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Supply Web: Concept and Technology*

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Abstract

The concepts of supply chain, supply network and extended collaboration between partners are constantly pushing the limits of what should be considered when dealing with supply chain management. Managers that were dealing only with adjacent partners, started to consider multi-level supply chains, then extended to more complex supply networks, and are now beginning to consider networks that are interacting with other networks. In this article we introduce the concept of Supply Web as a network of interrelated supply networks, involving multiple organizations with collaborative or competitive supply relationships. In order to take into consideration the complexity involved with this concept and to enable managers and analysts to exploit it, we present Supply Web Technologies. We focus on their conceptualization, on highlighting their usefulness in supporting managers involved in supply webs, and on depicting how they can be instrumental in enabling and enhancing collaboration between networked organizations.

Keywords

Supply Chains, Supply Networks, Supply Web, Mapper, Playback, Real-Time Monitoring, Business Intelligence

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1. Introduction

It has been almost 20 years since concepts such as Supply Chain Management (SCM), collaboration and information sharing among all the partners of a supply chain gained a large acceptance among researchers and practitioners [1]. It is well known that the structure, the behavior and the performance of supply chains are influenced by many factors due to the complex relations that actors maintain with multiple partners. Yet most SCM research considering soft behavioral and performance aspects focuses on dyadic relationships and most research not restricted to such simple dyadic relationships issues tend to be hard and structural [2]. Similarly, Supply Chain Business Intelligence (SCBI) tools generally focus on internal operations and bilateral relations between two partners without considering the entire and complex environment [3]. Overall, collaborative relationships within supply chains have been mostly limited to adjacent partners, with most collaborations occurring between a manufacturer and its direct suppliers [4].

Nowadays, leading organizations are extending horizontally and vertically, building complex relations with various partners in order to control more and more their supply context. Dell Inc. considers its entire supply chain as an organization and tries to control production, distribution and retailing by selling directly to final customers [5]. Retailers, such as Metro and Wal-Mart, have many stores and many distribution centers all over the world, and pilot complex supply relationships with numbers of suppliers, subcontractors and logistic providers [6]. Some manufacturers, such as Procter & Gamble, besides owning many distribution centers, operate multiple plants located in different countries and concurrently produce unrelated product categories such as electronics and beauty care [7]. Thus, an organization can own multiple sites that maintain complex relations between each other. Internally, such an organization operates a complex supply network with complex inter-organization informational and physical flows. The organization as a whole, as well as each of its sites, must also cultivate relationships with external partners that are also complex organizations, each with its own supply network. The result is a meshing of multiple networks, constituting a network of networks, with complex sets of relations and flows of goods, resources, information and money. We call such a network of supply networks a Supply Web.

The inter-organizational flows within a Supply Web result in huge quantities of heterogeneous yet related supply data. Each organization in the Supply Web has its own Information System (IS) and its own standards for collecting, managing and storing data. Sometimes, even inside the same organization, the standards and ISs can be different from one subdivision to another [8]. Thus, when members of a Supply Web contemplate collaboration that involves sharing supply related data, they currently face huge difficulties due to the huge non-homogenized and complex databases involved. Some data is confidential, not to be shared. Other data can be openly shared with partners. Yet large chunks may not be relevant to the collaborative intentions. Anyone interested in extracting information or knowledge currently struggles to manipulate, use, analyse

or exploit these databases due to the lack of tools that correlate the data together and ease its manipulation [9].

The motivation for the research presented in this paper is about finding answers to the following questions in a Supply Web context. How can we help managers make decisions, regardless of their level of interest and responsibility, either strategic, tactic or operational? How can we make it easy for them to visualize, to understand and to be aware of what happened or is happening in their supply chain/network/web? How can we provide them with a more global view of their environment and the dynamics that have an influence on their supply chain/network/web? Can we provide Business Intelligence (BI) tools that maximize and activate a real collaboration between actual or potential partners in a Supply Web? In other words, how can we help supply chain managers visualize, assess, mine and monitor their supply chain/network/web, and increase the inter-organizational collaborative capabilities and performance?

This paper has two purposes. The first is to introduce the concept of supply web, to position it clearly relative to the concepts of supply chains and supply network, and to highlight their tight interlaced relationships. The second is to introduce a conceptual framework for supply web technologies enabling managers and analysts to exploit the Supply Web concept for improving operations, decisions toward better overall performance.

The remainder of the paper is structured as follows. In section two, we formally introduce the concept of Supply Web (SW) and discuss its managerial implications. In the third section, we introduce a conceptual framework for Supply Web technologies enabling managers and analysts to assess, mine, visualize and monitor a Supply Web and its components. In section four, we present, justify and position three technological tools conceptualized and prototyped in our laboratories: Supply Web Mapper, Supply Web Playback and Supply Web Monitor. The final conclusive section summarizes our research work and findings, and proposes future research avenues.

2. Introducing the Concept of Supply Web

In this section, we gradually expose the concepts of supply chain, supply network and then supply web. Then we address the managerial implications of the Supply Web concept.

2.1. Linear Supply Chain

A supply chain was originally viewed as having a linear unidirectional structure with downstream flows, its set of nodes being focused on a single organization [10]. Figure 1 illustrates such a supply chain, focused on a manufacturer. It depicts on the left side the manufacturer as being fed by its supplier who is fed by its own supplier, and on the right side the manufacturer feeding its client who feeds its own client who serves final customers.

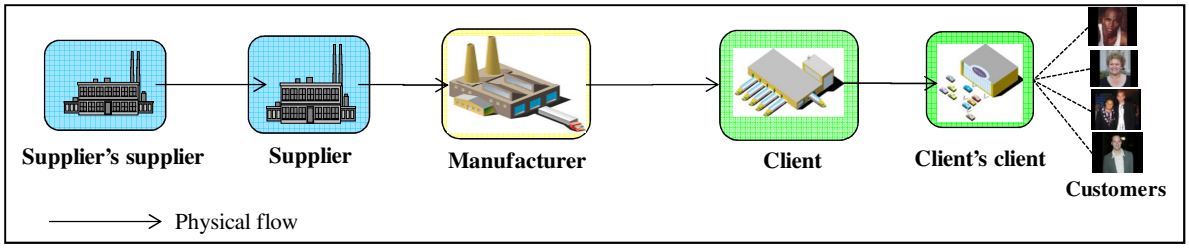

Figure 1: Linear Supply Chain

The introduction of the supply chain concept, and its associated supply chain management concepts, affected business operations and extended the notion of inter-organizational collaboration to an unprecedented level. It urged companies to look beyond their inner operations and the relations with their upstream and downstream partners. It emphasized the importance of information exchange through the entire supply chain, broadening, therefore, the vision of business actors.

Yet the linear supply chain schematization clearly overlooks the complexity of the supply operations since it does not explicitly show other non-linear relationships that actors can have and that can deeply affect their behavior as strategic partners and consequently the performance of the supply chain. Therefore, the linear supply chain representation was gradually extended to look more like a network than a chain and to consider upstream relationships [2] [11] [12] [13] [14].

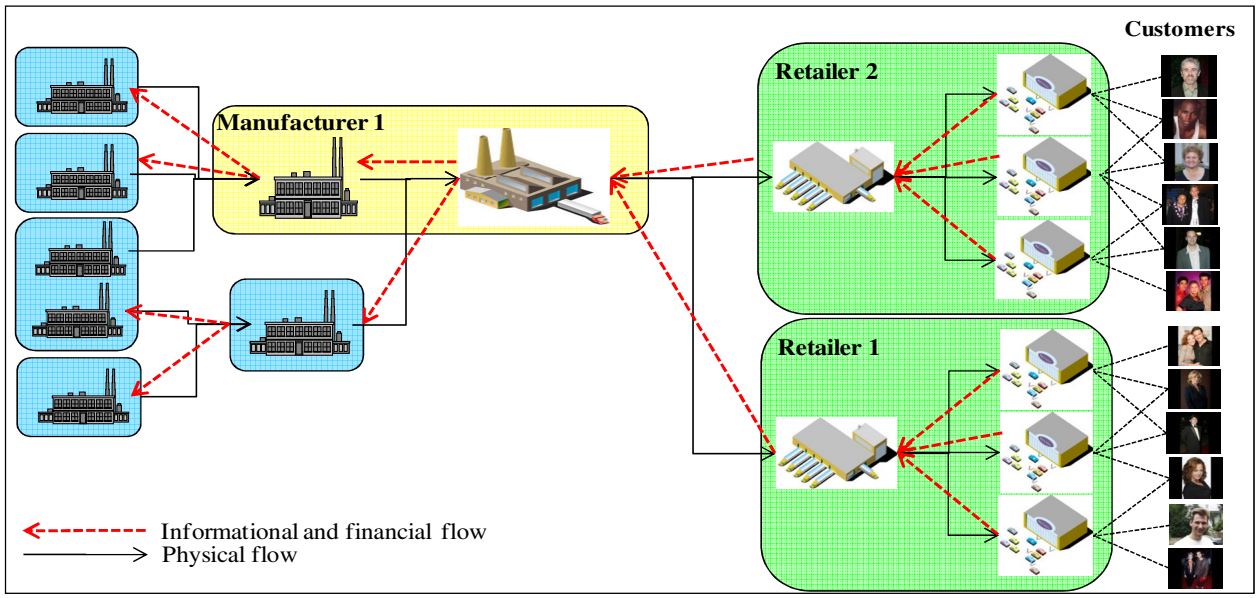

Figure 2 : Product Family Supply Chain

Figure 2 provides such an extended supply chain representation. It depicts a manufacturer's supply chain for a family of products. Examination of the schema makes it obvious that this is not a chain as common known. It does not have a linear structure, but rather a tree structure with

downstream material flows and upstream informational and financial flows. This presentation is useful, from the Manufacturer 1's point of view, since it gives a complete image of the players, operations and relationships involved in supplying the product family. It shows a higher level of organizational complexity than was provided with the classical linear representation illustrated in Figure 1. However, even though this more evolved representation is still commonly referred as being a supply chain, it has become a supply network, as described below.

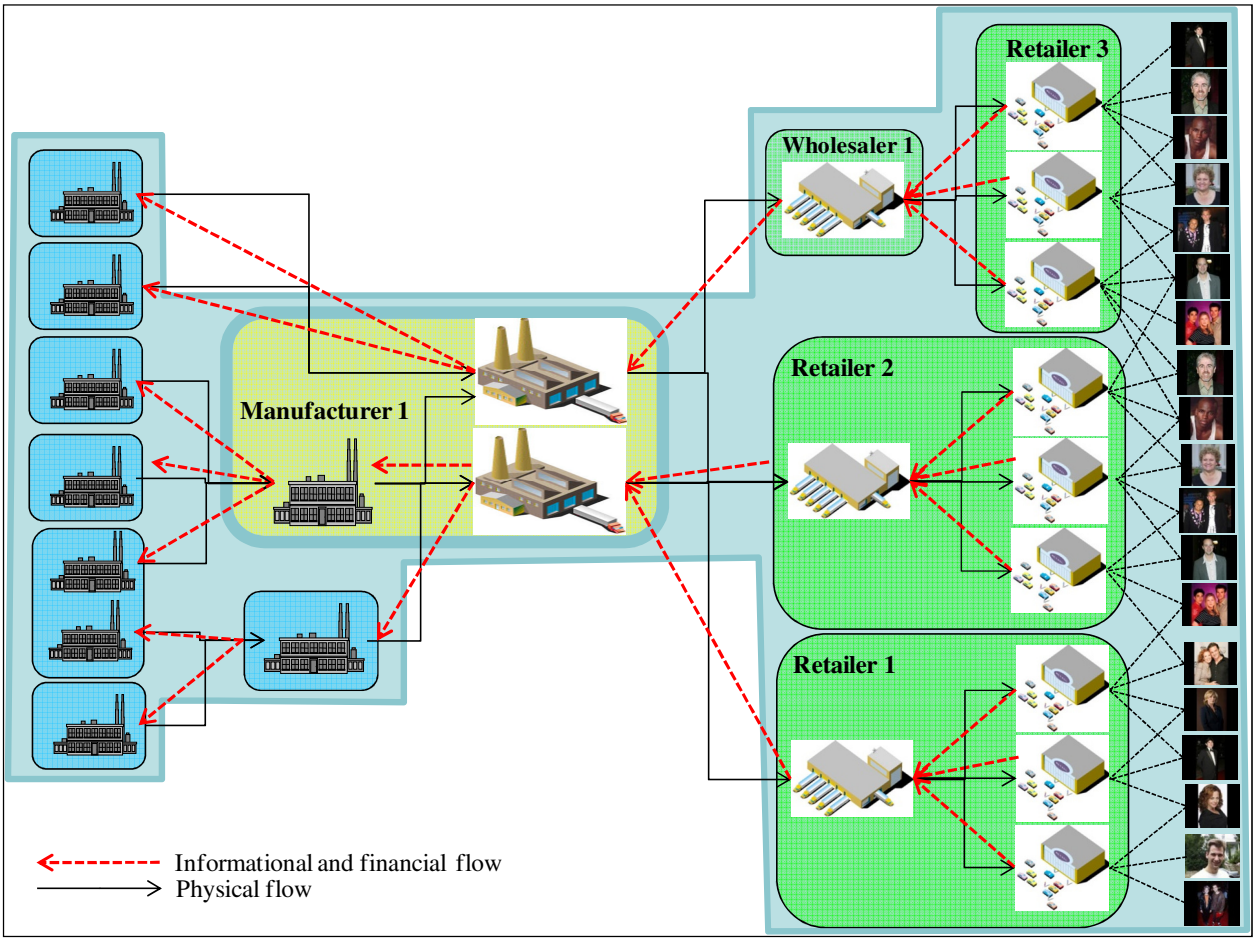

Figure 3 : The Supply Network of a Manufacturer

2.2. Supply Network

Defining the supply chain in association with a part of the operations, such as a product family or a specific site, has the advantage of decreasing the complexity. Nevertheless, when dealing with the behavioral aspects of supply chain management, day-to-day operations, relationships and interactions, the consideration of all the interactions engaging all the elements of the selected supply context is necessary [2] [14] [15]. For example, managers responsible for a product family can rarely work in isolation from other product families, because there are often serious

issues and potentialities associated with transportation mode sharing, storage site sharing, and manpower sharing, and so on.

The notion of supply network has emerged to explain the effects occurring between overlapping supply chains and to introduce softer and behavioral aspects related to the study of supply performances [2] [14]. Supply networks can be said to "*consist of interconnected entities whose primary purpose is the procurement, use and transformation of resources to provide packages of goods and services. Supply networks therefore essentially consist of a set of interconnected supply chains, encompassing both upstream and downstream relationships*." [9]. They generally exist as components of wider inter-organization value creation networks [9], for example including innovation partners as well marketing partners.

Figure 3 presents, as an example, the entire supply network of Manufacturer 1. Internally, it shows that Manufacturer 1 has two product assembly plants and one module assembly plant feeding them. Upstream it depicts an external module assembler feeding the product plants, and six parts suppliers. The upper two are feeding the upper product plant. The next two are feeding the internal module plant. The next and second lowest parts supplier has two plants from which it feeds both the internal and external module plants. The lowest plant feeds solely the external module plant. Downstream, Figure 3 shows that the upper product plant feeds the distribution center of a wholesaler that services the three stores of retailer 3. The lower product plant focuses on supplying both retailers 1 and 2. It feeds the unique distribution center of each retailer. The first retailer's distribution center services three stores, as does the second retailer's distribution center. In summary, the supply network shows all sites and flows involving the manufacturer's products and services.

Based on the key actors of Figure 3, several other supply networks could have been drawn. Each of these would have focused on a key actor or set of actors. For example, we could have drawn the supply network of the wholesaler or the supply network of retailer 3. In this network, manufacturer 1 would have been one of the many suppliers that the wholesaler deals with. Similarly, retailer 3 would have one of the clients of the wholesaler, indeed the only one to whom it sells the products of manufacturer 1.

2.3. Supply Web

In the case of Figure 3, mapping the entire supply network of manufacturer 1 provides it with a view of its impact on the upstream and downstream actors, and vice-versa on the impact of these actors on the manufacturer. Yet, this view is incomplete; offering a partial understanding of the relative impact. This incompleteness stems from the fact that the supply network of each of the actors involves other players not related directly to the business with manufacturer 1, yet having an impact on the actors and indirectly on manufacturer 1. For example, if a parts supplier is also supplying another competing manufacturer and is constantly having to decide to whom among both manufacturers it shall devote its productive capacity, then the supply network depicted in Figure 3 is insufficient to understand its overall supply stakes and risks. It is only by working

with the union of both supply networks that one can uncover this complex relationship and manage its impact.

Generically, an actor may lose competitiveness and put itself at risk by ignoring the indirect impacts of partners of its partners. It is important for an actor to recognize that he is evolving in a supply network that influences and is influenced by other supply networks. This space of interaction or of influence, between supply networks can be seen as a larger supply network of networks called a Supply Web (SW) [10].

We can define a Supply Web as a network of interrelated supply networks, each embedding interlaced supply chains, involving multiple organizations with collaborative or competitive supply relationships.

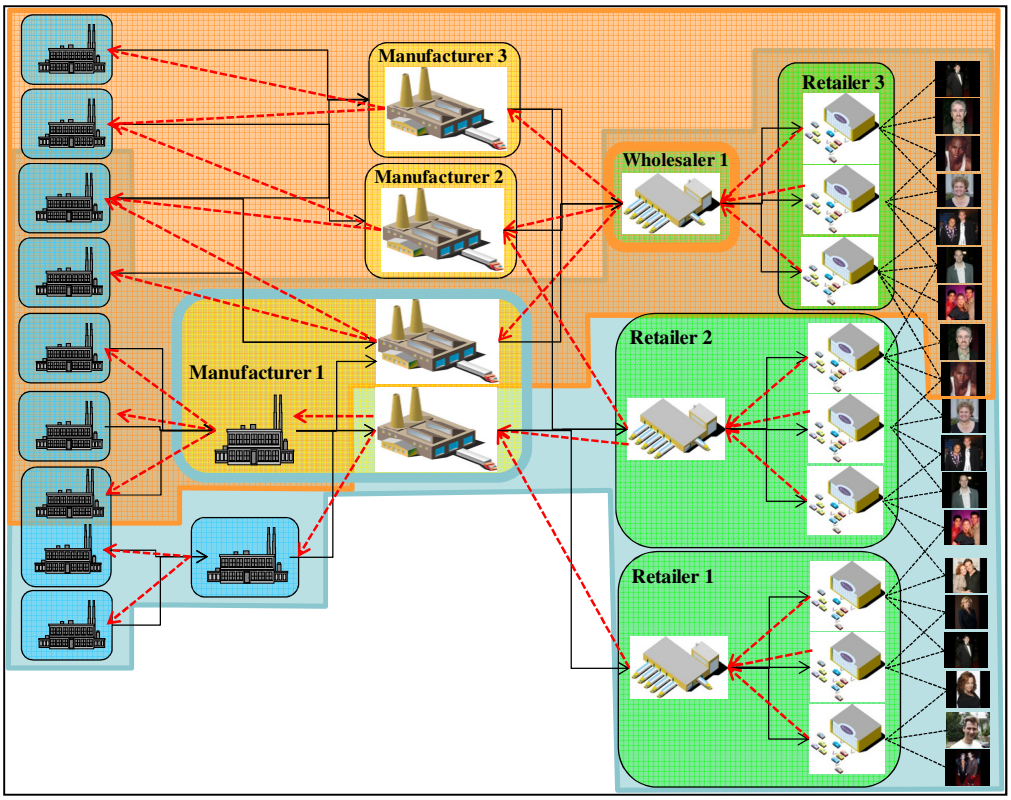

Figure 4: View of the Supply Web Depicting the Union of the Supply Networks of Manufacturer 1 and of the Wholesaler's business with Retailer 3

At the extreme, the Global Supply Web includes all suppliers in the world, with their relationships and flows. In practice, a Supply Web is generally scoped around the supply networks of a set of targeted key actors, for example those defining an industry. Supply Webs generally include a large number of actors and complex sets of flows and relationships among them. Their representation in totality thus looks like an indescribable and undecipherable spaghetti. It is therefore critical to examine it through selected views depicting targeted subsets of the Supply Webs. Such views may be drawn only with the mutual consent of the key actors.

For example, Figure 4 presents a Supply Web view depicting the union of the supply network of manufacturer 1 and of the supplier network of the wholesaler's business with retailer 3. It shows the zones of overlapping between the two networks, as well as the zones of non-overlapping. It reveals that manufacturer 1 is one of the three manufacturers that the wholesaler deals with in supplying retailer 3. Regardless of whether the three manufacturers are competitors, the wholesaler looks at its entire supply network as one system, where the three manufacturers share the same final customers, its resources and Retailer 3's resources. Therefore, it may be helpful for each of the manufacturers to understand the impact of other manufacturers on the wholesaler's and Retailer 3's supply and inventory decisions. Moreover, any bilateral collaboration between the wholesaler and one of the manufacturers will reach its greatest efficiency only when both partners fully understand the impact of indirect players on their collaboration. As a further example of Supply Web view, Figure 5 adds to the previous view of Figure 4 the supply network of retailer 1. It particularly reveals the three suppliers of retailer 1 share the same external module plant, which may be a source of synergy and/or a capacity bottleneck leading to supply-side competition between the three manufacturers.

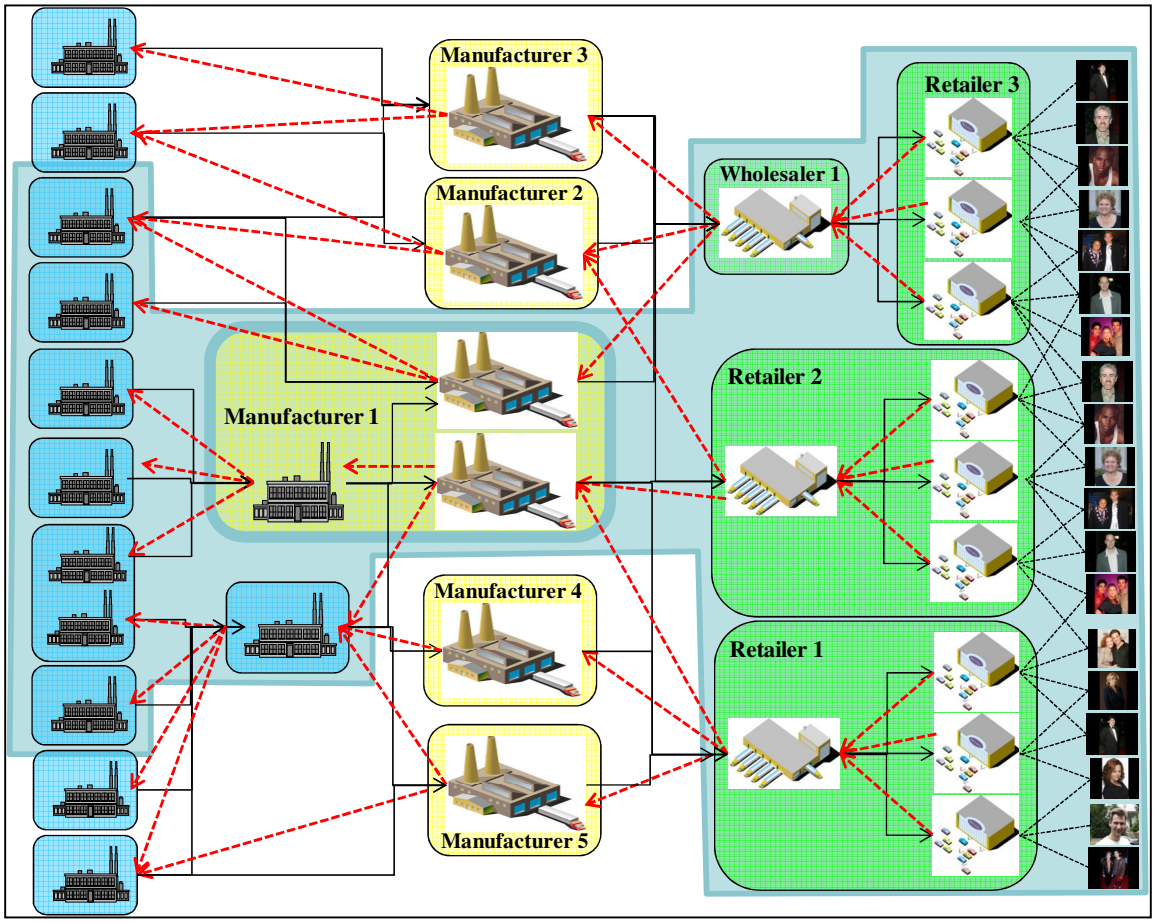

Figure 5: View Adding the Supply Network of Retailer 1 to the Supply Web View of Figure 4

2.4. Implications of Considering the Supply Web

The SW concept includes the concept of supply network which includes the concept of supply chain. It certainly broadens the field of view of researchers and practitioners and increases the level of complexity they are dealing with. However, it considers elements that were overlooked despite their major impact on supply networks and supply chains. Dealing with the complexity of a supply web does not necessarily imply a complication of supply chain management. On the contrary, it provides the opportunity to understand the real influence of the supply web environment on supply operations and decisions. Considering the SW environment does not mean that managers will be suddenly managing supply chains that are unrelated to their networks or that their tasks will be more complicated. It means that, if they judge it necessary, they can explore information about elements of the supply web that indirectly affect their decisions and operations. Managers should be able to zoom in to focus on a specific issue, or to zoom out to look at the issue in its real and global context. In the SW concept, the focus is not anymore only on the supply elements, such as nodes and links, but also on the direct and indirect impacts of the behaviour and the interactions between these elements in a larger environment, as well as on the dynamic aspect of the supply context. Considering fine granulated details and relating elements and in their context to each other, acquires a significant importance in supply web modeling. Thus, the modeling approach to be maintained is the soft systemic approach.

In order to provide this capability to focus on a specific portion of the supply context and offer the ability to get a more global view of the supply web without losing the links between the two levels of detail, two elements should be respected. First, build a large and dynamic view of the SW containing as many supply web elements as possible, making explicit their behaviour and their relationships. Second, use SW tools that allow delimiting the desired piece of this global context and linking it with its context through multi-dimensional relationships. The first element can be achieved through the construction of a cross-organization database that stores the SW elements, their relationships and behaviours. The second element can be achieved by using SW business tools that exploit the SW database and provide users with the ability to delimit supply contexts without detaching them from the global environment. The cross-organization database and the SW tools are the major components of what we call *Supply Web Technologies*.

3. Supply Web Technology Conceptualization

As shown in Figure 6, an organization can be represented as three interacting systems: Decision System, Information System and Operating System [18]. A SW solution is part of the organization's IS and is composed of a gateway, a SW DataBase (SWDB) and SW tools. The gateway is the SW data door, to and from the rest of the SW solution. It ensures that the received SW data from the organization and from other actors meets the SWDB requirements and it sends the organization's SW data to the other actors' SW solutions. The SWDB combines, in a standardized format, the received SW data. The SW tools are business intelligence tools that

connect to the SWDB and provide a higher level of decision support serving different management purposes.

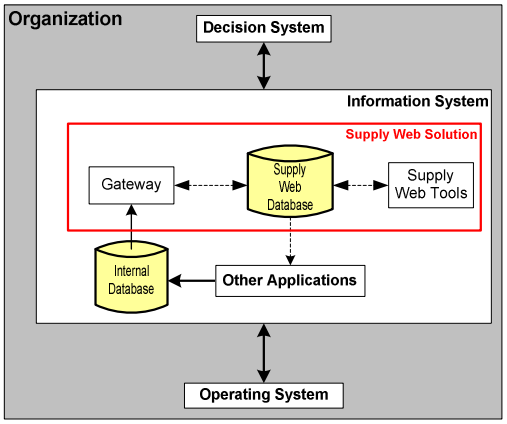

Figure 6 : An SW Solution in an Organization

The SW Solution can be considered as an applicative layer that uses the output of other applications of the IS, such as SCM and B2B solutions, used by different actors of the SW. Its objective is not to replace these existing solutions but rather to provide a higher level of cross-organizational visualisation, analysis and decision support.

SW Technologies consist of distributed SW solutions implemented by members of a SW and interconnected through an exchange of SW data. They are multi-organizational business intelligence technologies intended to provide internal and cross-organizational SW decision support. Figure 7 illustrates an example of SW Technology implementation in a part of a supply web containing three multi-sited actors, one manufacturer and two retailers. Each pair of members of the SW exchanges the SW data agreed upon bilaterally to ensure a maximum security and data confidentiality.

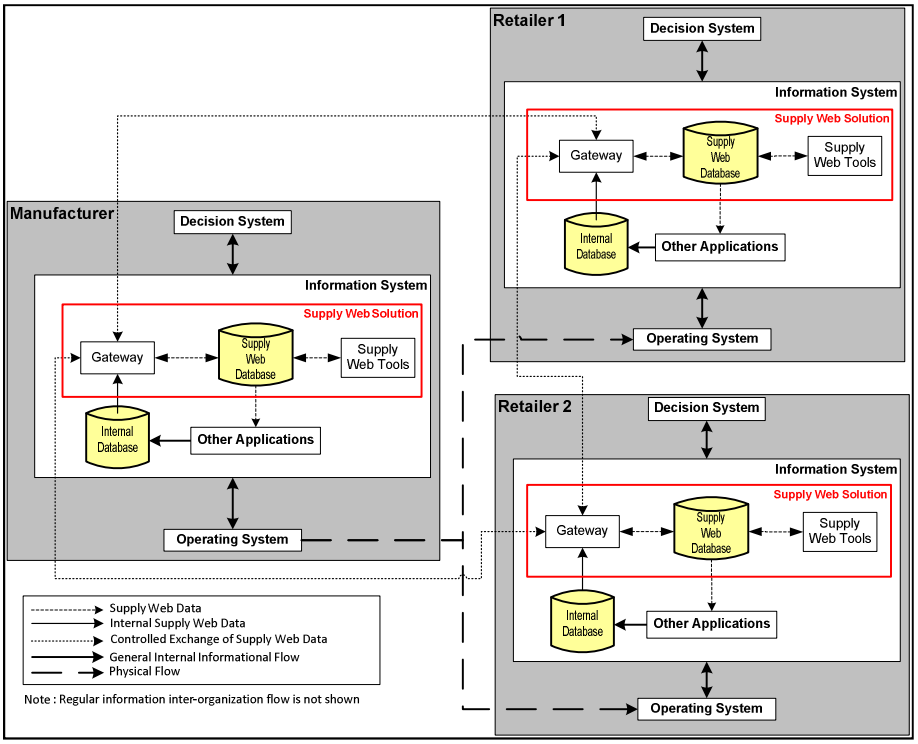

Figure 7: Supply Web Technology Implementation and Structure

The SW technology conceptualization should focus on three aspects linked to the parts of the SW solution. First, the conceptualization of standards and techniques for SW data exchange between SW actors through the gateway; second, the conceptualization of SWDB focusing on structure optimization and inter-organization SW element unification; and third, the conceptualization of SW business intelligence tools. The following subsections present these components.

3.1. Supply Web Data Exchange and Standardization: the Gateway

In order to exploit a SW solution, a member should own and manage a SWDB containing its own SW data extracted from its internal database, and as much SW data as possible from other actors, obtained through collaboration agreements. In the SW technologies, data exchange and standardization is ensured and controlled by gateways which link the SW solutions of the different actors and manage the SW data input and output. As depicted in Figure 7, the gateway has four main functions:

- Receive internal data, standardize it and store it in the right tables of the SWDB;
- Receive external data from external actors, standardize it if needed, and store it in the right tables of the SWDB;
- Request external SW data from other actors;
- Send already standardized internal SW data to external members.

In the SW context, the flow of information should be both downstream and upstream. Both clients and suppliers need to obtain a global view of what is affecting their operations. This bidirectional data exchange through bilateral agreements facilitates collaboration and increases confidence between partners. The more bilateral agreements a member signs, the more complete its SW data becomes. The SW can be seen as a map of which each member owns a piece corresponding to its supply network data. A member should get copies of as many pieces as possible from other members in order to get the most complete map.

Generally, supply web data includes two kinds of data: SW configuration data and SW event data. SW configuration data is generally static or slowly evolving that allows constructing the SW. It is exchanged once and updated partially when changes occur. SW events are rapid changing data reflecting the dynamics of the SW. A SW event is always associated to a time, a place, the actor who triggered it and other event specific data. Examples of events include a sale, an order, a shipment, an order handling, and an inventory update.

3.2. Supply Web Database Conceptualization

The SWDB is a database that each actor maintains besides its regular database(s). It contains two kinds of standardized supply web data, as depicted in FFigure 7:

1. **Internal SW data:** all SW data maintained in the regular database systems of the organization is transmitted frequently to the SWDB. It is, by default, data that the organization owns and does not need to receive from external sources. This data is of three kinds: data about the upstream flow from direct suppliers, data about the downstream flow with direct clients, and data about the flow between the organization sites. The internal SW data is the core of the SW data and is completed by the external SW data. Therefore, even if no external SW data is available, the SW solution can still work as a supply network solution.
2. **External supply web data:** comes from other members' SWDBs according to the established bilateral agreements between the organization and these members.

Since there is no guarantee that the data of different partners will have the same format and structure, an objective of SW technologies is to bring together this heterogeneous data in one global system based on standardization rules. In any supply context, the same supply elements are considered, such as organizations, sites or nodes, products, product families, product categories, shipments, orders and order lines. Moreover, any supply context can be illustrated through physical, informational and financial flows occurring between sites belonging to organizations.

Standard databases for any supply context illustration need to respect two conditions:

1. **Uniquely identify SW elements:** Each organization, each site, each product, etc., must have a unique identifier in the SW context. The SW technology should associate a global unique identifier to each supply element. Barcode product identification, for example, consists of a header, a manufacturer's identification number, the item identifier and a check digit [19]. As

concept of unique identification for their agent application, [20] propose an ID@URI format; where the URI is the Internet address of the server where the element is located and the ID part is a unique identity inside the server. SW technology can use similar concepts to identify an SW element.

2. **Conceive a generic and unified database structure that can express any supply context:** The basic structure of the SWDB should be the same regardless of the SW solution owner. It should allow the presentation of any supply context as a set of nodes belonging to organizations and exchanging physical, informational and financial flows.

Meeting these two conditions results in SWDBs where data from different SW members can be merged in the same structures and uniquely identified. Implications of this concept are important since each organization will only be required to standardize its data because any SW data exchange between members owning SW solutions will always involve standardized SW data.

3.3. Supply Web Tools

The SW tools are a set of business intelligence tools that provide a profound understanding and decision support for a selected SW context by exploiting the content of the SWDB to which they are connected. They come in multiple instances that are used for multiple purposes according to the user's interest. Supply Web Tools are used either internally by the users of an organization or in a context of joint collaboration projects between two or more members. In the former case, they are mapped to the organization's SWDB. In the latter case, they are connected to a common SWDB connected to the SWDBs of the concerned members.

3.3.1. User Focused Technologies

In terms of general conceptualization, SW tools should help users visualize, assess, mine and monitor any part of the SW for which the SW data is available. These tools should be user focused and provide efficient decision support and business intelligence. In general, these tools should focus on:

1. **Visual illustration:** presenting the information in conceptual figures, graphs and graphics rather than in tables, text or values. Use color, size and format coding when presenting the information to the user because in a context where the information is abundant, drawing attention is more important [21].
2. **Delimitation of the supply context:** a global view on the SW or a specific portion of the SW. A Supply Chain and a Supply Network are always linked to another word indicating a "focus" related to the analyst interest [9]. Generally, a supply chain or network is associated to a site, to an organization, to a product, to a product family, to a product category or to a combined focus. SWs are not an exception to this rule. As exposed in Figure 8, this notion of "focus" can be extended to a notion of multidimensional focus that will serve in constructing the supply context by intersecting four dimensions:
   - Organization dimension for selecting organization(s) or site(s);

- Product dimension for selecting product(s), product group(s), sub-category(ies), category(ies), etc.;
- Time dimension for selecting a time frame;
- Supply depth dimension for setting the desired visualization depth for upstream and downstream flows.

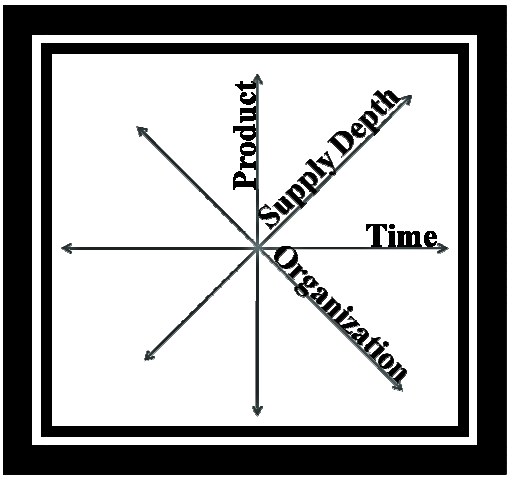

Figure 8 : Four Dimensions for Delimiting an SW Context

While it can be very useful to associate a supply chain, network or web to a focus in order to reduce complexity, it is crucial not to sacrifice considering the global SW context. The image of the SW surrounding an organization should be first constructed in the SWDB, then filters representing user's criteria should be applied to delimit the SW context.

3. **Multi-Focus oriented:** SW technologies should serve different purposes according to the user's orientation. It should provide vertical (strategic, tactic or operational) decision support [4]. It should support also horizontal decision support by providing information to users in different departments of the organization such as supply, marketing, finance, etc.
4. **Customized performance analysis:** Users should be able to customize the display of information by selecting KPIs and associating them to desired color, size and format.
5. **Cross-analysis:** the tools should provide easy and smooth investigation of the four dimensions allowing cross, horizontal, vertical and multi-organization analysis.

3.3.2. Enhancing Supply Web Collaboration

SW technologies introduced in this paper can bring inter-organization collaboration to an unprecedented level because it considers the real concerns of companies regarding data confidentiality. The key is that each actor can decide what to share with which member in the extended space of the SW. In addition, standardized cross-organization SWDBs and advanced SW tools facilitate cross-organization communication, analysis and knowledge transfer. Through information sharing, members can create groups overlapping each other where combined organizations can monitor larger parts of the SW affecting the performance of the collaboration, as illustrated in Figure 9. Knowledge transfer, strategic adjustments and indirect impacts

assessment can be acquired and transferred from one side to another without necessarily transferring confidential data.

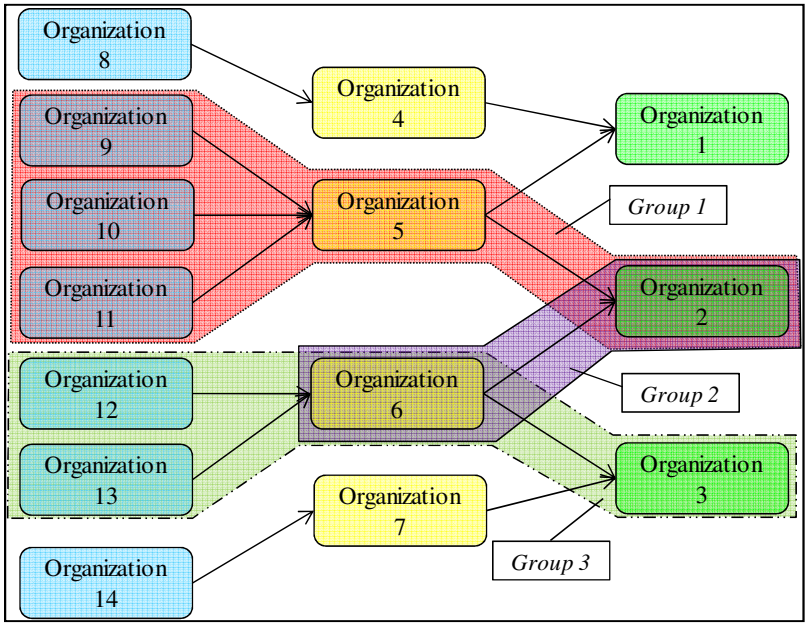

Figure 9: Information Sharing Groups inside a SW

The concept of collaboration can be extended not only to members of the same supply network, but also to those that affect or are affected indirectly by the supply networks. For example, if the products of Organizations 6 and 7, supplying Organization 3, are complementary, the two members can decide to share SW data in order to maximize their sales or, joined with Organization 3, create a strategic alliance to increase their global performance [16] [22].

4. Supply Web Tools

In this section, as architecturally depicted in Figure 10, three business intelligence applications are proposed as SW tools: the SW Mapper, which is a static supply mapping tool, the SW Playback which is a dynamic supply history reviving tool, and the SW Monitor which is a real time supply monitoring tool. While each of these tools is a standalone application intended to deal with certain aspects of the SW, they are complementary and can be used jointly to provide maximum benefit and full understanding of the SW.

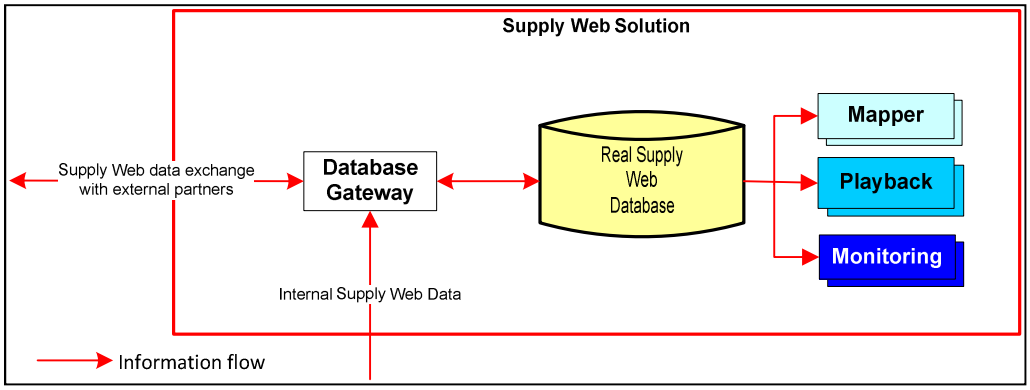

Figure 10 : The Supply Web Solution Structure

4.1. Supply Web Mapper

The SW Mapper is a business intelligence tool for statically visualizing, mining and assessing the SW or one of its embedded networks. It allows users to delimit a supply context efficiently and to explore it through a selected set of KPIs. Then, it allows the mining of the supply context by drilling down and up through multiple dimensions providing, thus, a multidimensional snapshot that can be explored from different points of view.

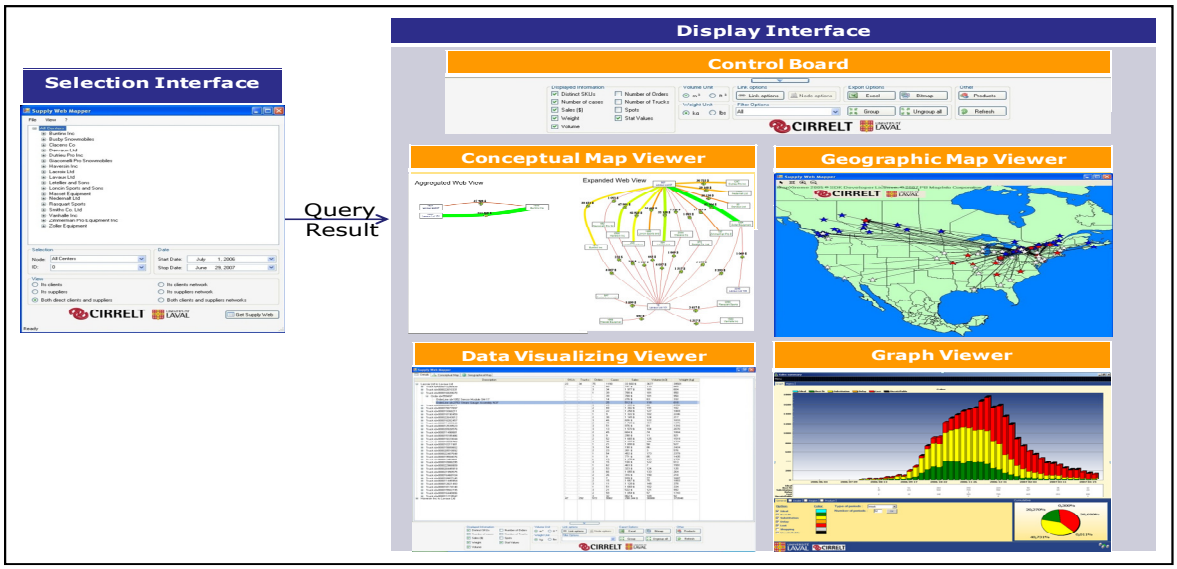

Figure 11 : SW Mapper Selection and Display Interfaces

Users interact with the SW Mapper through a selection interface and a display interface. The selection interface allows the user to set the boundaries of the supply context he is interested in. The display interface exhibits four interrelated viewers and a control board. The viewers correspond to a conceptual map viewer, a geographic map viewer, a graph viewer and a data visualizing viewer display [17].

4.2. Supply Web Playback

The SW Playback is a dynamic business intelligence tool that enables users to replay, explore and analyze the historic events and to travel easily forward and backward in the past of a SW context or one of its embedded networks. It reproduces the past of the selected supply context in a virtual world, at a controlled and accelerated pace, showing all the interactions and the dynamics between the supply elements. It helps to dynamically visualize, mine and assess the SW.

From a conceptual perspective, the SW playback consists of a synchronizer and three main interrelated components where changes in any one of the three affect the others. The miner allows the delimitation of the supply context and the exploration of the obtained result. The visualizer displays the supply web in an intuitive and customized way based on the user's specifications. The decision supporter monitors the supply events and draws the user's attention to important issues by generating appropriate messages and alerts, and by commanding smart displays on the visualizer. The synchronizer manages time evolution by controlling the SW playback access to the SWDB and by synchronizing the three components (Figure 12).

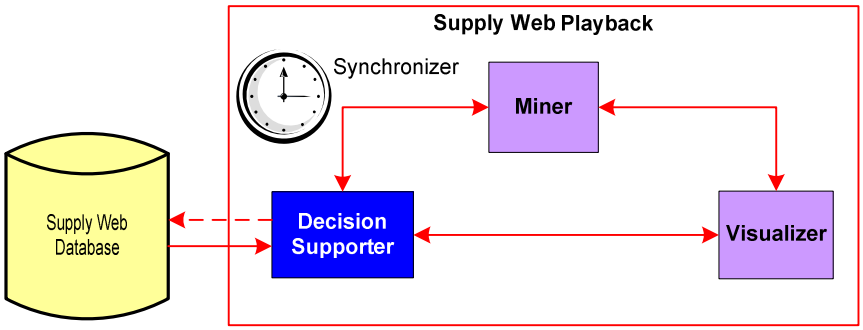

Figure 12 : SW Playback Conceptual Structure

As for the SW mapper, the playback is equipped with multiple screens, each focusing on different aspects of the SW. An example of the transport map viewer is shown in Figure 13.

4.3. Supply Web Monitor

The SW Monitor is a business intelligence tool providing real time visualization, mining and multi-criteria assessment of the supply chain. It tracks all the active SW events while it monitors the state of SW elements. Relationships between events and states are continuously re-evaluated in order to rapidly detect any potential rising issues and to direct the focus of users towards important and urgent matters through decision support and smart visualization. The user can explore the current state of the SW and its embedded networks according to the desired KPIs and dimensions. As for the SW Playback, the SW Monitoring is composed of a visualizer, a miner, a decision supporter and a synchronizer, as depicted in Figure 14.

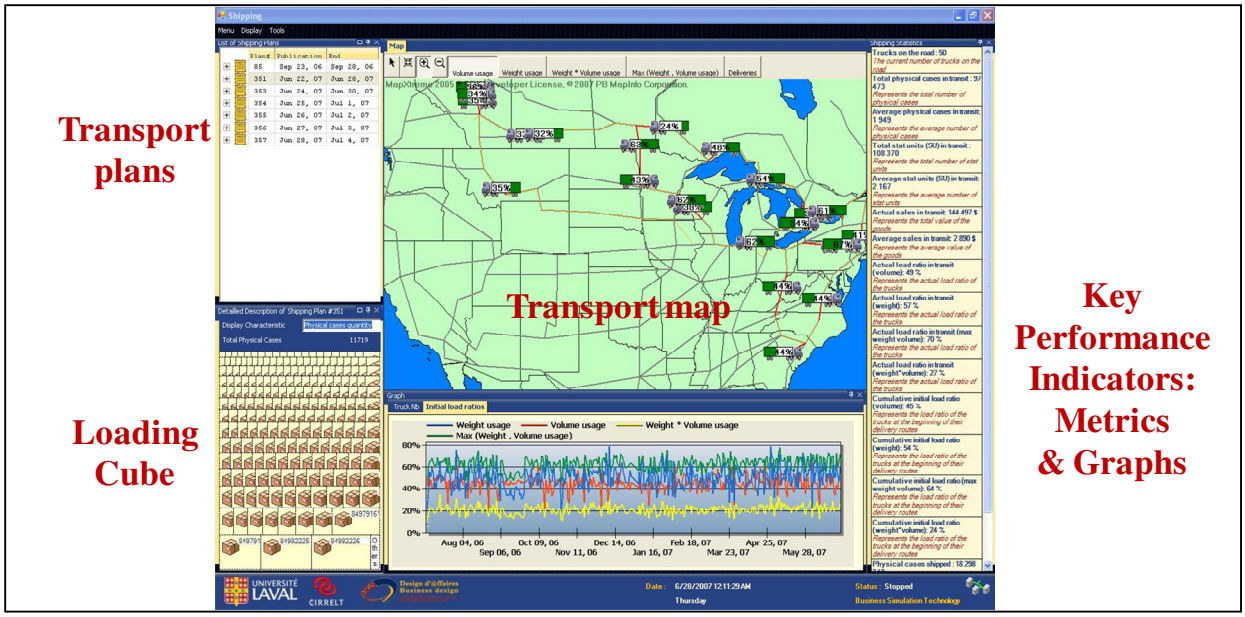

Figure 13: The SW Playback Transport Map Viewer

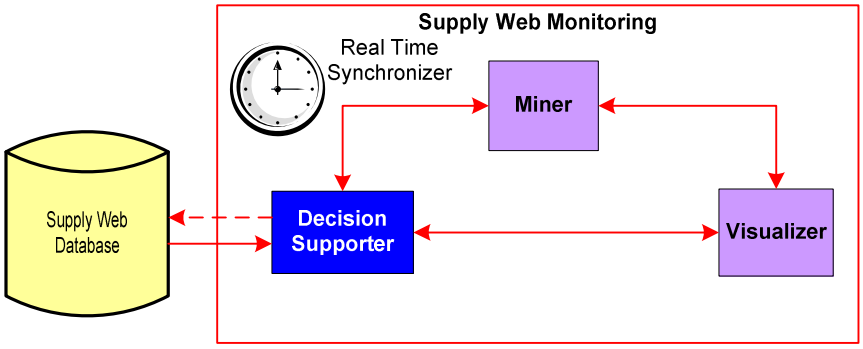

Figure 14: The SW Monitoring Conceptual Structure

The real time synchronizer monitors the database and ensures that all the components of the playback are synchronized internally and with the database. In terms of time frame, the SW monitor is more focused on the real time and short term past. Thus, it allows real time assessment of SW dynamics and evaluation of the impact of recent past decisions and events on SW behaviour and performance.

5. Conclusion

The evolution of the Supply Chain Management field reveals the relevance of the Supply Web concept. This concept considers complex physical, informational and financial inter-organisational flows between complex organisations embedding their own interlaced supply networks. Indeed, when trying to deal with daily supply chain management questions facing managers, the concepts of supply chain and supply network appear to be rapidly limited in

attempting to represent the complexity of physical, informational and financial flows, as well as the interactions between different actors of the supply context. Simple tasks such as visualizing their supply networks and following various KPIs can take months before being achieved without efficient SW technologies.

The introduction of Supply Web Technologies relies on the development of functionalities for managers and engineers to help their companies thrive in fast-paced, fast-evolving and wide-reaching Supply Webs. In this article, we set the basic elements for supply web technology conceptualization: (1) a supply web database system that standardizes and unifies the supply data of the supply web members, and (2) a set of business intelligence tools. Three tools are presented in this article. The Supply Web Mapper and Playback respectively help statically and dynamically visualise, mine and assess the supply web and its performance. The supply web monitor is a real time business intelligence tool. The research works presented in this paper focus on enabling better visualization of the dynamics involved in Supply Web, on providing user oriented supply web solutions and on activating real inter-organization collaboration.

Further research is needed to develop decision models to help specific users in managing a supply web. Besides, simulation conceptualization is required for creating a supply web simulator to complete the discussed set of tools and to provide supply web parameterization and what if analysis. Finally, more tests in different supply web contexts should be done in order to stabilize and validate the technology and to extend its application.

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