DEVELOPING A PROCESS MODEL OF BUSINESS TRANSACTION WITH DEMO

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Abstract: *In the DX society, the realization of customer experience value becomes more important in business innovation. Therefore the transaction data distributing through the value network between organizations need to have the following characteristics. Firstly the companies participating in this network have to identify the transaction as a series of phases in order to enhance of the information potentiality of transaction data, rather than identifying transaction at the phase of closing the transaction. Secondly, even each non-keystone company participating in the network have to use a de jour standard in order to autonomously construct of, participate in and withdraw from Value networks with agility and in a context-adaptive manner. Business Transaction State Machine could be used to achieve these two goals. However, there is no general guideline for recognizing the business events themselves that are necessary to govern/execute exchanges. This problem can be solved by incorporating the DEMO's recognition method based on LAP. However, the transaction processing system based on this recognition is almost impossible to realize excellent transaction processing functions such as Alibaba and Amazon. To solve this limitation, this paper proposes an extended DEMO.*

Key words: *Business Transaction State Machine, REA ontology, DEMO (Design & Engineering Methodology for Organizations), LAP (Language Action Perspective)*

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1. Introduction

In the society of Digital Transformation (DX), the realization of the value of customer experience becomes more important in business innovation (Kokolek, Jakovic, & Curlin, 2019). In such contexts, from the perspective of cybernetics, successful companies make full use of self-organizing functions rather than self-sustaining functions (Espejo & Watt, 1979).

The information potential of transaction data is enhanced by recognizing business events with elementary-dimensional, multifaceted, and detailed aspects, and wider scope phase of transaction process. These data can be used to enable a variety of analyses and forecasts, enable efficient and effective sales management and marketing, in other words, highly support the self-sustaining function of a company. Therefore, firstly companies should recognize transaction data by their business events with such these aspects acquired through a series of phases with transaction process, rather than acquired at the phase in which rights and obligations are finally established between the business partners. Furthermore, if these data are autonomously distributed and stored in each company participating in the value network with high security, it will be possible to build, reconfigure the network or leave the network at will. In addition, by combining with “Big Data” created by other information systems and processing, we aim to create new products and services and reconstruct business models, in other words, to realize highly self-organizing functions. Therefore, secondly from the perspective of constantly creating experienced value for customers, even small and medium-sized enterprises must be able to voluntarily and autonomously build, reconfigure, or leave the network as if it were the keystone or leader company of the traditional network. Thus, companies must assertively and actively transform their structure, function and context, and promote actively and positively environmental adaptation. To achieve this, it is crucial to use a standard transaction framework as a *de jure* standard, which can be used, regardless of the type industry or business, whether in domestic or abroad.

The standard transaction model for business transactions (ISO/IEC15944-4, 2007) can be applied as a framework for this type of transaction. This allows for the construction of a new type of transaction processing system, called a Business Transaction State Machine (BTSM), where it unitarily identifies business transactions between business partners as a series of phases in order to enhance of information potentiality of transaction data, rather than separately identifying the transactions by each business partner at the “actualization phase” in which rights and obligations are finally established between them.

Therefore, this ISO standard transaction model can be used in conjunction with a BTSM, to build a new transaction processing system that brings a high degree of sophistication to company self-organization and self-regulation functions. However, previous researches about the BTSM do not have a unified policy for recognizing business events, which occur in each of a series of phases, up until a transaction reaches the recognition of one of the agreed conclusions by all the involved business partners (Horiuchi & McCarthy, 2011; Horiuchi & Shimizu, 2016; Horiuchi & Shimizu, 2020). This issue can be resolved by incorporating Design & Engineering Methodology for

Organizations (DEMO), based on the “Language/Action Perspective” (LAP) (Winograd, 1986; Hunka & Zacek, 2015; Horiuchi, 2020).

However, DEMO (Dietz, 2003) inadequately appropriates transaction processes formed from a series of phases, starting with a seller’s offer (an increasingly common scenario, with online sales). In addition, it inadequately appropriates a series of multiple transaction processes (including mutual offers between buyers and sellers) related to conditions for negotiating details. This study proposes an extended version of DEMO that can properly model these transaction processes.

2. Previous researches about building BTSM

2.1 An introduction to BTSM

The standard transaction model in ISO/IEC15944-4(2007) provides the terms and definitions such as “business transaction” and “business transaction process.” Thus, those involved in a business transaction can clearly understand the meaning of the transaction, in a way that transcends industry type, scale and corporate group or business boundaries. In this model, all terms concerning the business transactions by referencing an elementary set of concepts derived from basic definitions in accounting and economics based on REA ontology (Geerts & McCarthy, 2002). It also clarifies that in any business transaction process there appear to be at least five phases (i.e., planning, identification, negotiation, actualization and post-actualization). If a business transaction is recognized by the traditional means of an actualization phase, the potential value of information acquired from such an actualization phase is fairly limited. For example, it is impossible to obtain useful information (e.g., the content, frequency, and type of the transaction failures after negotiating details or the customer touch-points that positively evaluates a company's after-sales service) to make decisions about sale and supporting strategy.

Business events which proceed the business transactions phases are the workflow tasks that is initiated by a business partner to accomplish an explicitly shared business goal and terminated upon recognition of one of the agreed conclusions by all the involved business partners. BTSM relates the business events with one or more primitives of the business transaction (e.g., economic resources, economic events, economic agents, commitments and claims), and business events in BTSM proceed dynamic representation through its five phases by changing the states of business transaction primitives.

2-2 Evaluation of previous researches on building BTSM

Horiuchi & McCarthy (2011) focused only on so-called “happy path” cases, where no exceptions or errors occur in the order or conditions under which business events were executed. Previous studies have not demonstrated a unified policy for recognizing business events, which occur in each of a series of phases, up until a transaction reaches the recognition of one of the agreed conclusions by all the involved business partners (Horiuchi & Shimizu, 2016; Horiuchi & Shimizu, 2020).

Business events themselves are difficult to recognize because there are many ways to handle a series of workflow tasks required, between business partners, to

accomplish an explicitly shared business goal. In response to this limitation, LAP allows the essentials of business transactions to be identified from a “semantic” perspective, in terms of what people can perform through communication, regardless of the context of specific business. Therefore, the recognition of transaction process in LAP and DEMO (Dietz, 2003) based on the LAP can be applied, in order to obtain a unified policy on the recognition of business events.

3. Recognition of Transaction processes in DEMO

3.1 Characteristics of transaction processes recognition in DEMO

DEMO is highly regarded, in both practice and research, as a design methodology for information systems, using LAP as a theoretical foundation (Weigand, 2005; Goldkuhl, 2017). This study summarizes the characteristics with recognition of transaction process in DEMO, based on Dietz (2003), in the following three points.

First, DEMO considers an organization to be an agent that performs “coordination acts” and “production acts.” In DEMO, transactions are not recognized through production facts, which are changes in the physical world, because LAP emphasizes the perspective of language that urges actions towards others to encourage consensus (through the creation of circumstances). Instead, coordination acts, which recognize transactions from the level of the commitment relationships that create action and fact, are positioned as the fundamental actions of organizations.

Second, there is a certain structural pattern in the relationship between a coordination and a production act. In this transaction pattern, a participant is either an “initiator” or an “executor.” This transaction process consists of three phases: the “proposition phase,” the “execution phase,” and the “result phase.” During the “proposition phase” and “result phase,” coordination acts and facts are created and executed. During the “proposition phase,” the “executor” does not always “promise” to fulfil the “request” of the “initiator.” Similarly, during the “result phase,” the results “state” by the “executor” are not always meant to be the “accept” by the “initiator.” Therefore, during the “proposition phase” and “result phase,” the recognition of transaction process is performed on the “success layer” (if an agreement is reached), “discussion layer (whether a request/state by initiator is promised/accepted by executor or not)” and the “failure layer” (if an agreement is not reached).

Third, DEMO can relate multiple business transactions with each other, and it call them as business processes. For example, in a business process that consists of sales and payment transactions, the sales transaction becomes the root structure, and the payment transaction is related with the sales transaction.

3.2 Business event recognition using DEMO, and two-tiered event recognition

As mentioned, DEMO treats coordination acts as an organization’s fundamental action. These coordination acts are recognized through the intention of communication between the business partners required to perform actions, regardless of the context of specific business; that is, these coordination acts are recognized through the eight essentials of business transactions (Dietz, 2003). These eight essentials are “request,”

“promise,” “decline,” “quit,” “state,” “reject,” “stop,” and “accept.” These essentials of business transactions can be perceived as fundamental business events, up until a transaction reaches the recognition of one of the agreed conclusions by all the involved business partners, regardless of contexts of the specific business. However, recognizing these business events is not enough to recognize a series of business events, required in real-world contexts. In order to overcome this, in addition to the recognition of business events as essentials, “two-tiered recognition of events” (Horiuchi, 2020) is presented as a means of recognizing a series of required business events, under specific contexts.

3.3 Limitations with the recognition of transaction processes in DEMO

DEMO can adequately model transaction processes, formed from a series of phases that begin when a buyer makes a purchase “request.” However, DEMO does not adequately recognize the transaction processes formed from a series of phases that begin with a seller’s “offer”; a common scenario for online sales (e.g., Amazon suggests products, based on past purchases and a user's browsing history logs). This is due to the commitment relationship between the two entities, because, in the latter transaction process, the business partner requesting the transaction (e.g., seller A) and the business partner executing the transaction (e.g., seller A) are the same agent, and the two entities in the commitment relationship that is the focus of DEMO, cannot be identified. It also cannot adequately model a series of processes formed from multiple related transaction processes, including mutual offers between buyers and sellers, related to conditions for negotiating details, such as price and delivery date (e.g., Alibaba). This is because a transaction (e.g., counter offer), initiated from a failed transaction, is not recognized as a series of transaction processes (e.g., failed transaction and a new transaction including the counter offer). Therefore, DEMO is typically provides limited coverage of the full scope of composite transaction processes that are interrelated with each other.

4. An Extended DEMO

4-1. Transaction processes beginning with a seller’s offer

Until now, the transaction patterns in DEMO has simply support transaction processes formed from a series of phases, beginning with a “request” from the buyer (“Demand Scenario” on the left of Fig. 1). Therefore, in addition to transactions beginning with a buyer’s “request,” the model must be extended to model transaction processes, consisting of a series of phases that begin with a seller’s “offer” (“Supply Scenario” on the right of Fig. 1). The extended model must be able to adequately model the coordination acts as commitment relationships between two parties (“initiator” and “executor”) that are the focus of DEMO. Therefore, the “initiator” (the agent that begins the transaction in the “proposition phase”) becomes the “initiator” that launches the coordination act during the “execution phase” and “result phase,” as well as the “acceptor” (the agent that accepts the transaction).

Fig. 1 shows an extended DEMO model that allows the transaction agent roles to be interchanged during the “proposition phase” and the “result phase.” This extended model adequately models both transaction processes (i.e., the purchase request and the

Fig. 1. An extended DEMO for Demand and Supply Scenario(Horiuchi, 2020)

sales offer). The right of Fig. 1 shows the extended model for transaction processes, formed from a series of phases beginning with a seller's "offer." The seller is the "initiator" that makes an "offer" in the "proposition phase," and continues to act as the "initiator" in the "execution phase" and the "result phase," by executing and "state" of an "offer" to be "accepted" by the buyer, as the "acceptor." Therefore, this model can represent the commitment relationship between two parties (the "initiator" and the "acceptor").

The extended model for transaction processes, formed from a series of phases beginning with a buyer's "request" to purchase, is shown on the left of Fig. 1. The buyer is the "initiator" in the "proposition phase," and is expressed as the "acceptor" that accepts the seller's "state" of execution for production, in the "execution phase" and the "result phase." Therefore, this model can properly represent the commitment relationship between two parties.

4-2. Transaction processes with mutual offers between sellers and buyers

A series of processes formed from multiple related transaction processes, including mutual offers between buyers and sellers, related to detailed negotiation terms, details, such as price and delivery date, can be recognized by an extended DEMO in Fig. 1 (beginning with a buyer's "request" or a seller's "offer") as a single linked process, and not as independent processes.

Fig. 1 illustrates the transaction process, whereby a buyer's "request" is rejected by the seller, who then makes a "counter offer." In the "proposition phase," shown on the left of Fig. 1, the "initiator" (buyer) makes a "promise" (1), the "acceptor" (seller) does "decline" (2-). The buyer then does "quit" (3), thereby terminating the transaction process. However, at this point, the two transactions (beginning with a buyer's "request" to seller (left of Fig. 1) and the seller's "offer" to buyer (right of Fig. 1) can be treated as a single, linked and related transaction process, allowing them to be recognized as a series of two transaction processes, including mutual offers. The same explanation applies to a series of two transaction processes, whereby the seller's "offer" is rejected by the buyer, and the buyer then makes a purchase "request."

4-3. A CPN model for the extended DEMO

Fig. 2 shows an example of the extended version of DEMO in Fig. 1, built as a CPN model (Van Der Aalst & Stahl, 2011). Due to space limitations, only an overview of this model is provided. In this CPN model, the "proposition phase" and "execution phase" are represented as a CPN model that has not changed from the model in Fig. 1. Contrastingly, in the "result phase," the two transactions whereby the seller sends products (e.g., delivery transaction) and the buyer pays cash (e.g. payment transaction) are separately represented in Fig 2, since these transactions in reality case do not always occur at the same time. Therefore, the extended CPN model separately represents the two transactions during the "result phase" in each Demand (left side of Fig. 2) and Supply Scenario (right side of Fig. 2) whereby the delivery and payment transactions are separately represented in each scenario. The representative transaction processes for this extended CPN are as follows.

Fig. 2. A CPN model of the Extended DEMO

First, a transaction process is selected and executed, from either a buyer's "request" to purchase, or a seller's "offer."

Second, in the "proposition phase," mutually offered transaction processes are continually executed, until the buyer and the seller are satisfied. For the success layer, the seller makes a "promise" in response to the buyer's "request" to make a purchase, or the buyer "accepts" the seller's "offer."

Third, in the "result phase," via the "execution phase," one of two transaction (delivery and payment) processes is selected in either Demand or Supply Scenario. Once that process completes, the remaining transaction process is selected and executed in the Scenario.

Note that the flow of activity in the discussion and failure layers, and the details of the CPN model, are omitted due to space considerations.

5. Discussion

5-1. Evaluation of "counter offers," from the Language/Action Perspective

Explanations for why DEMO does not (or cannot) model multiple related transaction processes, including mutual offers between buyers and sellers, are not always convincing. DEMO can represent multiple transactions as related transactions (e.g., purchase transactions and cash payment transactions). Therefore, it appears capable of adequately modelling a series of transaction processes, including mutual offers. However, in DEMO, it is not anticipated a transaction (e.g., buyer's request) denied in the failure layer via the discussion layer in the proposition phase serves as a trigger for next transaction (e.g., seller's offer). As shown by Weigand & De Moor (2003), "A successful request creates an obligations, and although the physical world has not changed yet, the social world has." (p.350). Therefore, unsuccessful requests that do not promise, do not create obligations. In other words, in DEMO, although transactions are identified in transaction processes that consist of a series of layers (e.g., success, discussion, failure), the transaction that does not carry obligation cannot be related with a new next transaction at the commitment level.

Nakayama (2002) emphasizes the limitations of the LAP as the theoretical foundation of DEMO. Specifically, Nakayama (2002) uses Geis (1995), to argue, "Austin and Searle's Language/Action Perspective is limited to analysing the written word, and has difficulty handling multiple utterance actions and other composite phenomena, as components forming part of a concerted action executed, while mutually confirming intentions during requests or group work, accomplished through a series of utterances" (pp.65–66). This argument does not directly explain why a series of processes, formed from multiple related transaction processes, including mutual offers between buyers and sellers, cannot be represented in DEMO. However, it may serve as a compelling explanation to surmise the exclusion of the mutual offer transaction process.

5-2. The need to expand the scope of transaction process recognition

Unlike the ISO/IEC15944-4(2007) transaction processes, DEMO can only explain the scope of transaction process recognition as two phases (i.e., the negotiation

and actualization phase can be recognized as a commitment relationship between two parties) in the ISO. In comparison to the ISO which can acquired data through these five phases by relating its data with historical transaction logs (e.g., advertising, offers, negotiations, usage and evaluation), the potential value of information acquired through such two phases in DEMO is fairly limited. Murthy & Geerts (2017) argue that relating the data acquired through these five phases with Big Data (e.g., website logs, social media, location/presence sensor logs, communication repositories, and intranet/extranet logs) can increase its potential for use as information. For example, in the “planning phase,” the relation can make a wide range of services possible, such as providing coupon information, based on customer location information (e.g., Bic Camera); in the “negotiation phase,” offering flexible guest room pricing, based on external data, such as nearby event information, and the reservation status at competing facilities (e.g., APA Hotels & Resorts); and in the “implementation phase,” tracking pizza deliveries on a map, based on sensor information (e.g., Domino's Pizza).

Although the evaluation contents depend on the perceived purpose of DEMO, DEMO is not enough to increase its potential as information and qualitatively improve management activities and decisions related to transactions, in the limited scope of recognition with the phases of transaction process. In other words, if the purpose is to raise an organization's self-regulation function to a higher level, DEMO cannot sufficiently recognize transactions. To resolve this issue with DEMO, the scope of recognition of a series of phases must be expanded beyond the negotiation and actualization phases and the potential for use as information must be increased by associating and identifying the transactions based on the five phases. However, these details fall outside of the scope of this study and this issue is recommended for future research focus.

6. Conclusion

Previous BTSMs have not demonstrated a unified policy for recognizing business events, which occur in each of a series of phases, up until a transaction reaches the recognition of one of the agreed conclusions by all the involved business partners. This issue can be overcome, based on the perception of transaction processes in DEMO. DEMO is based on LAP, and recognizes the essentials of business transactions from a “semantic” perspective, in terms of what people can achieve through communication, regardless of the contexts of specific business. However, traditionally, DEMO has been unable to model transaction processes consisting of a series of phases that begin with a sales offer, because a commitment relationship between two parties cannot be adequately represented. Furthermore, new transactions formed from failed transactions, are not identified as a series of transaction processes. Therefore, the full scope of multiple related transaction processes, including mutual offers between sellers and buyers, cannot be adequately modelled.

This study considers the existence of limitations from the Language/Action Perspective (Nakayama, 2002), as well as proposes an extended DEMO model (Fig. 2) that uses CPN to overcome these limitations. Additionally, this study argues the

importance of expanding the scope of recognition for transaction processes, in order to improve organizations' self-regulation functions.

Further research is required to achieve this on an operational level that can be applied (e.g., in a blockchain or other distributed ledger environment) to build a BTSM for use as a new type of transaction processing system, capable of supporting two functions required for an organization to perform the self-regulation and self-organization functions.

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