Industry-wide Inter-organizational Systems and Data Quality: Exploratory findings of the use of GS1 standards in the Dutch retail market

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Abstract

Standards in general promise more efficiency and effectiveness in doing (electronic) business. Lowering the costs of collaboration, achieving these gains depends of the development and adoption of the standard in its business environment.

Several studies report on research on electronic data interchange (EDI) and its added value to interorganisational collaboration. EDI messages have the purpose to enable organizations to exchange electronically supplier and purchase related content e.g. procurement orders. There is lack of research about product information sharing in business-to-business relationships.

A total of 22 cases (organizations) in the Dutch FMCG supply chain were conducted in order to get an industry wide overview on product information sharing. Our cases revealed that data quality is crucial for collaboration success, and that much is to be improved upon. Secondly, the creation of a feedback-loop mechanism is suggested.

Keywords

Supply Chain Information Systems; Standards; Supply Chain Management; Vertical Information Systems; GS1, Inter-organizational Systems
Introduction

The Dutch fast moving consumer goods (FMCG) supply chain IT architecture can be characterized as an industry wide information system with several proprietary solutions. The adoption and development of open-standards is still ongoing. A good example is the barcode, a widely accepted standard we utilize every day, intended to lower semantic barriers, especially in vertical chains. Vertical Information Systems (VIS) standards were developed to increase the connectivity between organizations to gain smoother process integration at the interorganisational level (Markus et al. 2006), (Dabhilkar 2013), as they lower the costs of collaboration (Markus et al (2006)). Hence, that achieving these gains depends of the development and adoption of the standard in its business environment (Steinfield et al. (2011)).

Although a large body of research concentrated on the value of electronic data interchange in buyer-seller relationships, however, as De Corbiere (De Corbière 2007) points out, there is relatively little research concentrating on product information sharing in business-to-business relationships. Product information can be defined as all information related to a specific product, such as its weight and sizes of the product as a customer unit, its outer case, and how it is stacked on a pallet. Besides these technical and logistical measures, marketing characteristics can be included as well.

Product information sharing within the Dutch FMCG sector generally either utilizes a direct point-to-point connection, or it makes (increasingly) use of a GS1 GDSN standard implementation. GS1 is a neutral, not-for-profit, international organization that develops and maintains standards for supply and demand chains across multiple sectors. Suppliers send their product information to the (centralized) GS1 data pool; retailers can retrieve product information from this data pool. Important advantage of the data pool is that retailers only have to create a single interface to retrieve product information from multiple products and suppliers stored in one up-to-date store instead of managing a collection of different formats and integrations, challenges related to versioning and semantic discussion due to different interpretations.

The (Dutch) FMCG market can be characterized as a heterogeneous and fragmented market with small as well as large retailers and suppliers. The product categories the standard covers range from fruit and vegetables to dry goods, what have their own specific characteristics.

This paper presents lessons learned from a series of exploratory case studies we performed within the Dutch FMCG market focused on product information sharing in the post-EDI era, using the GS1 GDSN data pool, and follows the recommendations given by (Chiasson and Davidson 2005). They state that increased attention to industry will extend and refine IS knowledge. Our research aims to contribute to the body of knowledge, to the adoption and use of industry standards, and more specifically the sharing of product information between manufacturers and retailers in the (Dutch) FMCG supply chain.
Research question and data collection

This research set off with the following research question: “What lessons are to be learned from the GS1 GDSN data pool implementations in the Dutch FMCG supply chains focused on product information sharing?”

A total of 22 cases (organizations) in the Dutch FMCG supply chain were conducted in order to get an industry wide overview on product information sharing, thus not solely concentrating on GS1 GDSN users. Each case was approached with semi-structured interviews, accumulating to a total of 33 interviewees that belong to a total of 22 different organizations. In larger organizations that have their own master-data department, we interviewed two people: one from the business-side and one from the master-data/IT department. All the interviews were audio recorded and later transcribed. Independent experts confirmed that the collection of cases provide a well representation of the Dutch FMCG market. Seven retail organizations where interviewed including two drugstores. The interviewed retail organizations together have more than 50% market share. 15 suppliers where interviewed divided in three different types of produced products, Figure 1 shows the total study population.
Dutch retail market & Inter-organizational Systems

Empirical evidence from the Dutch retail market

The Dutch FMCG supply chain is a diverse and fragmented market. Retailers offer a wide product range, ranging from fruit & vegetables, dairy foods, (dry) groceries, to drugstore products like toothpaste. These products are sourced from a diverse and heterogeneous group of suppliers, with large differences in organizational sizes and maturity/professionalism. There are multinationals that offer a series of worldwide brands vis-à-vis small suppliers offering one local product. Figure 2 gives an overview of the supply chain from manufacturer to retailer. It depicts the physical flow of goods from the manufacturer who ships an item, packed in a case, and stacked on a pallet via a distributor towards the retailer’s store. Beware that before a manufacturer can ship its products all corresponding product information should be in place and authorization has to be arranged for the retailer. This product information details information about the product, such as measures, stacking, use-by-date. The retailer can utilize this information to steer its internal processes, such as its shelf-stacking plans.

![Figure 2: Overview of the physical supply chain, shipping products.](image)

Inter-organizational IT architecture

The GS1 data pool offers a vehicle to enable this process, see the IT architecture depicted in Figure 2. This figure gives an overview how product information is shared in FMCG supply chains, by what applications. One can distill the importance of quality information seeing the widespread impact of product information in the supply chain.

Manufacturers publish data in the GS1 data pool, so that retailers can fetch the published data. The global registry, registers only a few items of one product e.g. the GTIN and the SSCC, see Figure 3. There are four options for manufacturers to publish data:

1) New retailer, new product
2) New retailer, existing product
3) Existing retailer, new product
4) Existing retailer, mutation of existing product

All these options have to be supported by the information flows and systems depicted in Figure 3.
Results

The first findings are diversity and heterogeneity of the FMCG supply chain. This was known on forehand, however this can be categorized in a few groups. Small organizations lack IT skills and knowledge about IT innovation. Furthermore, it became clear that filling the GS1 Data pool is no regular work for them as small organizations with few products use the data pool only once a year. This in contrast to large(r) organizations, that has specific IT personnel, which is on the other hand little aware of the product information sharing process in their own organizations. Likewise, the business lacks IT knowledge. We conclude that collaboration between colleagues is an important challenge, in particular for the reason that people within the same organization are not aware of each other’s goals and live their daily work life in silos, not aware of the impact of their decisions to others in the same organization or cross-domain.

Data quality

A series of important findings from the cases all relate to the quality of product information data shared between manufacturers and retailers. As retailers increasingly utilize the acquired product information as input to their own business processes, the quality of this data becomes rather important.

The current research defines data quality as the composition of several characteristics:

Completeness of the product information e.g. weight, sizes, shelf life, use by data, pallet stacking, tolerances, flexible packaging. GS1 introduced validation mechanism to identify whether mandatory fields indeed contain information.

Correctness is another aspect. Fields may be filled in, however that does not assure that the data is filled in correctly. GS1 uses a logical control mechanism e.g. given the size of the item, the number of item in case or pallet stacking can be calculated and controlled for.

Consistency of data remains an issue. In the past not all data was up-to-date in the GS1 data pool due to technical issues with the system, a challenge which is currently addressed by GS1 via new databases. Main sources for inconsistencies are however manufacturers that have updated information regarding products.
which is not published to the data pool and this never reaches the retailers. The interviews revealed several examples of exactly this. Retailers than get mutated products, but weren’t aware of any mutation – sometimes causing serious troubles.

**Interpretation** is a large challenge for product information in FMCG. Especially item level information of dry goods, goods that have very little boundaries/margin considering their width, height and depth. The (standardized) measurement rules are not always clear within the FMCG supply chain. In practice width, height and depth are confused with each other. As a result retailers use wrong information for their shelf-stacking plans.

**Relevance** of data fields. GS1 prescribes several mandatory fields, beware that several of these fields are only relevant for dry goods, and have zero-to-little relevance to fruit and vegetables. Take the example of the measures for a net of onions. The onions are stacked in open boxes and the measures on item level are not that important for the retail shelf-stacking plan. However the fields are mandatory and the GS1 Data pool automatically fires its quality control mechanism as described before. The agricultural companies are fed back all kinds of errors from the system, errors little relevant for their operations.

**Timeliness** of the data. Retailers articulate that they need all product information data 12 weeks beforehand, however not all product information will be available by then. In fact, it might happen that products do not even exist yet, for products still under development, which are sold already by the manufacturer. In the weeks before product launch development will finish and aspects such as the size/amount of the product and its packaging (e.g. a box or a plastic bag) will be set.

**Feedback loop**

We observed that both manufacturers and retailers articulate the need for the creation of feedback loops to improve data quality. However, currently the GS1 GDSN standard does not provide such a mechanism. Retailers are eager to set-up feedback mechanisms, because product information is an important and essential input to their own business processes. Feedback loops can improve data quality as retailers for example can reduce the amount of data quality checks. Furthermore, better data can help in reducing the number of disruptions in warehouses, and the error rate at tills.

**Conclusion**

There is a limited amount of literature on industry wide information systems (Chiasson and Davidson 2005), (De Corbière 2007), (Markus et al. 2006), (de Corbiere and Rowe 2013). Robey et al. (2008) explain that current the technologies of inter-organisational systems (IOS) nowadays largely differ from the first wave of “IOS research which focused on EDI implementations rather than more flexible technologies utilizing open standards”.

“What lessons are to be learned from the GS1 GDSN data pool implementations in the Dutch FMCG supply chains focused on product information sharing?”

The success of supply chain collaboration depends on several factors. The research presented here focused on the sharing of product information between partners in the supply chain. Our cases revealed not surprisingly that data quality is crucial for collaboration success, and that much is to be improved upon. The creation of a feedback-loop mechanism is suggested. Use of a standard alone is not enough. Success largely depends on the use of the standard, the heterogeneous environment, knowledge and skills of the people using the standard, and in especially the six data quality characteristics identified.

The cases illustrate the utmost importance of product information for retailers, as it is crucial input to drive their business processes supported by their IT systems.

A limitation from our research is that only the Dutch FMCG environment was researched, however also Multi-nationals were interviewed and their issues were discussed.
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