Modeling Dynamic Behavior of Business Organisations
Extension of BPM with Norms

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Keywords: Organisational Semiotics, Business Process Modelling, Norm Analysis, DEMO, e-Government.

Abstract: A successful system first begins with an understanding of the business processes of an organisation. As such, business process modelling (BPM) represents a collection of related, structured activities or set of tasks that produce a specific service or product to stakeholders. It graphically represents how a business organisation conducts their business processes conceptually. Throughout the literature, some challenges with BPM have emerged, such as standardisation of process modelling, identification of the value of process modelling, and model-driven process execution. However, one of the most challenging issues in business process management is that organisations are traditionally considered to be static networks of transaction processes rather than dynamic. There is therefore a need to aide analysts and practitioners alike by providing methods that can guide and capture the dynamic aspects of an organisation. This paper aims to present two BPM methods, and discusses extending them using the norm analysis method (NAM) to enable the analysts to model the dynamics of business processes and to accommodate exceptions that have not been dealt with by other conventional methods.

1 INTRODUCTION

Adding value to business process has become nowadays more and more the objective of organising business, in contrast to the traditional hierarchy perspective. As such, the concept of business process modelling (BPM) is a very popular way in which to better understand business processes. Throughout the literature, most experts in the field, in particular, information technology and business engineers, have suggested that a successful system first begins with an understanding of the business processes of an organisation (Davies et al., 2006). As such, business process has emerged as an important and relevant domain to facilitate the development of software, analysis of requirements, and re-engineering (Davies et al., 2006); (Recker et al., 2009). BPM represents a collection of related, structured activities or set of tasks that produce a specific service or product to stakeholders. BPM is typically performed by business analysts and managers who are seeking to improve process efficiency and quality in organisations. Hence, BPM is a way in which to graphically represent how business organisations conduct their business processes conceptually. There are many BPM conceptual models, for example, in a recent study by Davies et al. (2006), they conclude that the most common modelling techniques and methods used by practitioners in business organisations are ER diagramming, data flow diagramming, systems flowcharting, workflow modelling, RAD, and UML; all of which provide the means to represent the real world conceptually. As such, BPM is considered to be a key tool for the analysis and design of information system in business organisations. Notably, there are some challenges with BPM. Such as, standardisation of process modelling, identification of the value of process modelling, and model-driven process execution (Indulska et al., 2009). However, one of the most challenging issues in business process management is that organisations are traditionally considered to be static networks of transaction processes rather than dynamic. Van der Aalst et al. (2003) confirms such fact in the context of software development and state that “the goal is clear and it is easy to see that software development [within organisations] has become more dynamic”. Organisations are dynamic networks of interrelated transaction processes. When examining the inter-workings of organisations, the dynamic aspects need to be considered (Liu et al.,

Liu K., Al-rajhi M., R. Alsoud A., Chidzambwa L. and Tehrani J..
Modeling Dynamic Behavior of Business Organisations - Extension of BPM with Norms.
DOI: 10.5220/0004142101960201
In *Proceedings of the International Conference on Knowledge Management and Information Sharing* (KMIS-2012), pages 196-201
ISBN: 978-989-8565-31-0

2003). The popularity of business process orientation has produced a fast growing number of methodologies, modelling techniques, and tools to support it (Charfi et al., 2010). The process of selecting the right technique and the right tool has become more and more complex not only because of the huge range of approaches available, but also due to the complex dynamic nature of large organisations. There is therefore a need to aide analyst and practitioners alike by providing methods that can guide and capture the dynamic aspects of an organisation. This paper builds on previous work on modelling the dynamic behaviour of business organisations (Liu, 2000) by presenting two BPM methods, and discusses extending them using norm analysis method (NAM) to enable the analysts to model the business processes and to accommodate exceptions which have not been dealt with by other conventional methods (Liu, 2001); (Stamper, 2001). Norm analysis is method used to model the dynamic conditions of patterns of behaviour. Patterns of behaviour, in turn, share a set of 'norms' which govern how members behave, think, and make judgment. There are many types of norms depending on the way in which norms control human behaviour; however, for the purpose of this paper the analysis will focus on behavioural norms, which govern people's behaviour within regular patterns (Liu and Dix, 1997).

The aim of this paper is two-fold. On the one hand, it is to aid in modelling the dynamic behaviour of business organisations. On the other hand, it is to demonstrate the applicability of 'norms' with two BPM methods through presenting two case studies as a research method. The following section introduces two examples of modelling organisational processes, the notion of norms, and two case studies one in e-Government services and the other in home telecare. The paper ends with a discussion and conclusion.

2.1 Examples of Modelling Organisational Processes

2.1.1 Life-event Approach

The extraordinary growth in government information and services published and provided online raises a need for an efficient way to structure these government contents and to effectively deliver them to citizens. Life-event approach satisfies this need by being citizen-centric through providing these services based on real life-events and situations in order to facilitate and enhance citizens' experience when accessing governmental information and services. In information systems literature, Wimmer and Tambouris (2002) define life-events as a way to describe situations of human beings where public services may be required, or triggered according to Kavadias and Tambouris (2003) definition. According to Momotko et al (2006) most of the existing technologies that are used to implement life-events are either too static or too dynamic. Static as they cannot offer an effective way to incorporate potential differences in the needs and circumstances of a citizen or they are too dynamic to be used effectively by public administrations (Momotko et al., 2006). Therefore, they proposed an approach for implementing life-events based on generic workflows technologies by using workflow management. This organises life-events as processes and rule management to make them more flexible by including dynamic rules. They define the term "dynamic" as rules that can be validated at execution phase and during simulation. However, their use of dynamic rules is limited to identifying the responsible agent for the execution process.

2.1.2 DEMO

Dynamic essential modelling of organisations (DEMO) (Dietz, 1999) is a communication based modelling methodology aligned to language action perspective (LAP) theory. DEMO uses high-level process descriptions to analyse processes at the ontological level instead of focusing on implementation details. It highlights communication patterns between human actors, instead of the sequences in which activities are performed. The aim is to highlight the commitments that are entered during the communication process as drivers of action that is subsequently performed (Dietz, 1999).

One of five DEMO models is the business process model (BPM). Causal and conditional relationships are highlighted in BPM. The causal relationship cause the start of a transaction and a conditional relationship forms a condition of the start or completion of another. Although DEMO BPM shows such conditions, the process model is only capable of capturing static conditions and does not show dynamic conditions the exclusive-or transaction. Unexpected events might occur that require human judgement. These exceptions are difficult to represent using a process diagram. Catering for exceptional situations in behaviour is handled well by norm analysis.

3 NORM – A KEY CONCEPT

Norms exist in a community and will govern how members behave, think, make judgements and perceive the world. Norms are represented in various kinds of signs, whether in documents, oral communication or software code. A norm is more like a field of force that makes members of the society tend to behave in a certain way. As (Wright, 1963) explains: Norm has several partial synonyms which are good English. 'Patterns', 'standard' and 'type' are such words. So are 'regulation', 'rule' and 'law' ". The shared norms are what defined a culture or subculture. In an organisation, norms reflect regularities in the behaviour of members allowing co-ordination of their actions. Norms are developed through practical experiences of agents in a society and in turn have functions of directing, coordinating and controlling actions within society (Liu, 2000). Therefore, an organisation is system of social agents where people conduct themselves in an organised way by conforming to regularities of perception, behaviour, belief and value. The function of norm is to determine whether patterns of behaviour are lawful or acceptable in the context of the society.

3.1 Specification of Norms

Once the organisational norms are identified, it is possible to express rules using general shape:

If <condition> **then** <consequent>

However, norms do not constitute a closed logical system and in an actual situation, there are variations to be considered as people do not always conform to every organisational norms. When modelling the agent and the actions, which reveals the repertoire of available behaviour of the agent, the norms will supply the rationale for actions. Therefore, to capture and formally represent norms additional components including the authority(s) of action (agent), the effect and content of the norm, norm subject and context have to be considered (Wright, 1963). Behavioural norms prescribe what people must, may or must not do. These are equivalent to their fundamental deontic operators, 'obliged', 'permitted' and 'prohibited'. The following format is considered suitable for specification of behavioural norms (Liu and Dix, 1997).

Whenever <condition> **If** <state> **Then** <agent> **Is** <deontic operator> **To** <action>

The condition clause, describes the matching mechanism to apply. It clarifies the context in which norm can be applied and defines the data the norm subject requires. The actor clause describes authority (s) of action that is responsible for the action. The action clause specifies the consequence of norm, which can be an action, or generation of information.

Norm analysis gives a means to formally specify the general patterns of behaviour in business systems. The analysis of patterns of behaviour focuses on the social, cultural and organisational norms that govern the actions of agents in business domain. In general, a complete NA is performed in four steps, which are described in table 1.

Table 1: Main stages on norm analysis.

Norm ID	Description
Responsibility analysis	Identify responsible agents, i.e. norm subject
Proto-norm analysis	Select types of information required by the execution of the norm
Trigger analysis	Pre-condition: The conditions before invoking the norm
	Post-condition: The resultant after the successful execution of the norm
Detailed norm specification	Norms specified in the standard format

4 LIFE-EVENT ORIENTED E-GOVERNMENT SERVICES

Life-Event Approach is an emergent paradigm for providing e-government services and information to citizens, by distributing information and available electronic services (e-services) according to the major events of a citizen's life such as birth, education, employment and marriage. It can be a citizen lifecycle from birth to death. Life-events describe situations where citizens may require one or more of e-government services. The adoption of life-event approach enables the service selection process to be more tailored to citizen needs at a particular time of their life (Dias and Rafael, 2007).What makes it attractive is that a sequence of relevant services can result from a single request. For instance, in "getting married" life-event; the citizen with a single request and, ideally, a single form, could update all relevant departments on the new marital status, request for new personal documents, or obtain any other relevant information.

However, this cannot be achieved in a systematic way unless life-events are matched to relevant e-services in a dynamic manner. Therefore, a matching

mechanism is needed to provide public e-services based on some needs that have been implied due to the occurrence of a particular life-event. Using norms is a promising solution for such a challenge, especially after the failure of current technologies in supporting the "publish and find" process of the core e-service provision (Atkinson et al., 2007). Norms can play a key role in supporting the standard service brokerage model by identifying actual service needs (implications of life-events) to be used in finding the related services in the service registry. Life-events are matched with relevant services using the two ends of the norm construct. The workflow of the activities in life-event oriented e-government service provision system can be controlled using norms, which can trigger the relevant e-services of a particular life-event that are by a citizen.

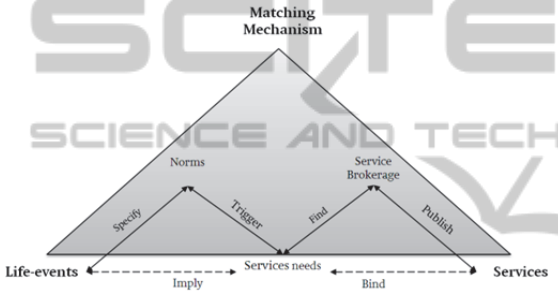

Figure 1: Matching Life-events with e-services using norms.

Norms can capture conditions and assign them to the responsible agents who can be a citizen (either the bride/wife or the groom/husband or both in some instances), a registrar (in this case registrar is a government officer at registrar office), or a system (government portal), and identify the actions that are associated with them. Norms can be checked against citizen profiles to determine the eligibility for a particular service. Norms can be useful to govern the static workflow of processes in life-event oriented e-government service provision system.

5 EXTENDING DEMO WITH NORMS (HOME TELECARE CASE STUDY)

Home telecare is the application of electronic and communication technology in caring for individuals at home. Before the service is installed it is essential to define the condition of the service user in order to determine their care needs. The best way to manage the expectations of users whilst raising acceptance and commitment to solutions is to let them define their important needs and express how they wish those needs to be met. Discussion between the user and assessor clarifies the acceptable statements and aligns them to service goals. Table 2 shows the transactions that take place during the assessment procedure as represented by DEMO. The transaction type is represented by "T" e.g. T1 and represented by a disk in Figure 2.

Table 2: Transaction results on compiling service user preferences using DEMO.

Transaction type	Transaction result
T1 Compile user care preferences	F1 Preferences defined
T2 Request condition definition	F2 User condition defined
T3 Define care problems	F3 Care problems defined

Home telecare is applied to the elderly, disabled and those with learning living in their homes. Family members and carers are usually involved in user assessment. Perceptual norms are applied in defining user conditions and cognitive norms are applied in defining causal relationships between care problem and condition. Axiological norms are applied in selecting care preferences. These norms affect how the individual behaves. Behavioural norms give structure to the complex world between actors. These norms are added to business process diagrams in order to guide the prediction and collaboration of future behaviour as design norms.

Conditions prevail which are not covered by static process diagrams but can be captured by applying norms. For example from Table 2 the service user, their representative or both can define user condition with the assessor. The user might only give one intervention preference which means there is no ranking required. The individual values, which would have been identified by ranking interventions, are still be required to understand the values impacting user decision making.. If valuation of interventions is dependent on external forces then those forces need to be involved in decision making because decisions done in their absence will not hold and may need to be revisited. Whilst DEMO identifies the core transaction it does not capture the dynamic properties of the transaction. This is important where social factors play an important role in the commitment that is made by the stakeholders like in home telecare. For example to capture the value system of a service user the norm in Table 3 is identified. Capturing these dynamic aspects provides greater flexibility in the execution of the tasks whilst ensuring that the objective of the transaction is

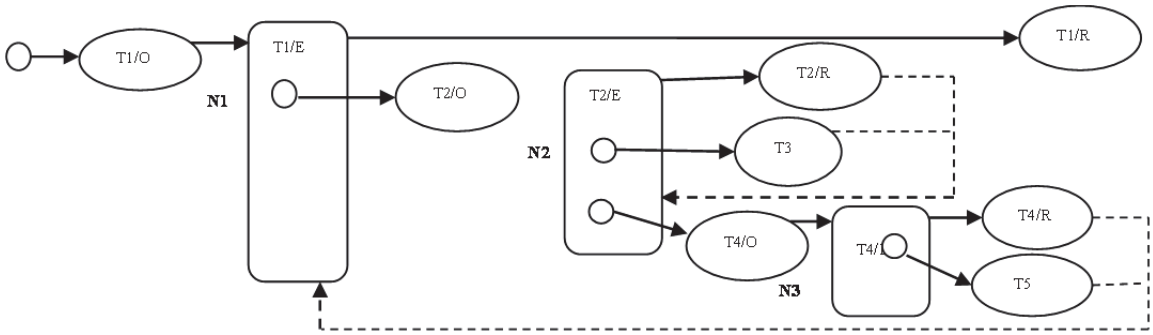

Figure 2: Business process diagram for compiling user preferences using DEMO BPM.

achieved. Using norms enables the inclusion of social aspects in systems design.

Table 3: Result of norm analysis.

Norm ID: N3	Determining service user value system
Responsibility analysis	Assessor
Proto-norm analysis	Identified care need/s
Trigger analysis	Pre-condition: The user has not provided information on their value system
	Post condition: How user values acceptable care has been established
Detailed norm specification	Whenever there is one care intervention preference given if the service user has provided information on their value system, then the assessor is prohibited to ask other value related questions

6 DISCUSSION AND CONCLUSIONS

As mentioned previously, the aim of this paper is two-fold, 1) To aid in modelling the dynamic behaviour of business organisations, and 2) To demonstrate the applicability of 'norms' using two BPM methods. In this sense, extending the BPM method using 'norms' enables analysts to model the dynamic behaviour of organisations, which has not been dealt with by other conventional methods. The paper contributes to the notion that organisations are not static networks of transaction processes but rather dynamic ones, by aiding analysts with modelling the dynamic networks of interrelated transaction processes. We have demonstrated the applicability of 'norms' using two BPM methods: The life-event oriented e-government and the home telecare system. As supported by both case studies, the applicability of extending the method using the norm analysis method is demonstrated. It is also shown, given that it has been feasible to study and define the patterns of behaviour within each case study, that norms play a vital role in identifying the responsibility and eligibility of both e-government and telecare services, as well as in defining the consequences. When examining the inter-workings of organisations, bearing in mind that organisations are dynamic networks of interrelated transaction processes, the dynamic aspects of such inter-workings need to be considered (Liu et al., 2003). Hence, information systems consist of social as well as technical dimensions all of which need to be taken into consideration. With the realisation that the individual is not outside, but is indeed part of the system, the importance of addressing users' social requirements, from a system design perspective, is increased. Thus, in telecare provision we need to understand which personal norms may impact the acceptance or use of the telecare solution. Bearing this in mind, we conclude that it is not only the technical functions of the devices that matter for the successful deployment of telecare systems. Instead, the social aspects also play an important part in such process and therefore warrant consideration in designing systems. The structuring of these social aspects using norm analysis enables their inclusion in technical systems and therefore can be automated. A current limitation may be the management of the increasingly complex set of norms underlying large organisations. An avenue for future work is to develop a way in which to manage such large sets of norms. Overall, extending BPM by norms helps to ensure that both, the social and technical systems, are captured and documented. The strength of this modelling approach results from the powerful base methods: DEMO and NAM. DEMO, on the one hand, is a rigorous approach that provides a solid understanding, first, of the types of transactions that take place within an organisation; second, of the participants involved in these transactions; third, the information that is needed and created while

carrying through the transactions; and fourth, the relationship between the different transaction types. NAM, on the other hand, enables the analyst to specify business rules, which is necessary for systems design. The specification of norms allows the recognition of human responsibilities and obligations. In addition, it has been demonstrated that NAM allows the modelling of the dynamics of business organisations, since deontic operators facilitate modelling situations were decisions are made solely based on human judgment and there is a degree of flexibility in patterns of behaviour. The extended method of DEMO with NAM leads to a powerful modelling approach for information systems analysis and design in business organisations.

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