Utilization of Electronic Data Interchange System to Support the Enterprise Resources Planning system in a Production Order Realization Process

Joanna Helman
Wrocław University of Technology, Poland

This paper presents the analysis of the possibility of using Electronic Data Interchange system to support the realization of the production order process by the ERP system. This paper describes the essence of EDI systems with advantages and disadvantages arising from their use and briefly characterizes the essence of ERP systems. It also presents a general model of production order realization with the use of EDI, which consists of six phases - Order acceptance, Creating documentation, MRP, Production, Goods dispatch and Payment receipt. On this basis, it was found that EDI messages are a perfect complement to the ERP system in the realization of the production order process.
Keywords: EDI, ERP, production order.

1. INTRODUCTION

The main conclusions of the study devoted to the analysis of Enterprise Resources Planning (ERP) systems used in a manufacturing company for realization of customer's order done by author of this article confirmed that the ERP system is essential for a company to be able to function efficiently[1]. Without an ERP system it would be impossible to run proper and effective management of the company resources (particularly the material ones) used in the production process. ERP system allows for a thorough analysis of a company's situation, so that production planning processes, scheduling and managing all resources can be performed better and more accurate. The study confirms the hypothesis that the enterprise resource planning system covers most of the processes included in the production order realization process. Enterprise analysis showed that 85% of the processes involved in the execution of order is processed in the ERP system. Noteworthy is that the processing of the remaining 15% of the processes is not supported by the ERP system, but it can be done within Electronic Data Interchange (EDI) messages (that can be processed by the ERP system). It was stated that the entire process of production order realization in the audited company can be supported by the ERP system, but it requires the full implementation of customer inquiries by EDI system.

Under the name of Electronic Data Interchange it is hidden data exchange formats described in international standards, with minimal human intervention. EDI can also be described as a kind of bridge between systems of cooperating companies. EDI was created by combining the techniques of computer science and telecommunications. Its use allows to maximize business effectiveness while minimizing paperwork participation in these activities. It cause that the execution of commercial transactions is easier than ever, as it eliminates much of work involved in creating, copying and sending business documents. All the information contained in a typical commercial documents are passed very quickly through the use of standard and acceptable worldwide data formats that make the specific language appropriate for all users of EDI [4].

The electronic exchange of data can be used regardless of the type of software used in the company. EDI should not be confused with the type of e-mail. Data stored in the appropriate

format are exchanged between each participating enterprises systems, not between people. The format in which they are stored can be automatically processed by a computer.

2. THE ESSENCE OF EDI

The document to be transmitted between the two companies working together is created in sender organization with its own information tools and in its own internal format. Then the document is converted to the format of sender company's software to a standard, defined, disseminated and globally acceptable EDI format. The modified data is sent to the recipient by the EDI network in an electronic format. The internal network of the recipient of the EDI message is converted to a format accepted by the recipient's system. Both organizations are in possession of the same data - each in a format of their own system (software). If the reception of data must be confirmed or replied from the recipient, it can also be uploaded quickly and automatically via EDI network. Elimination of activities related to rewriting information from the document makes electronic data interchange fast and flawless, and the probability of data loss is reduced to a minimum [4].

strengthens trade ties generally streamlines all the processes taking place both within the company and the connection between company and its environment.

There are many EDI standards, but all of them contains a fixed syntax and content. They are used to transmit business information in the formatted manner and forms some kind of a common interface between applications partners. There are four basic categories of electronic data interchange [7, p 21]:

1. Exchange of information-oriented data necessary to make decisions about the transaction.
2. Exchange transaction-oriented data, such as production orders, purchase orders, invoices, etc.
3. Electronic payment EFT (Electronic Funds Transfer).
4. Interactive EDI (question and answer) used in the service sector, mainly in making various kinds of bookings.

The most popular and most widely used international standard is UN / EDIFACT (United Nations / Electronic Data Interchange For Administration, Commerce and Transport), in

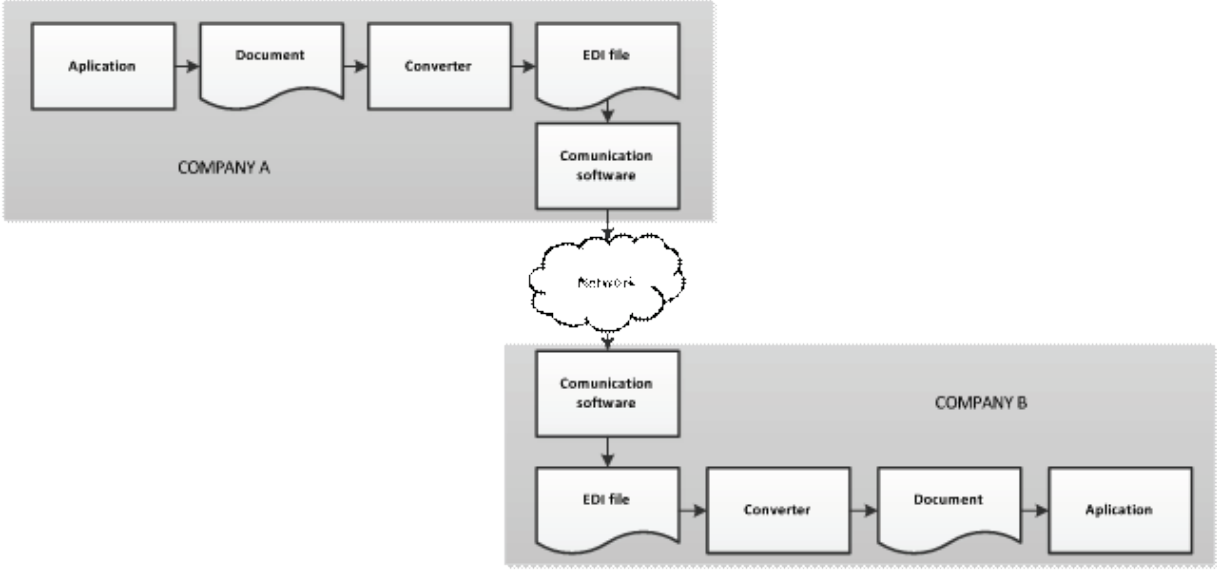

Fig. 1. Scheme of EDI performance

EDI is a kind of economic catalyst that unites customers and suppliers, banks and logistics companies, increases the effectiveness of partnerships based on improved operating procedures, fosters a closer exchange of information, increases productivity, and

Poland described in PN-90/T-20091 norm. EDIFACT is a standard recommended by the United Nations. The syntax of this standard is set to ISO 9735, and thus, its structure is governed by the relevant regulations, and any changes must be reported to the appropriate authorities. This

standard enables the integration of business processes (from the purchase of goods, through the payment of invoices for supply of goods under certain conditions).

EDIFACT standard includes a variety of messages. These messages can be divided into three main groups [2]:

- Commercial messages - Price catalogue, order, invoice; Used for the exchange of information between the seller and the buyer;
- Transportation messages - Transport order, shipping notification; Used to organize the delivery of the goods;
- Financial messages - Transfer, information about traffic on your account; Used to make payments and as an information about the movements of cash;

According to the type of information contained in sent message the following division of messages can be distinguished:

- Basic data
  - Used to describe the companies and the goods that are exchanged between trading partners, and to which the other messages are sent between the two companies;
- Transactions
  - Describes the business processes between partner companies, starting with the messages of ordering goods or services, with information on transport, ending with the financial documents and the payment order for goods or services;
- Reports and Planning
  - messages used to inform partners about the current situation with regard to their products and plans for the future to enable effective planning and supply chain management.

The benefits resulting from the EDI system application in the company and partner companies primarily includes [2, 3, 6, 7]:

- automation activities:
  - auditing of documents and processes,
  - the accounting documents,
  - the performance analysis,
  - reduction of the probability of error;
- Costs reduction:
  - work-related costs,
  - data re-entry costs,
  - postage costs,

  - Production scheduling,
  - Change management products,
  - Capacity planning,
  - Controlling of the production process.
- Purchasing and inventory
  - Cooperation with the storage application,
  - Registration of received parties of goods and invoices from suppliers,
  - Automatic submission of proposals based on shopping needs analysis, storage conditions, budget and current trade agreements,
  - Registration information for shopping, lots of goods, booking, production and contracts,
  - Designation of critical resources and the level of inventories.
- Suppliers / Customers / Clients
  - Purchasing control and billing separately for each supplier,
  - Processing orders,
  - Supporting specific orders, on-demand products,
  - Orders control and billing for each customer individually.
- Sales
  - Collecting orders,
  - Preparation of offers,
  - Issuing confirmation of delivery.
- Payroll / Personnel
  - Registration of employment,
  - Registration and payment of salaries.
- Assets and Finance
  - Records of fixed assets and equipment,
  - Carrying on all financial and accounting settlements,
  - Performing detailed analysis for a specific period of time,
  - Controlling the flow of accounting documents,
  - Preparing financial reports for individual users,
- The electronic transfer of EDI documents.

These systems due to their high flexibility (the ability to function consisting of individual modules without attending other modules) allow to match different conditions to individual companies. Another specific feature of these systems is that they allow to take the planning process from the bottom up, or make changes (applying patches, considering alternative solutions) in the solutions proposed by the system. Additionally, the system allows to set permissions for each user. Due to the fact that the current economy is growing faster and faster, the modern enterprise must be prepared to quickly assimilate process information and to control processes, both internal and external. Working in real time, ERP allows for direct data input to the system for individual operations and immediate update changed information in other enterprise department. In addition, these systems represent an advanced approach to increase productivity by combining a variety of methods including MRPII, JIT strategy, quality management strategy, TQM, Lean and benchmarking [5].

It is also worth mentioning that ERP systems are no longer only performing auxiliary functions, but they also have become a kind of key to the creation of an effective business. They have not only an impact on improving many business processes, they can also significantly affect the operations of the entire company. In addition, they allow for the implementation of all management functions, planning, directing, organizing and controlling by individual meeting the needs of the various departments, as well as individual fitting departments together. The introduction of ERP systems made it possible to fit the needs of systems and business requirements by introducing a new implementation model, which is based on an appropriate model for composing its own individual modules with user-oriented operation.

Due to the fact that companies focus primarily on logistics and financial processes, ERP systems architecture is primarily set on the pillars of logistics and financial services. The most often the main role is focused on logistics pillar, which is the ongoing support for the operational decisions in the wider field of manufacturing and also provides information to financial pillar. Full synergistic effect can be achieved by implementing both of these pillars.

Integration of business processes in ERP systems is focused on managing the production chain. These processes are supported primarily by the sale subsystem and distribution, production planning and materials management. Therefore, this area is a base of information for planning and integration of logistics processes.

4. EDI IN PRODUCTION ORDER REALIZATION PROCESSES

The simplest, a very general way to present the basic model of the production order realization process is to divide it into six phases:

1. Order acceptance
2. Creating documentation
3. MRP
4. Production,
5. Goods dispatch,
6. Payment receipt

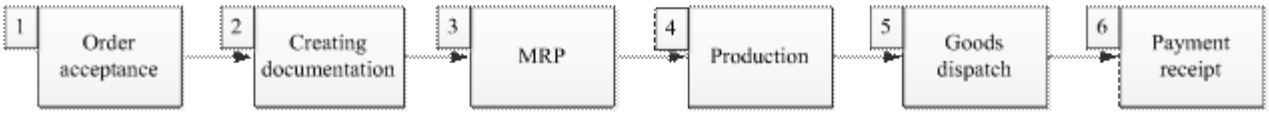

Fig. 2. Basic model of the production order realization process

The first step in the realization of production order is the acceptance of the order from the customer. However, before that happens, the terms of sales must be clarified. For this purpose, using EDI, the customer is sending to the manufacturer message *Request for Quotation (REQOTE).* This document contains a proposal for the conditions and day of payment and determines the volume of the order and the specifications of individual places and dates to receipt of goods.

In a response to previous message producer sends a message to the client *Quotation (QUOTES)* specifying all the necessary information on the finalization of the order – ie. payment terms, prices and conditions of supply of goods.

When both the client and the manufacturer agree on the conditions, the client sends a *Purchase Order (ORDERS)* to order goods together with the size, date and place of delivery. It can refer to a previously received offers. A common practice is to submit daily orders from the general principle - "one delivery, one time, one place of delivery". The message can also be used to send the details of the requirements for transport, packaging and labelling of goods.

Producer responds by sending a *Purchase Order Response (ORDRSP),* which acknowledges receipt of the order. Message accepts the whole contract or is used to send proposals for changes or cancellation of the contract.

In the case if the buyer would like make some changes in the order, he can use the message *Purchase Order Change Request (ORDCHG).* The buyer may submit a request for amendment or cancellation of one or more of the ordered goods.

The realization of the first phase of production order with the use of Electronic Data Interchange is shown on a figure 3.

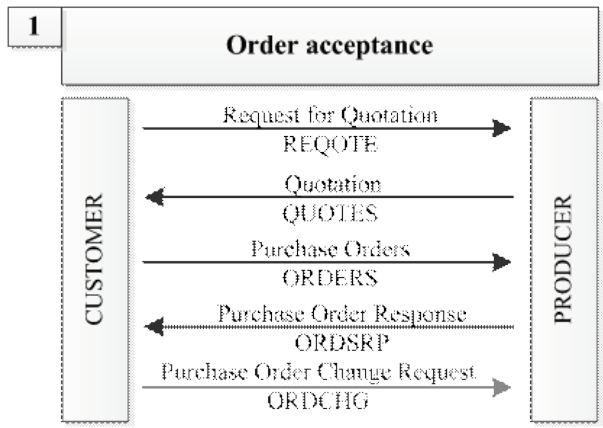

Fig. 3. EDI in phase 1. of production order realization process – Order acceptance

The next phase is creating documentation. This phase task is to develop rooting and technology of ordered item in ERP system. It involves the development of item master file for semi-and finished products based on previously developed design detail. In this step information about the specific materials that will be used during the production of the ordered item is inputted to the ERP system. It often happens that such data already exist, but sometimes there is a need to change the data required to create a new "material." The data must be developed in great detail, because it is up to them to continue the production process due to the fact that this information are used in the management of materials management, MRP, ordering materials from suppliers, as well as the verification of financial documents executed transaction.

EDI participation in this phase is small, it comes down more to determine in what form the ordered goods will be sent. Therefore, the manufacturer sends via EDI message *Despatch Advice (DESADV)* containing the specification of goods. One document describes a shipment, which can be delivered to one or more locations. This message allows the client to appropriate preparation for collection of goods in advance. The realization of the second phase of production order with the use of Electronic Data Interchange is shown on a figure 4.

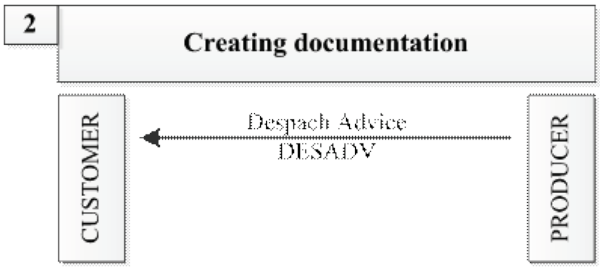

Fig. 4. EDI in phase 2. of production order realization process – Creating documentation

The third phase is the MRP, during this process in the ERP system are calculated material needs for each item and inventory status is checked. Based on the data from ERP system the deliveries of required materials from suppliers are planned. In the case that the company does not have a sufficient materials in stocks to complete the production order, the purchase of goods from a supplier is made. This phase is made within EDI by exchanging *Inventory Report (INVRPT)* with supplier and manufacturer, to find out which goods currently the supplier has and whether they meet the requirements of production.

When the supplier has specified goods the message described above *Purchase Order (ORDERS)* to order goods is sent. If the supplier is a fixed supplier, *Delivery Schedule (DELFOR)* message can be also used, which sets out the planned time and volume of supply in the short-or long-term. This allows for scheduling inventories. This step is very important because on the delivery schedule the production plan is based and materials management plan is prepared. Typically, materials are determined to be supplied when they are needed for the production, in order not to fill the stock (and thus do not generate extra cost).

After ordering goods from a supplier, the status of ordered materials can be monitored by *Transportation Status* message *(IFTSTA),* allowing to obtain information on the status and location in which currently is shipping. When the ordered products arrive to the factory a message *Receiving Advice (RECADV)* is sent indicating that goods were received and accepted within a particular delivery. This message allows to compare the list of ordered goods with a list of received goods. Within this message the information about the losses incurred during the delivery can be provided. The realization of the third phase of production order with the use of Electronic Data Interchange is shown on a figure 5.

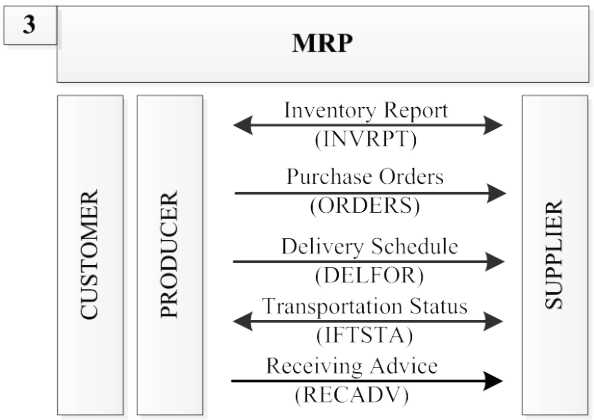

Fig. 5. EDI in phase 3. of production order realization process – MRP

The next phase is a production phase. It starts when the stock contains all materials necessary to begin the production process. This process is based on data from ERP system - order information and production plan. The use of the ERP system allows to control the production process and to run current analysis, because after each stage of the production workers can report a particular action in the system by the option of confirmation of production. On this basis it is possible to track the position where the product is in progress and who is responsible for the operation. It is possible to measure the amount of defective products which are not suitable for further processing and this allows to update a production plan. This phase is run within information contained in ERP system database only, and Electronic Data Interchange is not participating.

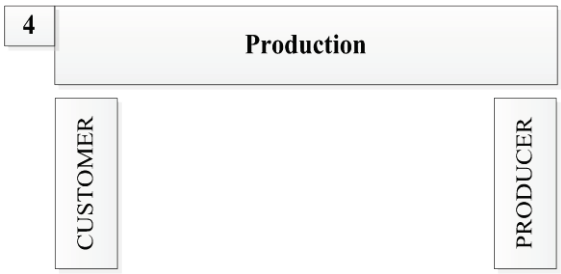

Fig. 6. EDI in phase 4. of production order realization process – Production [EDI does not occur in this phase]

The fifth phase is goods dispatch. This phase begins after passing all the operations specified in rooting file, so after the end of the manufacturing while the finished product is stored in warehouse. This step is controlled by the ERP system by comparing the delivered products to customer specification. Goods are stored in the warehouse of finished products and their storage location is marked on the system, which facilitates the subsequent process of packing details.

When all ordered products are already in stock and ready to ship, the manufacturer sends a message *Goods Handling and Movement (HANMOV)* to the client. This message instructs the preparation of ordered goods to transport. The message contains a description of how to prepare the transport, packaging and labelling of goods. If transportation of the ordered goods is done with external shipper the *Instruction to Despatch message (INSDES)* is sent, with specification used to describe goods transport. The information contained in communications are used to identify the place and time of delivery.

The customer using the message *Transportation Status (IFTSTA)* described previously can check the status and location in which the shipping is. After receiving a shipment client sends a *Receiving Advice (RECADV),* providing that he has received and accepted the goods, or provide information about the losses incurred during delivery. If the delivery is done by external shipper, the third company is sending *Arrival Notice (IFTMAN)* message. This document is indicating the arrival of the shipment and determines how to receive ordered goods. The realization of the fifth phase of production order with the use of Electronic Data Interchange is shown on a figure 7.

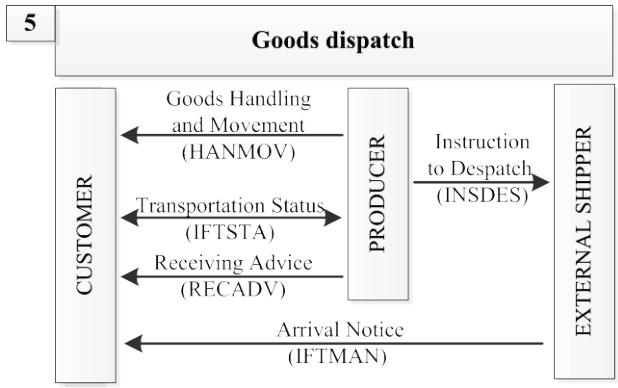

Fig. 7. EDI in phase 5. of production order realization process – Goods dispatch

The last phase of the realization of the production order is the payment receipt, during which the invoice is issued to the customer. This is done via *Invoice (INVOIC)* message containing an electronic invoice for delivered goods with previously agreed conditions. This document can also be used as a pro-forma invoice or credit note. The use of this message may be a source of significant savings in the work of accountants. The information contained in each invoice is properly processed, and the use of EDI allows to automate different accounting tasks and to reduce the possibility of errors occurs.

The following process after the shipment of the goods and the invoice delivery is analysis of settlements, which consists on monitoring the flow of receivables from the client as with the previously approved payment terms. This can be done via a *Sales Data Report (SLSRPT),* which enables transmission of sales data for statistics, planning and market analysis.

With information *Multiple Debit / Credit Advice (DEBMUL / CREMUL)* obtained from the bank, information about incomes on account can be achieved. The information may relate to one or more financial or commercial information such as invoices, debit/credit notes, bank service charges and others.

Other important EDI messages in financial analysis are *Banking Status (BANSTA)* and *Financial Statement (FINSTA). Banking Status (BANSTA)* message is sent by the bank to the customer informing him of the state of financial orders or answers to previous questions. *Financial Statement (FINSTA)* message is sent to make the client aware of the financial situation. It may contain information about his accounts, balances, investments, accounts information, interest rates, the list of operations executed on the client

accounts. The realization of the last phase of production order with the use of Electronic Data Interchange is shown on a figure 8.

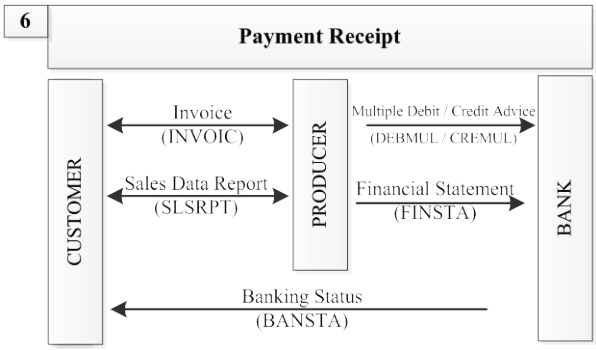

Fig. 8. EDI in phase 5. of production order realization process – Goods dispatch

5. CONCLUSIONS

The six-step order production realization process consists of Order acceptance, Creating documentation, Materials Requirement Planning (MRP), Production, Goods dispatch and Payment receipt. In the research to each of the processes the particular operations performed by Electronic Data Interchange messages were assigned. Only the process of Production was defined as a process without Electronic Data Interchange messages, due to the fact, that there is no communication between manufacturer and any other company.

The general diagram showing the described above process with the use of Electronic Data Interchange messages is presented on figure 9. On the scheme the range of Enterprise Resources Planning system utilization during the process of the production order realization is also marked. ERP system is not covering two of the phases – Order Acceptance and Payment Receipt, due to the fact, that these processes are mainly concerning communication between manufacturing company and its clients.

Based on these diagram it can be seen that as it was assumed in previous research that, the entire process of production order realization can be supported by electronic systems, was correct.

Processes which are not carried out within the ERP system support, are run with EDI messages. Therefore, it can be concluded that these two systems are complementary to each other in the order production realization process.

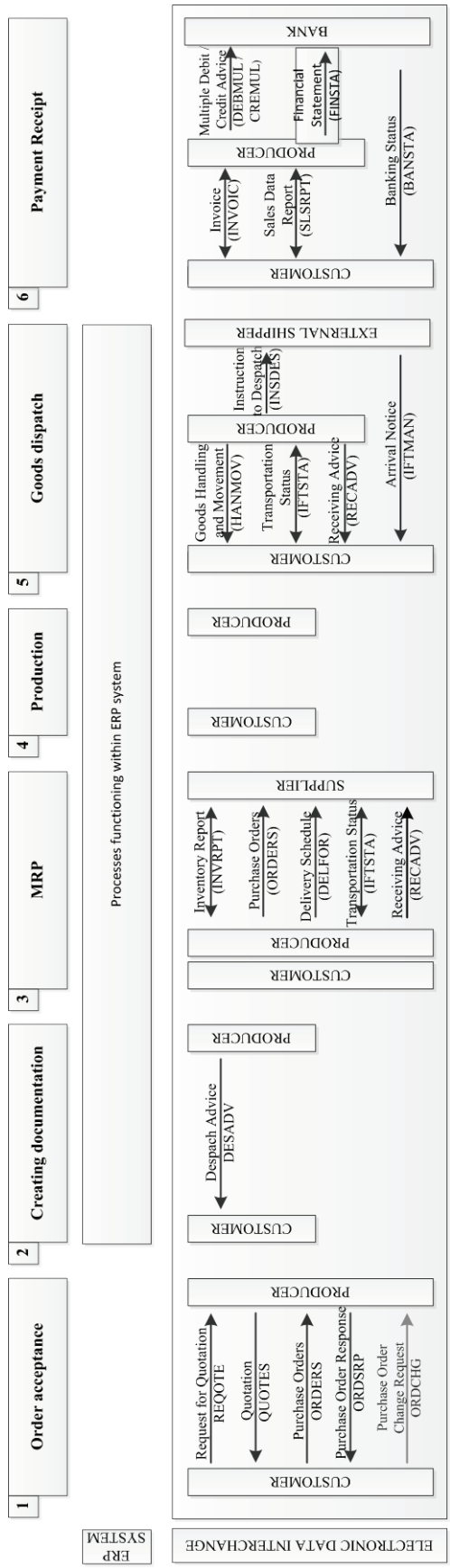

Fig. 9. Scheme of utilization of ERP and EDI in production order realization process

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Joanna Helman
Wrocław University of Technology, Poland
joanna.helman@pwr.wroc.pl