors or requests the customer to provide two independent quotes. Repairers and vendors perform the work and generate an invoice, which is settled by the insurance. The consultant then finalises the claim and estimates are updated with the final amount.

However, the business experiences regular peaks in claims volume during the Australian storm season (October - March). During this period, the probability of a severe thunderstorm rises to over 30% and claims volume double over normal volume for working losses. In the biggest event so far, the South-east Queensland storms in November 2008, the insurance incurred roughly 40% of its annual claims volume in a single event.
The case has appointed an event leadership team responsible for process governance in an event. This results in two different variants of the process or ‘worlds’, a term widely used by respondents. The ‘Business As Usual’ variant (abbreviated to BAU) comprises the processing of general working losses incurred throughout the year, which are not related to natural hazard. The ‘Event’ variant comprises the processing of claims in direct relation to a natural hazard such as thunderstorms, flooding, hail, or bush-fire. This distinction is reflected in the team structures to ensure continuous operation of the BAU teams during an event and better cost control (i.e. tighter control and monitoring for BAU).

6 QUALITATIVE ANALYSIS OF PROCESS CONTEXT

In this section we use the conceptual model suggested in section 3 to proceed with a qualitative analysis of process context and the impact of context change based on the data collected. In our analysis, we focussed on the ‘Event’ variant of the business process, as it is directly affected by external context change.

6.1 Qualitative analysis of context elements

The personal insurance lines of the case provide services directly to the customer. Performance of the lodgement area is measured as grade of service and customer satisfaction. At the same time, the business needs to remain profitable by reducing its claims handling process costs and administrative overhead. As a result, performance in the fulfilment area is measured by means of financial indicators. Several respondents reported that the different types of performance goals can sometimes be in conflict. Maintaining performance thus needs to consider the operating context.

In order to keep track of claims processing performance, the organisation has implemented a reporting infrastructure that allows it to retrieve performance relevant data from the claims processing system. It uses a set of key performance indicators to measure financial health of the business as well as customer satisfaction or “claims experience”. The key performance indicators in alphabetical order for claims processing are:

- **Cost of claim**: the average cost of claim comprising value of the loss, processing cost, etc.
- **Grade of service**: the average quality of service provided to customers (e.g. wait time)
- **Leakage**: the % of claims cost paid out in excess of the real value of the loss incurred
- **Life of claim**: the average time for a claim to transition from lodgement to settlement

In the interviews, respondents were asked to describe recurring deviations in performance and the reasons for which they believed these occurred. This data was used to identify themes or patterns that re-occurred and that consistently happened a specific way (Miles & Huberman, 1994). A structured comparison of the responses required two levels of analysis. First, we had to establish the individual understanding of claims processing context, i.e., a respondent’s ‘mental map’ of context elements. This provided the basis for us to then elicit a shared understanding of claims processing context, i.e., a ‘mental map’ shared by all or most respondents. This approach is summarised in the following.

**Phase 1**: we coded the responses based on whether respondents ascribed an observed issue to internal or external context (and internal or external stakeholders respectively). In a second step, external context was further subdivided into the categories provided by the PESTLE taxonomy (Mintzberg, Ahlstrand, & Lampel, 1998). This provided a first indication of the themes that preoccupied the mind map of a single respondent.

**Phase 2**: we grouped the individual themes into emerging factor clusters based on their semantic proximity (e.g., direct or implied existence of the same issue, stakeholder, etc.). The clusters were labelled following general recommendations provided by Sterman (2000). A label had to be unambiguous and had to provide an indication of quality of the observed symptom.
Different visualisation techniques including word clouds (rendering associated themes and relative importance based on frequency count) were used to confirm these mental maps with the respondents.

Table 1 lists the reported context elements per respondent and role (in Table 1, ‘Brand’ refers to overall responsibility of an insurance product and brand; FUL refers to the fulfilment area; LOD refers to the lodgement area, and SHD refers to a shared service between areas). Perusal of the interview data suggests that more factors are relevant as the process context than suggested by the prevalent focus on weather patterns as a driver of the current process design. The data also reveals a slight bias of respondents toward certain context elements. In fact, the operational picture of claims processing context seemed to differ between roles. In some instances, we observed contradictory statements about the importance of context elements. We attribute the discrepancies to the different roles and responsibilities assumed by the respondents.

<table>
<thead>
<tr>
<th>Context element</th>
<th>Executive Manager (Brand)</th>
<th>Executive Manager (FUL)</th>
<th>Business Manager (FUL)</th>
<th>Event Specialist (SHD)</th>
<th>Business Manager (LOD)</th>
<th>Observed effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>weather pattern</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Increases life of claim, cost of claim</td>
</tr>
<tr>
<td>economic climate</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Increases leakage</td>
</tr>
<tr>
<td>community attitudes</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>Increases leakage</td>
</tr>
<tr>
<td>government pressure</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Decreases grade of service</td>
</tr>
<tr>
<td>regulatory pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Increases cost of claim</td>
</tr>
</tbody>
</table>

Table 1 Context matrix of claims processing

In our ensuing analysis, we focus on the most prominent factors, defined as those that together accounted for more than 20% of occurrences of context elements in the interview data. According to the observations of the interviewed respondents, these factors make up for most of the effects observed on an operational level. These top factors are briefly introduced in the following:

Weather pattern: violent weather conditions such as thunderstorms and bushfires in Australia recur in yearly cycles. In fact, over the past decades, the frequency of natural hazards and damage incurred has dramatically increased. These cycles produce large spikes in claims volume and overall claims cost.

Economic downturn: The recent slowing of economic activity sees an increase in the volume of lower value claims as households are put under financial pressure or face unemployment.

Community attitudes: the general acceptance of insurance fraud in the community as a victimless crime is a major driver of overall claims cost. Fraud occurs in various disguises, e.g., the padding of otherwise legitimate claims, staged incidents, and the hiding of facts relevant to a claim (Insurance Council of Australia, 1994).

We confirmed our observations by triangulating interview data against industry reports (Insurance Council of Australia, 1994; KPMG, 2009), industry statistics issued by the Australian Prudential Regulation Authority, and meteorological surveys of Australia (Harper, Granger, & Hall, 2007).

6.2 Qualitative analysis of the impact of context element change on business processes

Following from the establishment of a mental map of the claims processing context, we studied the effects exerted by context change on the claims business process. The scenario selected in accordance with the case, the occurrence of a major thunderstorm causing widespread damage in a densely populated urban centre on the Australian East coast, was based on an actual event. We analysed the decisions taken by respondents during the event in response to context change (as reported in the
interview data). Table 2 provides several examples of process change in response to the natural event (i.e., the occurrence of a context change event of type weather pattern). As a first step, we separated product decisions (e.g., decisions that relate to policy coverage or eligibility for emergency services) from process decisions. We then classified and mapped decisions to the four conceptual perspectives of business processes proposed by Curtis, Kellner, and Over (1992).

<table>
<thead>
<tr>
<th>Process perspective</th>
<th>Lodgement</th>
<th>Fulfilment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioural</td>
<td>Fast track lodgement (e.g. truncated call centre procedure)</td>
<td>Fast track fulfilment (e.g. cash settlement, approval procedures)</td>
</tr>
<tr>
<td>Organisational</td>
<td>Working over hours</td>
<td>Recruiting temporary staff</td>
</tr>
<tr>
<td>Informational</td>
<td>Standardised, truncated capture of loss cause data</td>
<td>Changes to required proof of loss, proof of ownership data</td>
</tr>
<tr>
<td>Functional</td>
<td>Operation of so-called onsite claims centres in the affected communities</td>
<td>Reassignment of lodgement responsibilities</td>
</tr>
</tbody>
</table>

Table 2 Process changes in response to a context change event of type Weather Pattern

All respondents reported immediate effects of weather patterns on the workforce and process control level. In the aftermath of a natural event, claims volume can double over the BAU level for this period and the activities of claims processing need to be streamlined. For instance, the organisation reduces the average call time by using an event-specific catalogue of lodgement questions. Another example is the allocation of staff from other areas to the lodgement area.

With the qualitative analysis of context-induced process changes we were able to show the structure of the process system and the interaction between its elements with elements in the process context. The next step of our analysis was then to demonstrate how these interactions explain certain issues in the claims process. For this purpose, we used system dynamics modelling (Sterman, 2000), a tool for discovering and representing feedback processes and other elements of complexity in complex, dynamic systems. The advantage of the system dynamics method over other modelling methods is its support for qualitative analysis, its focus on feedback structures, a well-documented modelling process, and an easy to read notation for communication of results to practitioners.

Our starting point was the observation that the pressure to provide an above than average customer experience in claims intake during an event appeared to create issues at later stages of the claim life (e.g., rushed lodgement leading to incomplete information about loss cause, which causes delays in the settlement process). We observed two different opinions among respondents with respect to this issue. One group valued customer experience above all, arguing that high wait times for customers in distress will have an adverse effect on their brand perception. Another group stressed that a streamlined lodgement procedure actually increase the life of claim by creating a significant claims backlog in short time. This, as they claimed, strains back office capacity and increases the time to settlement on an individual claim level.

A more detailed analysis of claims processing dynamics was thus required. To that end, we first mapped the leading feedback loops between claims processing activity and elements in the external context. As losses incurred and reported increase, the lodgement frontlog fills with new claims. The pressure to lodge claims increases as more and more claims are reported in an event. Claims intake activity increases, expressed by the lodgement rate, which clears the frontlog. As pressure increases beyond a certain threshold (e.g., unacceptable wait times for callers or return calls from disgruntled customers), the intake procedure is truncated by the case in order to reduce the time required to lodge an individual claim. While this increases the lodgement rate, it has a collateral effect on the quality of the information captured in the scope of work (i.e., corner cutting).

Claims, after lodged, transition into the fulfilment backlog. Fulfilment pressure increases as the backlog fills up. Repairers are sent out or damaged items are replaced. The life of claim decreases as more and more repair or replacement jobs are performed. The claim is finally closed and removed from the backlog. However, if claims intake was truncated, repairs and replacements are often delayed...
as a result of incomplete information in the scope of work. Fulfilment consultants need to liaise with customers and suppliers to obtain the missing information. The life of claim increases, which drives cost through administrative overhead and modifications to the claim as a result of further deterioration of the damaged item.

As a next step, we mapped the context elements reported in section 6 to the internal feedback structures based on the effects reported in the interview data. This provided a causal explanation for the symptoms observed in section 6. By way of example, claim volume increases in the aftermath of a weather-related event. Population density in the affected area (risk exposure) and financial pressure on households (economic downturn) can further reinforce this effect.

Figure 2 renders the final model using a causal loop diagram (Sterman, 2000). Bold lines represent leading feedback loops, whereas thin lines represent auxiliary effects. We used this diagram to present and confirm our findings with the business analysts responsible for process design.

Figure 2 Causal loop model of claim business process issues

7 SUMMARY AND DISCUSSION

In section 6, we have observed multiple ways in which context change affected the business processes of the case organisation. We can summarize our findings from the explorative case as follows:

The claims volume resulting from weather patterns creates a significant backlog, which strains resources and increases the life of claim. Weather patterns furthermore generate higher value claims (e.g., total losses), which bind resources for case management and increase the average cost of claim. Interestingly, there is a reinforcing feedback between life of claim and cost of claim. As the claim life increases, processing cost increases and additional damage occurs through delays in repair.

An increase in lower value claims during an economic downturn has less of an effect on the cost of claim, but binds resources otherwise required for the processing of event-related claims. This increases the claims backlog even further, which has a negative feedback on life of claim.

Finally, an increase in fraudulent claims affects leakage. Fraud detection requires experienced staff, which is predominantly assigned to case management during a weather-related event. As a result, fraudulent claims may go undetected. This is further reinforced during an economic downturn through two feedback loops: a) staff shortage (e.g., as a result of a recruitment freeze); and b) a potentially bigger segment of customers under financial pressure (increasing the propensity to commit fraud).
Based on these observations, we offer a number of implications for process design. Specifically, we assert that context and context change requires different response strategies in process design. For example, weather patterns occur in regular, short-term cycles throughout the year. The frequent adaptations resulting from these cycles require that variability is built into the process design. Community attitudes, on the other hand, affect the process on two levels. There is a short-term response by building fine-grained customer segmentation into the process. In addition, there is a mid-to long-term response by educating the community about the downside of fraud (increased premium for all insurance holders). Common economic models suggest that economic cycles are a long-term phenomenon. Effectiveness of responses on a process level is thus limited. Responses are better build into pricing and policy design. By way of example, by increasing default excess, the case can cut off lower value claims.

We can also draw conclusions from the case exploration to offer some implications for future studies on context-awareness and process design. Prominently, we believe that through the analysis of qualitative data in section 6, we have provided initial input for the development of a formal method framework that can aid organizations in achieving context-awareness. Based on the structural issues observed, we argue that, presently, the dynamic aspects of context-awareness are insufficiently supported in contemporary methods for business process design. We specifically suggest the following extensions towards a framework of methods to achieve context-awareness:

**Context modelling**: process design should include techniques for “charting” the context of a business process (see, for instance, Table 1). Its objective is to provide a complete and exhaustive “map” of relevant process context elements (e.g., by developing common context taxonomies and/or conceptual modelling grammars). Such context modelling approaches, in turn, can complement standard process design maps and provide contextual information that is typically missing from process models.

**Context analysis**: process design should further consider an analytical framework for assessing context change impact on a process design. Its objective is to qualify (where?) and quantify (how?) the impact of context change on a process design; a precondition for developing suitable response strategies to adapt a business process when required through the occurrence of a contextual event during run-time (e.g., by applying system dynamics to the domain of process management).

In our view, context modelling and analysis emerge as important keystones for the development of a framework towards context-aware, adaptive business process systems. This is supported by a growing interest in the challenges of designing external adaptive processes fielding the academic literature (e.g., Gunther, Rinderle, Reichert, & van der Aalst, 2006; Hallerbach et al., 2008; Rosemann et al., 2008). Applied to the case, we suggest that context-awareness can provide more effective business process design incorporating context factors such as customer preferences, government attitudes, and the general economic situation of households. We suggest that certain context elements can be mapped to a rule-based system to govern the variability in claims processing. For instance, this includes:

- More effective customer segmentation (customer loyalty, contract type, claims behaviour, etc)
- More effective classification and pathing of claims to avoid build up in claims backlog
- More effective settlement (“settle early, settle often”, e.g. cash settlement)
8 CONCLUSION

This paper presents empirical evidence and initial input for the development of a formal method framework for achieving context-awareness in business processes. Through the qualitative analysis of interview data from an exploratory case study, we were able to extend the operational picture of process context, adding two factors (community attitudes, economic downturn) to an already known factor (weather patterns). These observations were confirmed by recent industry reports and statistics. We also demonstrated that context-awareness is not a trivial problem. The context of a business process is highly dynamic and factors can overlay to create problems that reinforce structural issues in the business process. We performed an impact analysis of context change on the business process and were able to uncover some of these issues through system dynamics modelling. Based on our analysis, we suggested some extensions to typical process design and analysis approaches, namely to complement these with approaches for context modelling and context analysis.

We acknowledge certain limitations to the work. The insights and conclusions were drawn based on a within-case analysis of context-awareness in one business process. Additional efforts will be required to demonstrate external validity of the findings across different case organisations. To this end, we are currently negotiating two additional case studies. The selection of case sites and replication of findings follows literal replication logic (Yin, 2003). Ultimately, we consider the use of a focus group toward the end of study for the final validation of findings made during the course of the study.

Future work will furthermore include a quantification of the impact of context change and structural issues based on statistical data provided by the case. The analytical procedures applied during the current and future case study will ultimately feed into the design and engineering of a systematic method for context-awareness. Specifically, we will focus the development of a common context meta model, conceptual modelling extensions and context analysis approaches to formalize a framework for achieving context-awareness in business processes.

References


