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**COMPARATIVE ANALYSIS BETWEEN PROCESS MAPPINGS USING IDEF0
AND FLOW**

Paulo Cesar Chagas Rodrigues

UNESP – Univ. Estadual Paulista

Av. Dr. Ariberto Pereira da Cunha, 333

Guaratinguetá, São Paulo, Brasil CEP: 12516-410

E-mail: pauloccr@feb.unesp.br

Phone: +551481112815

ABSTRACT

This paper describes and analyzes how the flow of the value chain and the mapping of processes are linked, pointing out the main aspects in an industry that operates in stationery products and is headquartered in the region of Bauru, Brazil. Once the company decided to adopt the formal model for mapping of the flow of the value chain in a product, as an indicator of viability and observe the results, it can make observations about the volumes of stocks of raw material and process, as well as the size of production batches and that the frequency of daily production. The analysis between the model and IDEF0 diagram, can observe that the IDEF0 model facilitates the understanding of the processes, allowing standardization which will facilitate decision making by management and direction.

1 INTRODUCTION

The methods of intervention for organizations to rationalize their processes of production, improving the quality of their products and services, having the objective of satisfying their customers' necessities. From these methods, what will be approached in this article refers to the management of inventories of the flowchart mapping of the flow of the value chain in their productive processes. The Integrated Definition for Function Modeling (IDEF), pattern will be used for mapping all the productive process that will enable to identify the key processes, and therefore, their variables.

When managed in a wrong way, it become one of the biggest waste generators in the production line, masking several management problems, having direct and meaningful reflexes in the financial efficiency and in the company's image.

In the graphic industry, because of products high given the high seasoning and the complexity of the processes, the inventory management has an even bigger importance. Through a capable management of movement, storage and the control of intermediate is possible to reduce considerably the costs and the risks which involves the raw material inventory in process, highlighting the importance of the materials management concept and its narrow relation to the issue treated here.

Base in the subjected the main objective of this paper is to describe and analyze the way how the mapping of the productive processes show the main points in an industry that performs in the graphic sector that has a head quarter in the region of Bauru/SP.

Therefore, a qualitative research will be done based on the study-case methodology, because this kind of research is worried mainly about the understanding and interpretation of a particular phenomenon, as it is intended here. The instruments used to collect data in this studied company were done through interviews, document analyzes and in loco visitation.

A theoretic review is done in this article about the mapping of process in which the main emphasis is given to the flowchart and the IDEF patterns to emphasize conceptually the cited study. This article has the main objective to present how mapping productive processes and what is its influence in the decision taken by some of the managers team of the company.

According to Alves (1999), the industrial environment characterized by a competition based mainly in the given period of time and the customers' satisfaction often related to their demands for unique and exclusive products and immediate deliveries or as fast as possible.

2 MAPPING PROCESS

According to Oliveira, Montevechi and Marins (2007), the mapping is performed to represent the various necessary tasks and the sequence that they should occur to the delivery of a product and service.

The process mapping should be presented under a graphic way: to expose the details of the process gradually and controlled, to describe the process with accuracy, to focus attention the interfaces of the process mapping, and provide an analysis of processes according to the vocabulary of the project (TSENG; QINHAI; SU, 1999).

In general, Leal (2003) says that to begin open the mapping phases of the process it is important the development of a list of activities through semi-structured interviews, which allows the participants of the processes talk clearly and openly about their daily work. The first question is to ask directly to the participant: "*What do you do, exactly?*".

Due to a research in scientific literatures, we could observe an existence of various techniques for the mapping and process reorganization, in which the objectives are

commons, i.e., to identify, to map and to detail the processes with the objective of effective understanding and resolution (KINTSCHNER, 2003).

According to Oliveira, Montevechi and Marins (2007), it is essential to "filter" the appropriate technique for each situation where it is necessary to use the process mapping. Leal *et al.* (2003) say that the main techniques of process of mapping are: flowchart, Integrated Computer Aided Manufacturing Definition (IDEF), Unified Modeling Language (UML), service blueprint and service map. It was giving a special distinction for the techniques of IDEF and flowchart.

The process mapping techniques have been used to stand the process stages of computer simulation (RYAN; HEAVEY, 2006).

The flowchart is a formal graphic representation in which the symbols are used to represent a logic sequence of a program, work or manufacturing processes, organization structure, or similar formal structure, such as operations, data flow direction, and equipments for the definition, analysis or solution of a problem. They a sequential flow of actions, but it doesn't give support to division of activities. The flowchart pattern is possibly the first process of representation. There has been frequently used for a long time, even though there is not an accurate date for its origin, the Illustration 1 is an example of how to use the flowchart (AGUILAR-SAVENA, 2004; MAYER; WITTE, 2009; CHEN; FENG, 2006)

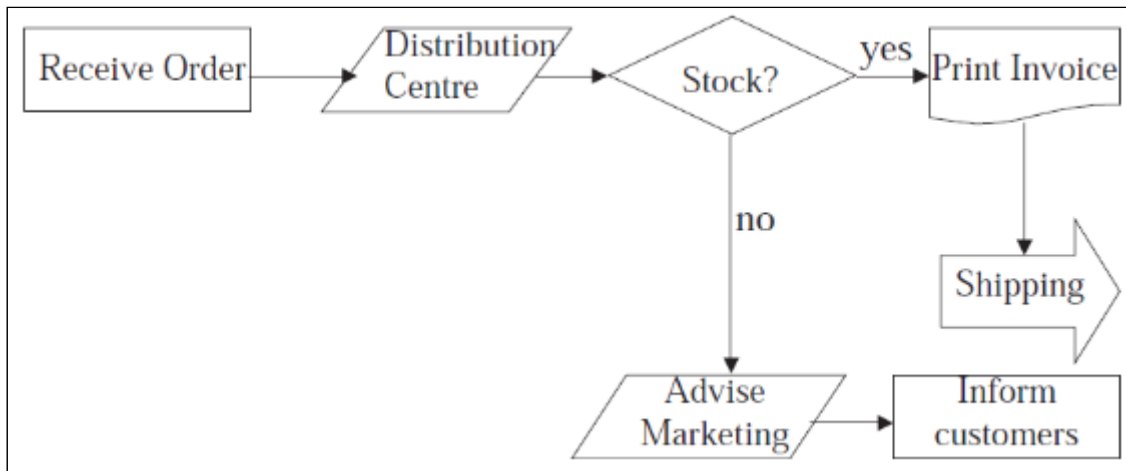


Illustration 1: flowchart

Source: Aguilar-Saven (2004)

The Integrated Definition for Function Modeling (IDEF) is a family of methods that supports a paradigm able of lead with the modeling necessities of a company and its business areas (IDEF, 2009).

According to Aguilar-Saven (2004), the IDEF family is used according to different needs. The most important models are: IDEF0, IDEF1, IDEF1X, IDEF2, IDEF3, IDEF4 and IDEF5. However, to model business processes, the most useful versions are IDEF0 and IDEF3, being explained as follow.

Aguilar-Saven (2004) describes the IDEF0 as a technique of modeling used to structural development, graphical representations of processes or complex systems as the businesses. It is used to specify patterns of function, the "what should I do?" Patterns. Those show the high level of the activities of a process, indicating the main activities and the input, output control, and mechanisms associated to each important activity, being the most popular process of modeling of the market, Illustration 2 shows the layout of a process in the IDEF0.

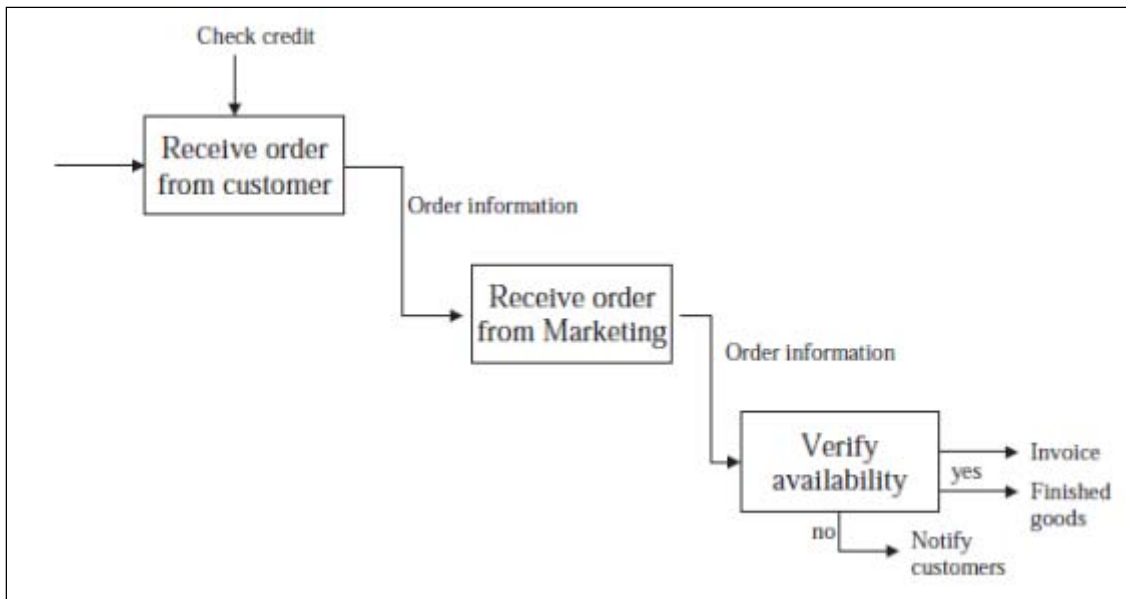


Illustration 2: IDEF0 diagram of graphic components

Source: Aguilar-Saven (2004)

3 CASE STUDY

The company studied employs about a thousand professionals in the city of Bauru, SP, distributed between the factory unit, which has a built area of 40 thousand square meters where there are two production units, named Unit I and II, and there is a distribution center that is approximately 11 thousand square meters, where all the production is taken to.

In Unit I, they produce calendars, office and house products and, secondary notebooks; this occurs because they installed an equipment in the unit that automates the notebooks production. In unit II, they also manufacture notebooks.

In 2004, the company was purchased by a U.S. group that manufactures paper containers, office materials and special chemical products. The company in Brazil adopts a production system with classical model features, can easily be identified for features like: using layout linear, production of great lots, low level of productive

flexibility in relation to the market variation, a variety of finished products relatively high and specialized employees.

The semi-structured interviews done with the industrial manager, factory units managers and with the PCP manager, allowing to observe the reports of production order, inventory and the production lead time. The in-loco visitations were done with the supervision of some of the staff.

Today, the company works with four product categories, each one having particularities in relation to the inventory and are classified like:

- a) *agendas*: these products have validity term, thus, they are dated, they are seasonable and because its productive peak is from April to December, the production will grows gradually;
- b) *School*: because they are sold for school returning, they are seasonal and their productive peak is from July to December;
- c) *Office*: for small companies, self employed professionals or offices. They don't have a season, and are produced almost the whole year; and
- d) *House*: these products have a specific distinct characteristic for house hold usage. They aren't seasonable, and are produced almost the whole year. It is a market niche that is very explored in the United States and that has been developed in Brazil where a company is developing some products and doing benchmark to detect its acceptance level in the Brazilian market.

The company has a capacity to manufacture about 700 thousand notebooks every month. To cover the school return season in the beginning of the year in Brazil, which is from January to March, the production starts in September. When the school year

finished, all the production is focused to attend the demand of countries in the North Hemisphere.

The study delimitation in the company will be school products. It is an assembly line, which is seasonable, and the productive system adopted is the Make-To-Stock, the manufacturing process of the model product notebook will be analysed and how the flow mapping of the value chain is defined.

The production strategy employed is the one to Make-to-Stock, as the notebook product undergoes with school period season in the beginning of the school year and the productive capacity cannot attend all the order requests that will be done during this period.

Based in the season time, in the productive capacity and in the information system, the board along with the support of the managers in the marketing, sales, production, finances and supply areas formulate the demand forecasts.

Two procedures to plan the production are used: the first one is through the material planning in process, inventory, production routings, and production time. The second one is through the relative dedication from the lines to a specific product category.

The production area has a staff of Times and methods production methods (TMP) that participates in the products development. The objective of this team is to evaluate the product technically, and together with the marketing staff, develop it, creating a study of viability, so if it is possible to produce this product inside the script, how much its cost will be, what will the losses and what materials will be used.

The TMP team has developed new procedures with the intention to reduce the losses, avoiding with this that a product leaves the marketing area with a high level of loss which can be caused by time, setup, script and raw materials.

All possible product compositions are documented so the costs can be evaluated, to conceive a measurement pattern. This documentation is composed by the product design, materials list, machine efficiency, setup time and time for production of a specific limited product lot, but we can conclude that the process mapping is done superficially and by the flowchart.

The product notebook having a high volume of raw material, there is only a few weeks of raw material in inventory and in process, using the FIFO concept to paper raw material, corrugated cardboard, varnish and ink and LIFO to the other raw materials (wire, plastic, accessories), as much in the inventory management as in the bookkeeping department. Because there is a very high quantity of material and because there is not an area of the proportion for storing, the inventory coverage varies between three to six weeks.

Yet in relation to the finished product, they work with the production for inventorying which is stored in the distribution center, adopting the FIFO concept, the finished products are packed in boxes, pallets so they can be put on shelves that should be tagged as a way of identification.

The PCP team has the main function to analyze the amount of raw material existing in the inventory, the productive capacity, what should be produced and for how long, starting the purchase for raw materials. There is a team dedicated to forecast the sales, they observe the market and makes sales forecast for the coming month, and with this information they determine how much will be produced.

From the general sailing plan, the PCP plans the production, capacity analysis, critic resources analysis, critic material analysis and the best script analysis, setting a planning with shorter terms, in other words, a monthly planning, as a way of volume the measuring produced that will mark out the volume of the raw materials obtained, the time of the machine not working because of product lack, setup, maintenance, in other words, if the time spent for the productions of notebook wasn't high. This verification is done weekly.

The monthly planning is dismembered in four weeks so it can be given to the factory the weekly planning when the material has already been used, the manufacturing router defined and the possible backlash.

The flow mapping of the value chain can be observed in the macro way in Illustration 3, in which it is possible to observe in a generically all the processes that occur and which ones are its interconnection with its respective time of performance.

Showing how the production process occurs, with a fewer more detail, in this process they try to show the production time and the inventory volume in process that will influence directly the product volume daily finished, because the production the production goals should be reached every day.

The process for manufacturing notebooks is done in Unit II, considering they are equipments with distinct productive capacity and flexibility. All the provisioning is done manually, being the spiraling process automatic, happening right after the quality control and the packing of the notebooks in plastic packages and then into boxes. Each plastic package can have up to five notebooks and each box up to six packages.

In Illustration 4, it is describe the flowchart model using a symbology used by the administration, which was adopted in the beginning of the research by the company that

presented some weak points, for example: an engineer difficulty understanding, lack of standardization, difficult in understanding key processes, etc.

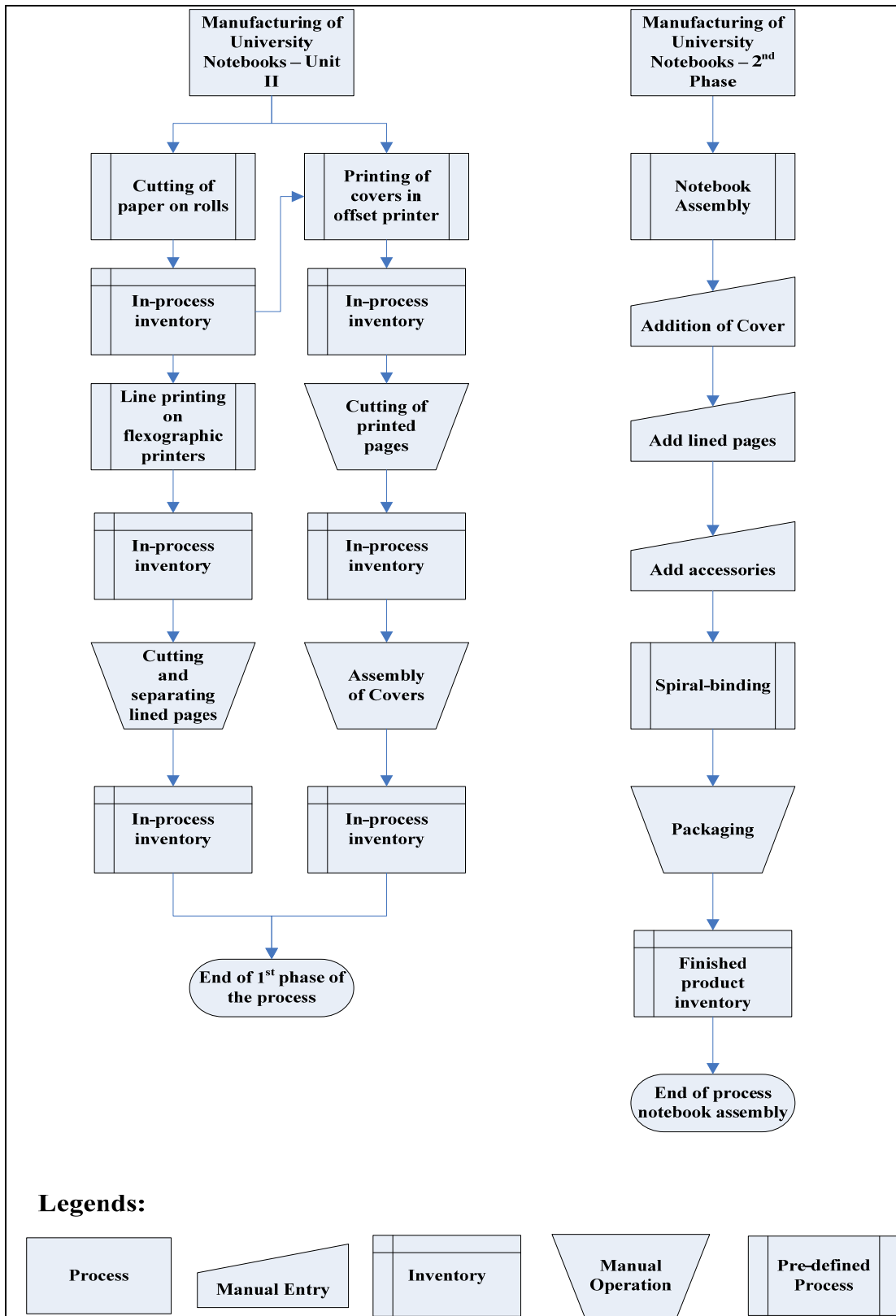


Illustration 4: Flowchart of the process of notebook manufacturing

In Illustration 5, a model of flowchart is presented using a symbology used by the engineering, which is today adopted by the company that presented some weak points, like: difficulty in understanding the lack of standardization with other models developed for the team, lack of definition of key processes, etc.

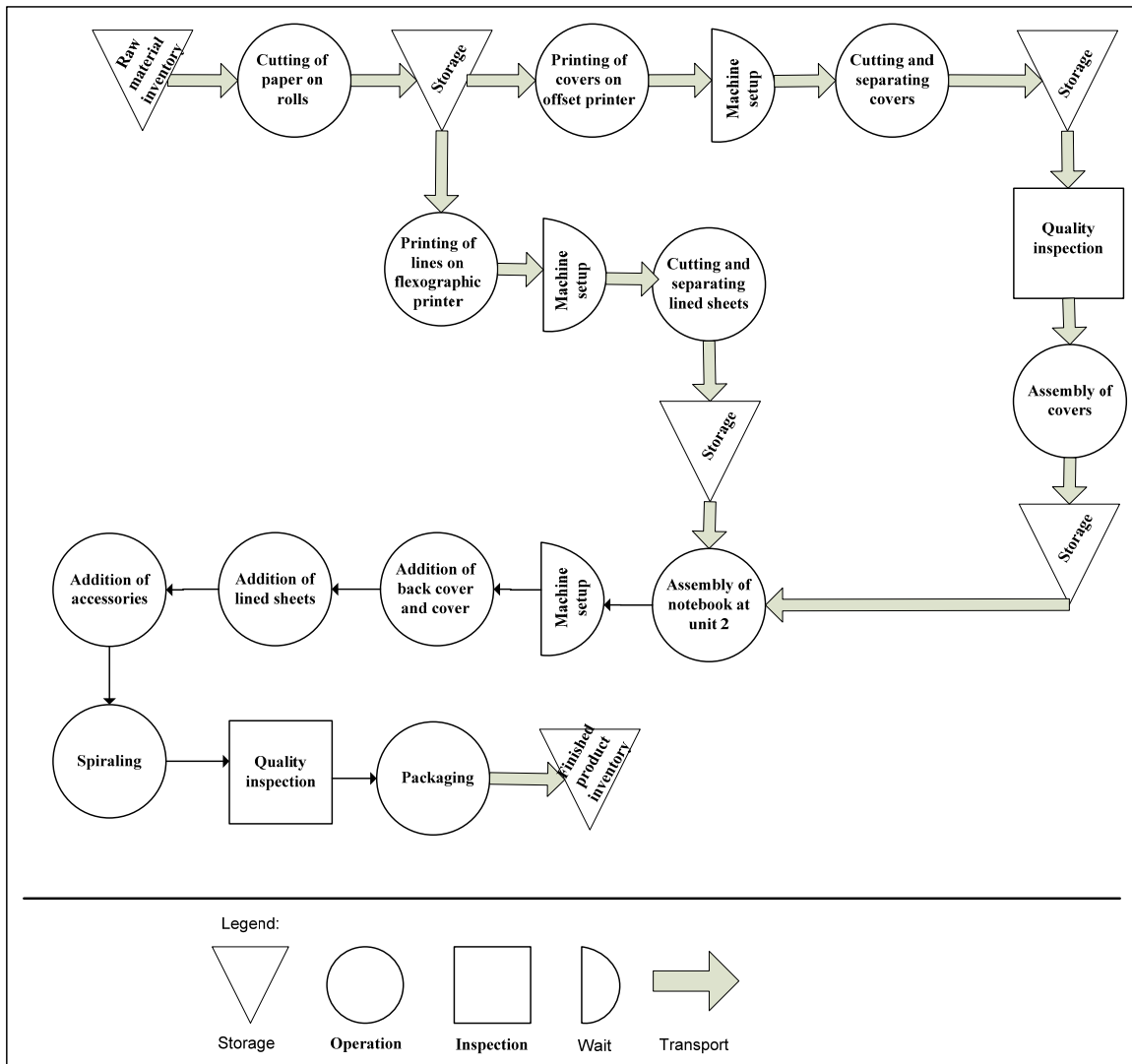


Illustration 5: Flowchart of manufacturing process specifications

In Illustration 6 is described by the IDEF0 a way how all the process of manufacturing occurs, which are the controls that can influence and which are the elements involved in each one of the processes.

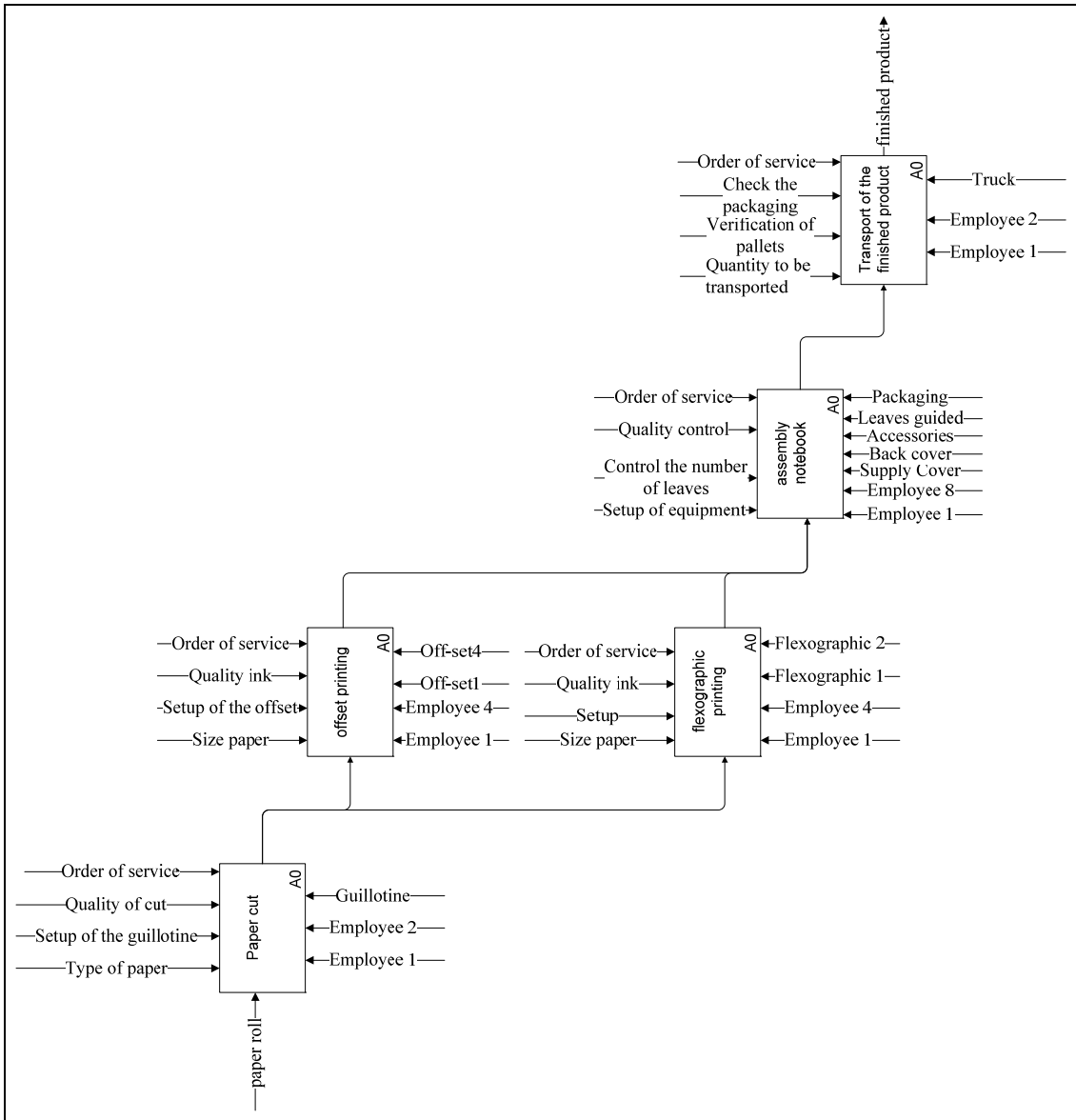


Illustration 6: modeling of notebooks manufacturing process in Unit II according to IDEF0

In each of the processes, there is a work service in which it is possible to identify and follow the raw material in process. Those orders have their origin and destiny, shift data and machine data that was changed and/or will be changed. Those some new information come with the raw material during all the transformation process which can be considered as an informal Kanban control.

The company did not have flow map of the value chain and therefore of the modeled processes after the IDEF0, because of the employees involved in this process that do not master the tool, consequently they cannot show total confidence to the management and the direction how to use it.

4 CONCLUSION

From the moment the company decided to analyze the viability and the profits that they could have with the adoption of a formal model of the flow productive process modeling, they could make reflexions about the inventory volumes of the raw material and in process, as well as the size of the production lots and what their daily production frequency is. This reflexion was made to a specify product model as a way to evaluate its viability and observe the results.

After the flow productive process modeling was done, emphasizing the IDEF0 model to perform and analysis between the modeling using the flowchart method according to the symbology adopted by the engineering and administration areas and the IDEF0.

With the analysis between the flowchart and the IDEF0 was observed that the IDEF0 model will facilitate the understanding of the processes, allowing a level of details related to the controls and machinery and learn if they are shared or not between other processes, to know which processes are inter-related and what its criticality level.

The IDEF0 has also shown interesting because it allows the operations standardization, i.e., after a process mapping already elaborated and in use that can be used as a model to future process mapping, besides facilitating the remodeling of the processes mapping existing.

The company will be able to reach a level of detailing of the productive process of the product model being studied, which may observe the controls, machines, the entries, and departures inside the operational function that aggregate value, the ones that do not aggregate value, but are necessary to the ones that really do not aggregate value.

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