Modeling a Retailer B2B Integration Portal as Choreography Intermediary with BPMN 2.0 Choreography Diagrams

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Summary—In the retail industry, vendor integration in the supply chain is strategic to gain competitive market advantage. Supply chain integration has technological, organizational, planning, operational, and processes management aspects, and requires the integration of collaboration and cooperation processes of retailers and vendors to reduce the effects of information distortion in the logistics chain (bullwhip effect). B2B Integration Portals are key collaborative tools for information exchange and business processes, especially for logistics, business and financial processes. We propose to model B2B Portals as intermediaries among choreography model parties, which are finally implemented using ESB-type applications. The approach is illustrated by analyzing a Chilean retail vendor integrated logistics, which is modeled using choreography and conversation models and the new BPMN 2.0 choreography diagrams. An empirical validation approach is also suggested and ongoing in real projects.

Keywords: Business Process Model and Notation (BPMN 2.0); Business to Business (B2B); Supply Chain Management (SCM), ESB (Enterprise Service Bus), Processes Choreography.

I. INTRODUCTION

Currently, there is a strong momentum in the retail industry for vendor’s integration, based on the need of collaboration of these agents in the Supply Chain. Multinational players consider this integration experience as a strategic issue that requires higher levels of efficiency and standardization for vendor’s integration, when searching collaborative businesses. One of the main tools that act as driver for integration is the Vendor’s Portal; these are technical-functional tools for retailers that allow to develop B2B (Business-to-Business)[12] relationships with their vendors. B2B includes software, hardware, and business processes solutions, which enable vendor integration according to retailers’ needs and requirements. Integration, collaboration, and cooperation between retailers and vendors are the main business challenge in Supply Chain, through initiatives and projects that aim to reduce the effects of information distortion in the supply chain (bullwhip effect) [11].

This article approaches and analyzes the usability of the new diagramming technique for B2B models, in this study case, for the logistics integration of vendors, based on the new type of choreography diagram of the BPMN standard 2.0[9]. Essentially, it will present a study case of this Vendor's Integration Model (B2B type) utilization, based on orchestration, and choreography of integration processes between vendors and retailers. This study case will be the implementation of the logistics integration process of purchasing and receiving between vendors and retail customers (inbound logistics).

The article is structured as follows: Section II presents the Problem Definition, focused on the integration between Vendors and retailers; Section III summarizes the State of the Art; Section IV analyses the experience and presents a Solution Proposal; Section V describes a proposed empirical Validation; finally, Section VI summarizes and concludes.

II. PROBLEM DEFINITION

The problem of business processes integration among retailers and vendors is a long-standing issue in business management; these are coming down to the level of use of Information and Communication Technologies (ICT’s), which will enable in the short to medium term the long-awaited integration, primarily through process models, concepts that rely on the ESB and B2B type portals.

The specific problem addressed in this article is not having a suitable technique for modeling choreography logic B2B processes, since BPMN collaboration diagrams focus only on the messaging exchange and does not include the logic that may exist between retailers and vendors that aims to lessen the effects of the distortion of information in the logistics chain (bullwhip effect).
III. STATE OF THE ART

Supply Chain Management [13] is increasingly playing a leading role in business profitability, and has become a driver in optimization and productivity. The B2B concept has reached, according to industry, a turning point for the insight into the retail business, mainly driven by the introduction of multinational operators like Walmart who is providing a strong impetus to collaborative relationships with vendors. Lee [10] studied the use of the Internet to improve collaboration in the Supply Chain, and showed that it is a gradual and phased process to achieve higher levels of integration.

The implementation of BPMN 2.0 can be performed on Enterprise Architectures with SOA approach, by displaying Web Services, as stated by Herry [6]; here he gives an example of Web Services in an ESB-type structure. Another important tool for the implementation of business processes is the Reference Model for the Supply Chain or Logistics, there is the SCOR (Supply Chain Operations Reference) reference model, used as a basis of macro processes for developing processes surveys in the Supply Chain.

Furthermore, this model allows [7] managing ICT's in the Supply Chain, besides proposing a framework to identify and manage KPI's (Key Performance Indicators) of the Supply Chain and thus, being able to make them available in a Balanced Scorecard scheme.

The BPM and BPMN concepts are increasingly gaining importance in the industry of Information Technology, and are becoming enablers of changes in the processes management. There are concepts, methodologies, and tools supporting the implementation of BPM, such as BPM Governance, SOA, EA (Enterprise Architecture), Maturity Models for BPM, BPE (Business Process Execution), etc; see [8] for details. All of these concepts are closely interrelated and can supply additional knowledge necessary to implement BPMN, specifically the new BPMN 2.0 notation.

A study carried by Cortes-Cornax [3] showed that BPMN 2.0 features apply largely to support processes choreography diagrams; also, comparative studies of BPMN 2.0 notation, and BPEL 2.0 made by Lenhard [4] demonstrate that BPMN 2.0 notation, is a robust notation for choreographies diagramming. In summary, the management approach based on processes (BPM), proposed methodologies, tools available, current notation (BPMN 2.0), are in an early stage of incorporation and adoption by business. In this sense, a methodological contribution is also expected for the development of integration projects in the logistics area and in the Supply Chain, in the near future. The choreography model is useful as a preliminary specification for the implementation of the vendors and retailers integration process through the ESB's available, integration tools and processes choreography, and web services in complex systems and environments.

For this project we considered the possibility of using the new types of choreography diagrams for modeling, offered by BPMN 2.0, which reduce the description of processes logic, focusing on the exchange of information among participants [2].

Generally, choreography and conversation models are most useful to manage and coordinate exchange of information protocols, such as B2B portals of vendors and retailers integration. These diagrams allow to take up the current trend, to extend integration of processes outward for B2B and B2C (vendors, customers, retailers, banks, regulators, etc.); here, choreography and/or conversation diagrams, are an ideal approach to agree protocols for exchanging information, which later will be transformed into services.

Collaboration between vendors and retailers in B2B environments can be modeled using processes choreography models, in this case, logistics, commercial and financial integration processes. Different languages can be used to complete these modeling, as shown so far, and these languages are basically, BPMN 2.0 and BPEL, as stated by Kopp [5]. Lenhard's publication [4] shows another language evaluation for diagramming orchestration processes with processes choreography in B2B integration environments, this time the BPMN 2.0 and BPEL 2.0 notations. The result shows that both languages do provide support for a proper process orchestration diagramming, but is BPMN 2.0 who provides greater functionality for choreographies in B2B environments. In a similar work of Cortes-Cornax [3], it is demonstrated again with an evaluation of BPMN 2.0 functionalities that it applies excellently to support process choreography diagrams.

IV. ANALYSIS AND SOLUTION PROPOSAL

The analysis seeks to prove the quality in the usability of the new choreography models diagramming technique. The study case will allow analyzing and developing a proposal of a choreography model for the integration of vendors in a B2B environment. This choreography model is based on the incorporation of retail vendors in the logistics processes of customers, through a collaborative and cooperative processes modeling in a Vendor's Portal (B2B), and in the incorporation of other Information and Communications Technologies, as example, the use of RF
(radiofrequency) in warehouses, GPS in trucks, RFID in logistics operations, etc. However, consideration of these complementary technologies is beyond this work. A concrete solution to the integration problem will be presented with a study case of logistics process integration of purchasing, reception in warehouse, and vendors payment, using BPMN 2.0 notation, which will allow showing the integration model and processes choreography between vendors and customers.

The B2B integration model proposed considers four incremental levels of integration between vendors and retailers:

- The first level corresponds to the Exchange of relevant Information between stakeholders.
- The second level refers to the Integration of that relevant Information.
- The third level represents the Integration and Business Processes Management.
- The last level applies for the Development of New Business Models in the Supply Chain.

Furthermore, the Model is based on three main pillars for its development:

- The first pillar is related to a robust Methodological Support for addressing the ICT’s adoption projects or process improvements.
- The second pillar is based on a Business Collaborative Approach between the actors of the Supply Chain.
- The third pillar is based on the proper management and implantation of ICT.

The model, in the levels of information management, is based on the Processes Management under the BPM approach, which allows a systematic approach to identify, raise, document, design, implement, measure and control both, manual and automated processes [1]. The models used for integration process modeling of vendors and retailers will be the Conversation Model and Choreography Model. Diagrams for conversational models represent the most compact BPMN form for modeling the exchange of information among independent participants in BPMN[2]. These diagrams are not a new type of diagram in BPMN, but they represent a closed collaborative model, except that the Conversation Diagram allows indicating cardinalities in the relationship between pools.

![Figure N°1: Vendor’s Logistics Integration Model](image)

Figure 2 shows the result modeled with the new BPMN 2.0 choreography diagram for the Purchasing and Receiving process of a Retailer and a Vendor, using Portal B2B as a tool of integration and choreography. This web portal allows synchronization of processes in a collaborative environment and promotes choreography of the various processes, such as:

- Generation and Publication of Purchase Orders, by the retailer (upload)
- Retrieve (download) and process Purchase Orders, by the Vendor
- Appointment's scheduling of goods delivery, by the Vendor (Appointments)
- Generation and Publication of the Packing List (ASN), by the Vendor
- Delivery of Vendor’s physical goods and reception and redelivery process, by the retailer
- Payment Process to the Vendor, by the retailer
Generally, one of the great advantages of these types of choreography diagrams is that interaction among participants can be represented in a much compact way; however, they have a disadvantage when showing or displaying the internal logic, especially the logic that is not participating in the collaborative process.

Another useful diagram for the integration process modeling between Vendors and Retailers is the Conversation Diagram, which is within the modeling resources offered by BPMN 2.0.

Figure 3 shows the Conversation diagram between Vendor and Retailer, for the Purchasing and Receiving Integration process, using a B2B portal as a means of communication. This diagram is very explanatory and shows the different flows of information with which the three major entities or agents interact in the integration process: Vendors, Retailers, and B2B Portal.

Figure 3 shows that it is possible to specify the information systems that represent the key computer support for integration: WMS Systems (Warehouse Management System), which manage the reception and delivery operations of Distribution Centers and on the other hand are the ERP (Enterprise Resource Planning), representing the backoffice support of business and financial-accounting processes. We should not forget that B2B Portal is also a software application that runs on the internet platform, which should be integrated with the Vendor's Computer Systems.

Figure N°3: Conversation Model in BPMN2.0. Vendor-Retailer integration process, using B2B web portal

Regarding the BPMS implementation or implementation layer, there are additional tools that enable the services orchestration between the different actors to foster collaboration; one of these tools is the ESB (Enterprise Service Bus). An Enterprise Service Bus (ESB) is a combination of software architecture that provides essential services for complex architectures through a message system (the bus) based on rules and regulations that respond to events. Developers often implement the ESB using middleware type technologies.

An ESB provides an abstraction layer built on an implementation of a message system, an ESB does not implement alone a Services Oriented Architecture (SOA), but provides the features by which it can be implemented. An ESB should be based on standards and provide flexibility, covering different means of transport, able to implement both, traditional SOA patterns as business architecture, and an enriched SOA 2.0.

Figure N°4: Role of services orchestration and ESB applications integration
Figure 4 shows functionalities of the transactional and services concept offered by ESB; these message services allow the coordination of business processes involved and define the orchestration role of these services by the ESB.

V. ONGOING VALIDATION

The proposed modeling technique for integrating logic B2B choreography models are in ongoing validation in real projects in a major retailer of the Chilean market. We are in the process of formally validating the proposal with two process modeling projects between retailers and vendors.

We expect improvements in the process of specification, coordination, development, testing, and implementation of Portal B2B. Some of these improvements, attributed to the use of the proposed model and BPMN 2.0 notation are:

- Improvements in the survey, statement and documentation of business process integration.
- We expect a significant reduction in the times of process design compared with integration projects without the support of this technique.
- The model allows the alignment of survey and redesign of logistics processes involved, using reference models (SCOR: Supply Chain Operations Reference).
- Furthermore, the choreography modeling technique allows aligning Information Technologies with necessary implementation processes and methodologies, obtaining a more collaborative vision of vendor's integration.

VI. CONCLUSIONS

This project has represented an effort to investigate the state of the art in ICT of the logistics sector and in the supply chain, in order to suggest improvements to the area through the proposed integration models, methodologies based on the new BPMN 2.0 compact choreography modeling technique. The proposed model for vendors and retailers integration in the logistics environment, shows the different practices of both actors, displaying also the principal ICT's currently used in the industry; it also proposes an incremental model of integration, which is based on the integration of information and in business processes management.

The integration model proposed allows to conclude that Chilean companies, mainly the retailer-vendor relationship (especially in logistics), are in a phase of growth, mutual understanding and especially trust generation. The above is based on the current way of exchanging information, from file-sharing to the use of B2B portals, but only from a perspective of exchanging information, even without further focusing on efforts for the integration and management of logistics processes of purchasing, receiving, meeting agenda (appointments) and payments.

Regarding the exercise of modeling the logistics integration process between retailers and vendors, using BPMN 2.0 choreographies notation, it can be concluded that it allowed modeling the business logic in all of its expression, displaying the functionality, collaboration between actors, processes choreography and enabling to visualize the collaborative relationship of retailers and vendors business processes.

An additional benefit of the model is presented in the quality of the information managed in the chain, since it reduces the Bullwhip Effect problem and information distortion in the Supply Chain.

Finally, an empirical validation approach is under way by the authors in real projects.

REFERENCES


