THE CONTRIBUTION OF ROSETTANET E-BUSINESS STANDARD

Mika Hannula
Dr.Tech.
Tampere University of Technology
mika.hannula@tut.fi

Tuomas Vasama
M.Sc. (Eng.)
tuomas.vasama@anilinker.com

Abstract

Efficient management of supply chain, its actors and operations, is one of the most critical success factors in today's competitive industrial environment. To mention some examples of possibly gained benefits; more efficient material flows and operations, better change management, smaller inventories, reduced error related costs, better quality of work and information may be achieved by successful supply chain management. However, companies are unwilling to use the growing number of different e-solutions requiring a variation of different e-business processes in their supply chains. Technology centered standards have proved to be inadequate and a need for standardized process activities has emerged. A clear need to develop globally uniform e-business processes has arisen.

The aim of this paper is to introduce the set of RosettaNet e-business standards (later referred as RosettaNet standards or simply RosettaNet). RosettaNet's background, organization, main driving forces, in addition to technical and process related issues will be discussed. The central theme of the paper is to consider RosettaNet standards' contribution by studying different tools it offers for managing e-business in supply chain environment. RosettaNet introduces a way of standardizing partner interface processes (PIPs), which formalize activities between trade partners. PIP based e-business standardization will be also discussed in this paper. Besides, possibly emerging problems in RosettaNet standards' implementation will be considered.

The key finding of the paper is that to accelerate global collaboration between supply-chain companies RosettaNet introduces Partner Interface Processes, PIPs. It extends e-business standardization from business messages to business processes. PIPs' introduction and their effect on supply chain collaboration are considered to be RosettaNet standards' main contribution. RosettaNet is also a highly influential player amongst other standards because of its powerful background organization. It has a strong influence on high-tech industry and as a reference on other industries. RosettaNet affects a growing number of companies around the world although parallel standards will most likely continue to exist. RosettaNet represents the next generation of e-business standards after EDI.

Keywords

RosettaNet, e-business standard, supply chain management

BACKGROUND INFLUENCES

E-business solutions aim to improve companies' business performance by using electronic information technologies and standards to connect suppliers and customers along supply chains (Balls et al. 2000, p. 14). The earliest electronic data interchange (EDI) developments originate from USA. The first applications were developed in 1960's by transportation industry (Clarke 2001). Nowadays EDI is one of basic tools for supply chain management in most industrial environments. After development of EDI new requirements to conducting e-business have emerged in organizations justifying the development of e-business standards like RosettaNet.

Development of company information systems

Companies aim to maximize the return on owners' investments by efficiently utilizing their resources. In order to improve companies' operational efficiency different computer applications have been developed to assist for example in data processing, design activities, and as machine members. Later these three separate application areas have been combined in computer integrated manufacturing (CIM) systems (Halevi 2001, p. 8). Material requirements planning (MRP and MRPII) systems were originally developed to perform manufacturing planning, scheduling, inventory control and purchasing functions by accountants to know better the value of inventories (Halevi 2001, p. 147). Besides different management information systems (MIS), product data management (PDM) and customer relationship management (CRM) systems have been designed.

The concept of enterprise resource planning (ERP) systems has been introduced to simplify the overall structure of company data systems. Integrated ERP systems are installed across entire enterprise to connect parts of enterprise through sharing of common data (Balls et al. 2000, p. 12). When data comes available in some part of an organization, it is immediately in use of other functions. ERP systems' aim is to unite separate corporate data systems under one system umbrella. Usually parts of an ERP application (accounting, finance, manufacturing, inventory management, etc.) use a common shared database and are designed to be real time. This makes the use of data resources more efficient offering at the same time different forecasting, analyzing and reporting tools to manage better the business (Halevi 2001, p. 147). Nowadays it seems that integration is a common trend in company data system development as well as in business process design.

Supply Chain Management (SCM)

Supply chains consist of companies lined up along value chains. The different actors in a chain are for example original equipment manufacturers (OEM), material and component suppliers, subcontractors, distributors, resellers and different service providers. Their common goal is to reduce economical and operational risks by reducing inventories, better utilizing plant production capacity and efficiently controlling flows of material and information (Halevi 2001, p. 271). The success of company operations depends on right resource

investments, procurement of right qualities and quantities of materials and services, at the right price, at the right time and in co-operation and synchronization with suppliers.

Internationalization causes rapid changes in industry. Thereby outsourcing has become a strategic business decision to move internal work to external suppliers to increase flexibility (Hall and Braithwaite 2001, p. 82). This means concentrating on core businesses and outsourcing non-centre activities. Companies complement their competencies by forming trading networks, which are also called virtual enterprises. This concept can be defined as an enterprise which consists of co-operating companies physically located on different parts of the world and which work together to meet some common goals (Halevi 2001, p. 229). Global supply chain co-operation requires efficient data access, manipulation, distribution, management, handling and storing. The role of company computer systems and their integration has become essential. Supply chain synchronization completes the integration process that the ERP system development has started (Halevi 2001, p. 148).

Electronic Data Interchange (EDI) standards

The potential for cost reduction in paper documentation handling created the basis for international standardization in trade data interchange. Electronic data interchange (EDI) means direct transfer of structured business data between computers by electronic means (Unece 2002). The first step in EDI standardization was taken in 1968, when United States Transportation Data Coordinating Committee (TDCC) was established to co-ordinate the development of EDI in transportation industry (Clarke 2001). Later American National Standards Institute (ANSI) developed X.12 standard to replace and improve standards developed by TDCC. The British Simplification of Trade Procedures Board developed and published its own General-purpose Trade Data Interchange (GTDI) standards in 1981 (Unece 2002). From the basis of different standards United Nations developed an international set of standards called Electronic Data Interchange for Administration, Commerce and Transport (UN/EDIFACT) first introduced 1986 (Unece 2002).

In UN/EDIFACT standards the basis for trade data interchange is the United Nations Trade Data Elements Directory (UNTDED) in which data elements are uniquely named, tagged and defined. UNTDED specifies also expressions and syntax of data entries. United Nations Standard Message types (UNSM's) specify the rules by which the data elements can be grouped to different messages. UN Trade Data Interchange Directory (UNTDID) includes common terminology, guidelines for message syntax, rules for syntax implementation and standard message designs. It also contains the "Uniform Rules of Conduct for Interchange of Trade Data by Teletransmission" (UNCID) setting internationally accepted rules of electronic data interchange. Other rules between trade partners are agreed in bilateral communication agreements. Common abbreviations and codes are also defined in the UN/EDIFACT standards. The most common applications that apply EDI are different enterprise resource planning systems, which communicate with each other by using standardized messages (Zuckerman 2000).

INTRODUCTION OF ROSETTANET

The need for common and world widely implemented e-business standards made 40 global information technology (IT) companies to found RosettaNet organization in February 1998 (RosettaNet 2002a). The organization facilitates the evolution of Internet-based business standards and e-business processes which are developed with co-operation of supply-chain companies operating in high technology trading networks. RosettaNet is a self-funded, non-profit organization, which drives its e-business standards to become a common language for future development of supply chain e-business activities (RosettaNet 2002a). Member companies provide such resources like expertise and human resources for RosettaNet development projects. Besides they implement standardized practices and promote the standards in their supply chain environments. RosettaNet organization is global having offices in North America, Europe and Asia.

RosettaNet organization and its driving forces

RosettaNet organization creates, implements and promotes open and Internet-based e-business standards, guidelines and specifications for cross-platform, application and network communication aiming to develop business process and system integration between different business partners (RosettaNet 2002a). RosettaNet concentrates on standardizing public processes between companies. It does not take the position concerning companies' private processes which means processes involving companies' in-house operations (Tammisto 2002). Standards are developed with co-operation of RosettaNet partners that operate in global electronic components (EC), information technology (IT) and semiconductor manufacturing (SM) trading networks. Besides several solutions provider (SP) companies provide different tools and applications for RosettaNet development and implementation. Nowadays RosettaNet comprises more than 400 leading EC, IT, SM and SP companies with over 1.5 trillion US dollars in annual revenues that makes it a highly influential organization in industrial high-tech environment (Tammisto 2002).

RosettaNet organization is lead by four managing boards that are electronic components manufacturing, information technology manufacturing, semiconductor manufacturing and solution provider boards (RosettaNet 2002a). They define development projects and priorities at the consortium level. The boards include in addition to supply chain and solution provider companies, different standard bodies, trade associations, universities, other academic institutions and government agencies (Tammisto 2002). For example the EC supply chain board consists of representatives of EC trading networks including companies like semiconductor suppliers, passive suppliers, connector suppliers, distributors and customers (RosettaNet 2002e). The IT board includes manufacturers, software publishers, distributors, resellers, end-users, shippers and e-Technologists, etc. (RosettaNet 2002f). The SM board includes companies like integrated device manufacturers, device manufacturers, foundries, material suppliers, and assembly, test and probe companies (RosettaNet 2002g). The fourth supply chain board, the Solution Provider board, comprises of application developers, solution integrators, consultancies, etc. (RosettaNet 2002h).

RosettaNet standards

RosettaNet standards comprise of data dictionaries, processes specifications, implementation framework and business message schemas (RosettaNet 2002a). Dictionaries define common

vocabulary to be used in business processes to reduce confusion caused by different company specific concepts. RosettaNet Business Dictionary defines common terminology for business transactions and processes between partners (RosettaNet 2002b). Different manufacturers, supplier, resellers, customers, and etc. use various ways to describe products distributed in their supply chains. Thereby RosettaNet Technical Dictionary provides common language for defining these high-technology products (RosettaNet 2002c). RosettaNet Business and Technical Dictionaries together provide common terminology for conducting e-business globally between different partners. Besides Global Trade Item Numbers (GTIN) codifies products and Data Universal Numbering System (DUNS) codifies companies to be identified and handled uniquely in RosettaNet trading networks. Those areas of co-operation and processes between trade partners that are not covered by RosettaNet standards are agreed in bilateral Trading Partner Agreements (TPA). RosettaNet offers drafts for TPAs but leaves conciliatory details for business partners (RosettaNet 2002a).

RosettaNet standardizes business processes and actions between supply-chain actors. When processes are not uniform, trade partners need to conduct a number of variations of the same process between different partners. Obviously this increases possibility of confusion and risk of errors causing additional operational costs. To solve problems related to process inconsistencies RosettaNet organization creates and implements Partner Interface Processes or PIPs. Each PIP defines how two different private processes running in two different organizations will be standardized and interfaced by public processes to entire supply chain (RosettaNet 2002d). Partner Interface Processes, PIPs, set common bases between trade partners leaving the public processes to each company's own responsibility (Tammisto 2002). PIP documentation includes process specific business logic, rules of message flows in addition to message structures and contents. The number of PIPs is increasing constantly being today around 150 (Iivarinen et al. 2002, p. 11).

RosettaNet standards group PIPs to seventeen segments, which are again divided into six different clusters. Clusters and segments serve as a basic framework to group and manage all the PIPs (Marlow 2000). The clusters are presented in Table 1.

Table 1. PIPs' cluster division introduced as a summary (Andersson 2002, p. 7).

Cluster	Cluster description	General goal of the cluster
1.	Partner, product and service review	Establish relationship between trade partners
2.	Product introduction	Introduce products and provide product structure
3.	Order management	Assist manufacturing, fulfill demand
4.	Inventory management	Assist manufacturing, fulfill demand
5.	Marketing information management	Stimulate markets and create demand
6.	Service and support	Provide post-sales support

The PIPs in cluster one are designed for reviewing partner, product and service information between trade partners so that basic information needed for conducting business is up-to-date in organizations' information systems. Cluster two introduces processes to product introduction by exchanging preparation for distribution information and notifying about product distribution information changes. The third cluster of PIP segments defines activities of order management related to following issues; quote and order entry, transportation and

distribution, returns and finance in addition to product configuration. Inventory management in form of collaborative forecasting, inventory allocation, replenishment, and reporting and price protection is discussed in the fourth cluster. The fifth cluster of PIPs involves marketing campaign issues and the sixth service and support process descriptions. When partners implement PIPs they choose a subset of all PIPs, which corresponds best to their business development needs. RosettaNet organization aims to create PIPs so that new business requirements are met once they have arisen. It also aims to take into consideration the variation of different business operation modes between companies.
Partner Interface Processes, PIPs, are defined at different levels in RosettaNet standards (RosettaNet 2002d) see Figure 1 below.

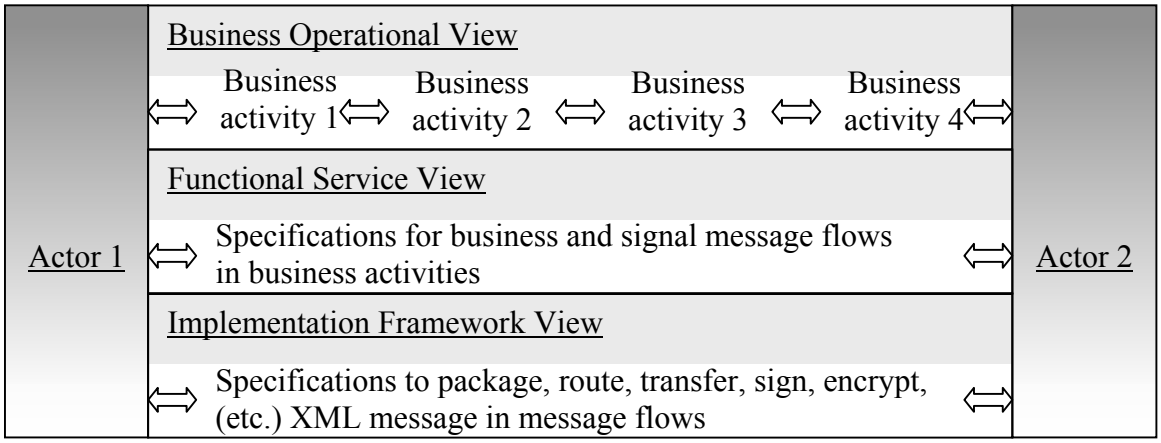

Figure 1. RosettaNet defines partner interface processes, PIPs, at three hierarchical levels, which are business operational-, functional service and implementation framework views.

Business Operational View (BOV) defines the flow of exchange between business data entities as they perform business activities. Functional Service View (FSV) includes network component design and the interactions in form of PIP protocols between the network components as they execute PIPs. Implementation Framework View (IFV) defines the message formats and communication requirements when partners' software programs execute a certain PIP. Besides IFV is a specification including security aspects descriptions to package, route, and transfer business action and business signal messages. Business action messages are of a business nature such as purchase orders. Business signal messages are negative and positive acknowledgements, which are sent in response of business actions. These messages are described in extended mark-up language (XML) format in message guidelines.

ROSETTANET'S CONTRIBUTION TO BUSINESS PROCESSES

Need to develop RosettaNet standards have emerged amongst implementers of former EDI standards like UN/EDIFACT and ANSI X.12 (RosettaNet 2002a). Common knowledge is that these standards and existing implementations serve relatively well in many cases in basic e-business processes like purchasing and invoicing. These EDI practices are general ways of conducting business especially in wholesale trade and retail business where transaction volumes of standard products are large. Therefore electronic data interchange has enabled economic of scale type of cost reductions for example in order management. New business

requirements especially in high-tech industries have accelerated introduction of next generation e-business standards. In table 2 parts of UN/EDIFACT and RosettaNet standards have been placed on a level in the limits of consistency. Comparison is completed in relatively general terms to emphasize the most important areas of RosettaNet in consideration of its contribution.

RosettaNet compared to UN/EDIFACT

UN/EDIFACT was originally founded in 1986 and RosettaNet in 1998. Operational requirements in industry have experienced a dramatic change in these 12 years. Changes in competitive environments have involved for example globalization, outsourcing, specialization in core competences, etc. UN/EDIFACT was developed for electronic trade data interchange to replace the exchange of paper documents originally in transportation industry. RosettaNet was founded to develop collaborative and open e-business processes to interchange data in collaboration between partners. Both standards define conceptually in similar fashion common terminologies, abbreviations and codes, data elements and message schemas. Naturally there are some distinctive variations in similarities mentioned above like the ones in the message schemas. UN/EDIFACT defines messages in EDIFACT format, which is based on value parameters whereas RosettaNet describes its messages in hierarchical XML format. In spite of these variations many basic concepts are similar in general terms. The development of RosettaNet has no doubt been influenced by former UN/EDIFACT. Besides, both standards leave open questions to be agreed in communication agreement in UN/EDIFACT or in Trade Partner Agreement in RosettaNet. The standards are presented side by side in Table 2 below.

Table 2. Parts of UN/EDIFACT and RosettaNet standards are presented side by side. Different parts are not completely consistent but still comparable.

Consistent parts	UN/EDIFACT	RosettaNet
Found in year	1986	1998
Background organization	United Nations	EC, IT, SM and SP companies in supply chain boards
Original field of industry	Transportation industry	Information technology industry
Original basis for development	Cost reduction in paper document handling	Collaborative development of open Internet based e-business processes
Focus of interchange	Trade data interchange	Collaborative data interchange
Business processes, rules for business activities	Uniform Rules of Conduct for Interchange of Trade Data by Teletransmission (UNCID)	Partner Interface Processes (PIPs)
Terminology	United Nations Trade Data Interchange Directory (UNTDID)	RosettaNet Business and Technical Dictionaries
Trade partners' bilateral rules	Communication agreement	Trade Partner Agreement (TPA)
Implementation technology	Open; recommendations for technical solutions in UNTDID	Open; requirements in RosettaNet Implementation Framework (RNIF)
Data elements	United Nations Trade Data Elements Directory (UNTDED)	RNIF
Message schemas	United Nations Standard Message types (UNSM's), EDIFACT format	RNIF, XML format
Abbreviations and codes	Defined to some extend	Defined to some extend

There are also some remarkable developments in RosettaNet standards compared to UN/EDIFACT. They originate from RosettaNet's influential background organization including around 400 world leading high technology companies at the same time making RosettaNet a powerful player in field of e-business standards. United Nations has designed common standards to be used by most companies whereas RosettaNet has developed standards for EC, IT and SM high technology trading networks. These industries have specific e-business requirements because the exchange of collaborative information is essential. UN/EDIFACT concentrates more on trade data interchange. To support collaboration in trading network RosettaNet introduces Partner Interface Processes, PIPs, which define how two different private processes running in two different organizations will be standardized and interfaced by public processes to entire supply chain (RosettaNet 2002d). RosettaNet PIPs influence also other industries and partly therefore RosettaNet is planning to move into adjacent industries like automotive (RosettaNet 2002a). Naturally implementation of PIPs influences also development of companies' private processes by setting up external requirements. In short one could say that RosettaNet extends e-business standardization from business messages to business processes.

RosettaNet's influence on supply chain management

For instance the complexity and costliness of new technologies, risks involved in them, need for better cost efficiency in addition to shorter product development and time-to-market periods have encouraged companies to collaborate in their supply chain environments. Development of technological areas, such as, telecommunication, broadcasting and computerized business systems has also supported collaboration (Littler et al. 1993, p. 214). Collaborative commerce or collaborative business can be defined as advanced implementation of e-business between companies interlinking their business process across the Internet (Penfold 2002). It enables partners to share up-to-date information for example related to product development and marketing, integrate workflows, collaborate in decision making in addition to electronic business transactions. RosettaNet offers tools, in forms of business process standardization (Partner Interface Processes) and support of Internet based technologies, for collaborative supply chain management. By using certain PIPs companies can for example send technical information to their partners or marketing information to different e-catalogues and portals in a standardized way what activates collaboration, see Figure 2.

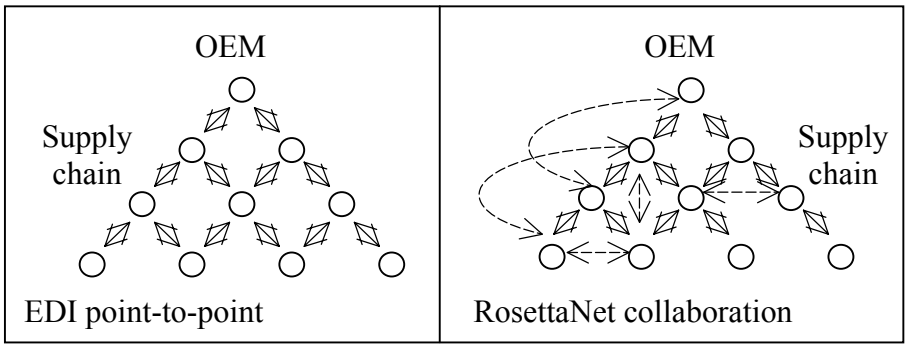

Figure 2. RosettaNet Partner Interface Processes offer tools for better collaboration in supply chains. Traditionally EDI supports mainly point-to-point trade transactions between suppliers and their customers, a simplified example.

An example of RosettaNet's contribution to collaboration in supply chain environment is segment 4A, which handles collaborative forecasting, processes between supply-chain companies. It is a part of cluster four dealing with inventory management processes. Segment 4A includes processes related to business planning, strategic forecasting, order forecasting and replenishment in addition to exception management (Andersson 2002, p. 13). Purpose of business planning is to create long-term joint business plans and TPAs that set agreed rules on forecasting and replenishment. Strategic forecasting processes are designed for joint manufacturing capacity planning. Trading partners share up-to-date information of mid-term capacity requirements and their available capacity so that changes and needed adjustments can be anticipated beforehand. Order forecast processes are for joint replenishment planning so that trading partners share information related to short-term demand and available supply capability. Strategic and order forecasts are usually send by the party with most accurate picture of required capacity and product demand (Ibid 2002, p. 15). Typically this is an OEM or a contract manufacturer (CM). Replenishment processes are tactical in nature and sometimes can be merged to order forecast processes. They include collaborative processes to co-ordinate material releases from suppliers to customers both in vendor-managed inventory (VMI) and customer managed inventory (CMI) modes of action. Exception management is an

integral part of forecasting and replenishment processes to identify and solve exception conditions related to supplies. In forecast and replenishment processes iterative forecasts and forecast replies are used thereby supporting collaboration in supply chains (Ibid 2002, p. 8).

In general successful collaboration in supply chain environment can offer benefits like gaining access to new markets and technologies, spreading risks, securing economies of scale and scope, sharing costs in technological developments and marketing, complementing core competencies and blocking competition (Littler et al. 1993, p. 213). RosettaNet's collaborative processes can be seen for example to reduce inventories, speed time-to-market and lower transaction costs (Tammisto 2002). Besides collaborative forecasting may enable a better match between supply and demand by reducing unnecessary judgment points and inaccurate forecasts, increase interaction, improve supply chain visibility and decrease inventories throughout the supply chain (Andersson 2002, p. 6). Efficient sharing of information offers also better grounds for management decisions. Partner interface processes provide tools for controlling, measuring and reporting process activities at the same time affecting efficiency and transparency of material and information flows (Tammisto 2002). Process automation offers potential for routine work reduction, which usually enables less number of errors and better customer satisfaction as it is noticed to be in the case of EDI.

Possible problems in RosettaNet implementation

Collaborative forecasting in supply chain environment is naturally only one example of collaboration between companies what RosettaNet supports. Often discussed issue is collaborative design, which has developed along with new technologies, standards and methods for example in form of collaborative project environments. RosettaNet's second cluster introduces PIPs for these design purposes. For example PIP 2A9 defines a process, which enables engineers to ask suppliers directly technical information using electronic communication between data systems. In high-tech supply chains it is important that design and components' information is distributed efficiently. These PIPs are more complex than other PIPs and therefore challenging to implement (Baljko Shah 2002). It is even seen that the transfer of design information is a central theme to the success of RosettaNet in its mission to create more interactive supply chains (Ibid 2002). According to Baljko Shah RosettaNet PIPs are even too tightly bound to the purchasing community and therefore not responding enough to requirements of collaborative design activities.

Implementing RosettaNet PIPs is a time-consuming and complex process (Baljko Shah 2002). Deployment of PIPs has been slow and therefore implementation has concentrated in big companies like Cisco Systems, Intel and Nokia (Roos 2001). Worldwide PIP connections are divided so that 50 % of them are in North America, 42 % in Asia and only 8 % in Europe. This indicates that Europe's relatively larger number of small and midsize companies, with less manufacturing activity, may be one of the main obstacles to RosettaNet implementation in Europe (Wilson 2001). Obviously, companies implementing RosettaNet could gain cost reductions and better return on investment if they get also the smaller companies to invest in RosettaNet too.

Software products, which support RosettaNet, cost often hundreds of thousands of US dollars (Roos 2001). Therefore different third-party-hosted RosettaNet services and low-cost solutions need to be developed for smaller companies to boost RosettaNet's expansion.

Different development tools, RosettaNet software platforms and test environments for testing software solutions against RosettaNet specifications are required. Therefore RosettaNet organization has created the Solution Provider board in June 2001 to react on these challenges. PIP implementations generate in addition to initial expenses monthly costs related to data system support, updates, etc. Also the strong existing EDI base slows down RosettaNet adoption; companies will continue to use EDI but will reduce investments in it (Wilson 2001). Often EDI installations have been very expansive to implement, so many companies fear RosettaNet will be that too (Ibid 2001). Parallel systems will be most likely in operation. In spite of that Wilson believes that standards like RosettaNet are going to win in the end, but remain mainly within the high-tech industry. It is obvious that availability and reasonable costs of suitable software tools for both big and small companies is one of the critical success factors in RosettaNet standards' implementation.

CONCLUSION

It is challenging, if not impossible, to exactly define RosettaNet e-business standards' contribution. There are no exact measurements for it. This paper discusses RosettaNet standards' effects by considering influences of company data system developments, requirements of supply chain management, former EDI standards, in addition to RosettaNet's background drivers and content. This consideration is reflected on process efficiency and collaboration issues in supply chain environment for example in form of collaborative forecasting. The vision of next generation e-business, collaborative business or to put it short, c-business, has also affected the findings. When companies concentrate on core businesses they need seamless collaboration; collaborative tools, methods, technologies and standards. In future it seems to be that collaborative supply chains compete more and more with another instead of individual companies referring to the concept of virtual enterprises. RosettaNet may be in a key role to support this transformation especially in high-tech industry.

To accelerate global collaboration between supply-chain companies RosettaNet introduces Partner Interface Processes, PIPs. It extends e-business standardization from business messages to business processes. PIPs define processes for more efficient and controllable collaboration. Their introduction and input to further developments in supply chain environment is considered as RosettaNet's main contribution. Another important conclusion is that RosettaNet is a highly influential player amongst other standards because of its powerful background organization with more than 400 world leading electronic components (EC), information technology (IT), semiconductor manufacturing (SM) and solutions provider (SP) companies. It is important to notice that standards are developed by RosettaNet member companies for their own needs giving them a direct possibility to influence the contents of the standards.

This paper considers the contribution of RosettaNet in relatively general terms to provide an overall review of the issue. It introduces RosettaNet standards and surveys different aspects affecting its contribution. Therefore, further studies should examine separate parts and aspects of RosettaNet in greater detail. The following areas could be studied:

- Challenges and possible gains of collaborative forecasting. Study could consider different forecasting scenarios and practical implementations to identify possibly

emerging problems and gained benefits. Case studies should be carried out in addition to statistical studies to measure the results of collaborative forecasting. The interesting issue is how collaborative forecasting affects supply chain management.

- Collaborative design and engineering. This research could study how RosettaNet supports collaborative design activities and is there a need for another standard which concentrates on collaborative design. Or is there a need to develop RosettaNet further to better respond to these topics?

- Case studies about PIP implementations examining time spent, resources used and productivity developments gained. Also some common factors between implementation methods and achieved results could be identified to recognize PIP implementations' success factors.

- Supply of RosettaNet software solutions. Especially solutions and their costs for smaller companies would be relevant in terms of RosettaNet adoption in whole supply chain environment. Lack of suitable software solutions may become an obstacle to RosettaNet expansion.

Today a growing number of companies in high-tech industry are facing decisions related to RosettaNet. Big companies, which have adopted RosettaNet PIPs, are requiring their smaller trading partners to exploit RosettaNet standards. However, there are yet some obstacles to overcome before total RosettaNet expansion in high-tech supply chains. For example PIPs are expensive to implement especially for smaller companies if suitable software solutions are not available. So solution providers are in key role to lower the costs and make RosettaNet PIP implementations easier. RosettaNet have a strong influence on high-tech industry and it may expand to other industries like automotive or at least work as a reference in them. Anyway RosettaNet is going to influence a growing number of companies around the globe although parallel standards will most likely continue to exist. RosettaNet represents the next generation of e-business standards after the period of EDI.

REFERENCES

Andersson, M. 2002. RosettaNet Collaborative Forecasting Process Scenarios. Version 1.0. Case study published by RosettaNet organization.

Baljko Shah, J. 2002. Design Collaboration Poses Tough Problems. Issue 1297. Start page 6. ABI/Inform database. <http://proquest.com/pqdweb> 18.12.2002.

Balls, J., Grant, N., Dunleavy, J., Hartley, K. & Hurley, J. 2000. E-Business and ERP: Transforming the Enterprise. New York: John Wiley & Sons, Inc.

Clarke, R. 2001. Electronic Data Interchange (EDI): An Introduction. Business Credit, Vol. 103. No. 9., 23-25

Littler, D., Leverick, F. & Wilson D. 1993. Collaboration in New Technology-based Product Markets. Technology Analysis & Strategic Management. Vol. 5. No. 3., 221-233

Hall, D. & Braithwaite, A. 2001. Handbook of Logistics and Supply-Chain Management. Oxford: Elsevier Science Ltd.

Halevi, G. 2001. Handbook of Production Management Methods. Oxford: Reed Educational and Professional Publishing Ltd.

Iivarinen, J., Karlsson, T. & Martikkala, I. 2002. RosettaNet in Finland 2002. Anilinker Ltd and Iocore Finland Ltd. <http://www.anilinker.com> 3.6.2002.
Marlow, K. 2000. RosettaNet Overview: Clusters, segments and PIPs. Issue 01.01.00. Summary published by RosettaNet organization.
Penfold, R. 2002. What is Collaborative Commerce? Infoconomy. <http://www.infoconomy.com> 8.4.2002.
Roos, G. 2001. RosettaNet for the Masses. Issue 1282. Start page 32. ABI/Inform database. <http://proquest.com/pqdweb> 18.12.2002.
RosettaNet (2002a). RosettaNet organization's Internet site. Background. < http://www.rosettanet.org/background> 29.10.2002.
RosettaNet (2002b). RosettaNet organization's Internet site. RosettaNet Business Dictionary. <http://www.rosettanet.org/businessdictionary> 1.11.2002.
RosettaNet (2002c). RosettaNet organization's Internet site. RosettaNet Technical Dictionary. <http://www.rosettanet.org/technicaldictionary> 1.11.2002.
RosettaNet (2002d). RosettaNet organization's Internet site. RosettaNet Implementation Framework: Core Specification. <http://www.rosettanet.org/rnif> 24.9.2002.
RosettaNet (2002e). RosettaNet organization's Internet site. Electronic Components board. <http://www.rosettanet.org/ecboard> 12.11.2002.
RosettaNet (2002f). RosettaNet organization's Internet site. Information Technology board. <http://www.rosettanet.org/itboard> 12.11.2002.
RosettaNet (2002g). RosettaNet organization's Internet site. Semiconductor Manufacturing board. <http://www.rosettanet.org/smboard> 12.11.2002.
RosettaNet (2002h). RosettaNet organization's Internet site. Solution Provider board. <http://www.rosettanet.org/spboard> 12.11.2002.
Tammisto, J. 18.3.2002. ANI Seminar. Tampere, Special Telecom program & Nordic User Group Coordinator, RosettaNet Europe.
Unece 2002. United Nations Economic Commission for Europe's Internet site. <http://www.unece.org/trade/> 11.11.2002.
Wilson, D. 2001. The PIPs Are Coming. Issue 1282. Start page 16. ABI/Inform database. <http://proquest.com/pqdweb> 18.12.2002.
Zuckerman, A. 2000. ERP: Moving beyond the enterprise. Transportation & Distribution, Vol. 41. No.3., 31-36