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Adding Value by Handling of Logistics: Study Case in Algeria

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Abstract: *The current economic climate drives firms to look for solutions to improve their performance, through the reduction of the "Non-Added Value" (NAV) time and improving the "Added Value" (AV) tasks. This challenge must also apply to Algerian firms who need to enter the global competitive market. In this context, this article presents a methodology integrating a management of the logistics with an application on a local SME. Indeed, logistics is an essential function of modern production and distribution systems and creates AV for the firm. Moreover, logistics is also a system of product flows and information flows, which determines the enterprise performance and its competitiveness. The proposed approach combines methods following both tools of information flow management and lean manufacturing. Thus, the flow chart maps the firm's flows, the Ishikawa diagram identifies the causes of malfunctions and the 5S method establishes a plan of improvements. The application of the methodology on the considered SME gives all steps of the approach, improving the physical and information flows of this firm. So, the added value is evaluated giving the fluidity index of flows and the final results show an increase of this performance measure by reducing unproductive time. As the methodology is based on a generic model, the complete approach offers a set of tools to manage the information flows for ensuring an added value growth to improving the competitiveness of any SME.*

Keywords— Logistics; Added value; Information flow management; Lean manufacturing; Fluidity index.

1. INTRODUCTION

If the Taylor-Ford model aimed at reducing costs by acting only on volumes, today, the firm must ensure its sustainability in the face of a changing environment and competition. For that purpose, the firm must rethink its production involving "Added Value" (AV) tasks and "Non-Added Value" (NAV) tasks; some of which must be systematically eliminated according to the new modern industrial vision [1] and must seek competitiveness lever by improving its management. The management action could logically be at the level of its logistics chain because it is one of the major functions of current production and distribution systems, for creating AV. The logistics refers to physical operations such as transportation, warehousing, handling and packaging, which generate an important part of the value of final products. In other words, the logistics is a system of product flows and information flows which it is necessary to manage while ensuring their quality, reliability and reactivity at the lowest cost of the process [2]. It is considered as a strategic function and creates added value for the firm.

This article presents a logistics management approach to improve the added value in the firm that determines its performance and competitiveness. Our approach consists in combining methods around information flow management and lean manufacturing. As Algerian firms must be competitive, the proposed approach was applied to a local SME (Small and Medium-sized Enterprise), specialized in leather store, to improve the physical and informative flows.

The second section is dedicated to concepts concerning the logistics. The authors present in the third section the analysis of the AV following a methodology in three stages. Finally, the approach validation is explained in the fourth section through its application on the considered SME. The fluidity index is evaluated following the AV calculus and the obtained results allowed to increase the performance enterprise by reducing the unproductive times, improving the competitiveness of this firm.

2. BASIC AND CONCEPTS

Logistics is defined as the planning, execution and control of movements and deployments of people or goods; this function supports activities related to these movements and implementations, within a system organized to achieve specific objectives [2].

Logistics can be defined as all the activities involved in the flows of raw materials, intermediate products and services that support integrated or distributed production processes in the space so as to make the production of these processes available to the public, final or intermediate consumer at the right time, in the right place and at the lowest cost [3]. Logistics is therefore more and more about improving flows over an extended supply chain.

According to the Institute of Materials Management and the Institute of Logistics and Distribution, "The supply chain is a sequence of events to satisfy customers. It can contain the activities of supply, production, distribution and waste management, with associated transport, storage and computer technology. But, at the same time, it will give a synthetic definition: "Logistics is the fact of positioning resources according to time [4].

2.1 Logistics flows

The supply chain is defined as a global network of organizations that work together to reduce costs and speed the flow of materials and information between suppliers and customers. The goal of the supply chain is customer satisfaction [5]. This definition emphasizes the importance of the cooperative aspect to achieve better overall results and therefore the need to define and implement a sharing process [6].

There are two types of logistic flows [7], internal and externals flows:

- Internal logistics flows (workflows) circulate within the firm. This is the movement of materials and components in the manufacturing network. These flows consist of the intermediate processing chain, machining, handling operations and storage operations.

- External logistic flows called supply flows (upstream flows). This involves the movement of materials and consumables from the supplier's store to the customer's store; it also concerns the distribution flows (downstream flow) and the circulation of the finished or semi-finished products from the customer warehouse to another client firm. The external logistics flows are all constituted by a packing, handling, transport and storage operation chain.

Besides, a supply chain can be apprehended from the process point of view, where two basic processes [8] are identified, a production process (covering production and supply planning, manufacturing and inventory management) and a distribution process (covering the planning and management of distribution networks and the transport and delivery of finished products).

2.2 The added value in firm

Increasing business performance requires optimizing flow management, giving by the logistics mastery. In other words, it reduces the time of production or transport thus allowing significant financial gains. Logistics is now a strategic issue and the AV is a major factor in the firm competitiveness, regardless of its size or specificity. In this context, non-AV activities need to be eliminated and this aim is achieved through the Lean concept [9]. Indeed, the elimination of waste (Muda in Japanese) is at the heart of the Lean approach. Waste is defined as an action or situation that does not create value for the customer [10]. Seven types of wastes [11] are identified. Among these wastes, overproduction is considered by Ohno to be the most problematic, since it generates and conceals all other types of waste. Thus, overproduction necessarily creates surplus stocks and this excess inventory inevitably hinders continuous improvement.

As with production, Lean Manufacturing principles also adapt to logistics. Lean Logistics aims to eliminate all wastes in the supply chain [12]. This translates into improved productivity, reduced inventories, reduced floor space, reduced overall logistics costs and improved service levels (on-time delivery) [13]. Inside logistics, we have established that there are also seven areas of waste.

- Handling disproportionate, movements / movements of quantities larger than necessary,
- Empty Transport,
- Unnecessary operations such as traveling /unnecessary and / or redundant transport, repackaging, etc.,
- Unnecessary movements and human movements,
- Stock accumulation and outstanding
- Non-conforming Deterioration of goods, errors in picking,
- Inoccupation of machines.

3. PROPOSED METHODOLOGY

Logistics is defined as the activity that seeks to control the physical and information flows of an organization in order to make them available and manage the resources corresponding to the needs. It remains a key element of the firm's strategic approach as it is a cross-cutting process that concerns all organizational functions. Its objective is to optimize physical flows and daily information (in the short term) and to put in place action plans to optimize production and storage parameters (medium and long term).

In this context, we propose a methodology based on a model integrating three stages, where each step is supporting by specific tool. The first one analyzes the current state, following by the identification of malfunctions and corrective actions and last, the analysis of the future state is done.

3.1 State analysis with the flow chart

The approach consists in analyzing the physical and informational flows of the manufacturing process of a product by comprehensively identifying the different stages of process realization. Each step of the process can create added value or non-value added. In this context, we recommend the flow diagram [14] which is an analytical tool aimed at improving transformation processes.

The purpose of flow analysis is to identify and improve the efficiency of the current process by categorizing each step as an Added Value and non-value added task. The flow analysis is standardized by the use of symbols [15] to qualify the constituent steps of the process through the implementation of both the flow graph and the flow matrix. The flow graph defines the sequence of tasks and the flow matrix quantifies the time dedicated to each stage but also the traveled distances, the quantities of material transformed, the involved weights and the number of impacted operators.

The process improvement consists of identifying the actions to be taken to simplify the process by eliminating the wastes that pollute it. To do this, each step is analyzed in order to evaluate whether it is relevant to eliminate it, to combine it or to switch to another step or to simplify it. The future process is then constructed with the same symbols and the parameter improvement ratios presented above are determined.

3.2 Identification of malfunctions with Ishikawa diagram

In a context of competitiveness of the firm through the elimination of wastes, the identification of dysfunctions is fundamental and the diagram of Ishikawa [16] or diagram of the 5 M remains one of the most known and most used quality tools. It is a graphical tool used to understand the causes of a quality defect and to analyze the relationship between a problem and all possible causes. Causes that may be causing a problem are classified into five families: Manpower (Workforce), Mother-nature (Environment), Methods, Material and Mean. Each cause family receives other causes depending on the level of importance or detail. It is an excellent communication tool to explain a phenomenon and plan the implementation of corrective actions.

3.3 Corrective actions with the 5 tool

The 5S (Seiri, Seiton, Seiso, Seiketsu and Shitsuke) method is the first tool to implement in a Lean Manufacturing approach. The 5S [17],[18] eliminates what is useless, defines a place for everything, cleans, defines the scales and procedures needed to finally audit and measure improvement. It allows a better control of the environment in the field [19]. It is also a way of setting up a participative management by making operators responsible for the organization of the firm [20].

The main objective of this basic Lean tool is to change attitudes and set in motion a policy of continuous improvement. The application of 5S builds a solid foundation for a Lean Manufacturing approach [21],[22].

4. CASE STUDY

The complete methodology is applied on an Algerian SME. The concerned firm is a limited liability firm which manufactures and markets leather goods, natural and synthetic leather. Its activity field covers the entire territory through its distribution network (short and long circuit, depots and clean shops). Although the firm has been certified ISO 9000, the firm is confronted with various organizational problems at the level of production in particular. The organization and operation of the workshops have become permanent challenges that lead the firm to rethink its organization.

Understanding the need to remain competitive and effective in the face of competition, the firm aims to optimize its business process by avoiding significant investments. To do so, it must first determine its production process and choose the type stages of development that best meets its needs. It must also plan the circulation of physical and information flows. In this context, the main problem is how to improve the manufacturing cycle? This work tries to answer this problematic.

4.1 Organization and manufacturing process

The organization of the manufacturing process is based on the material flow and information flows (Fig. 1) between the various workstations spread over three levels (L): I, II and III. Three stores are located (raw materials, accessories and finished products). Thus, the first level concerns cutting and assembly, the second level is reserved for gluing, assembly and stitching operations and the third level concerns the finishing of the product. There is exchange of products between levels, for example the finished product is transferred to the first level for quality control.

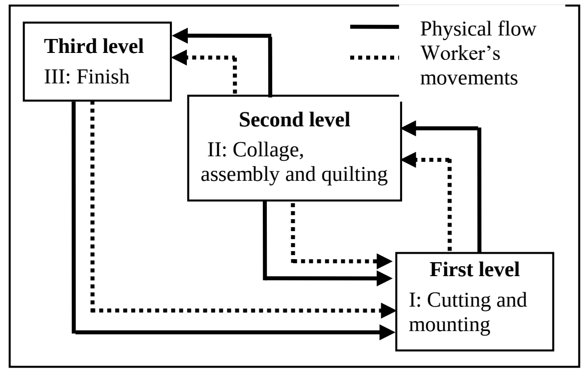

Fig. 1. Organization of flows

4.2 Flowchart for the current state

To encircle better the posed problem, our approach consists in analyzing the various flows of the current manufacturing process which contains 24 stages. We begin with a descriptive analysis of the manufacturing process of the product "school bag", identical for all the made products by taking into account all the stages of production. This analysis allows generating the diagram of progress of the current state (Table 1) where every stage is modeled by a standard (Operations: O, Control: C, Transport: T, Time limit: TL and S: Storage).

The time dedicated for every stage "Operation" is multiplied by 160 what represents the daily production.

The analysis of the flow chart reveals that:

- "AV" operations (O) have 526.01 min as a total time, so the flow index of the duration of the manufacturing process is 54.58%.
- The "NAV" operations (C, T, TL) have 437.62 min as a total time; flow index is 45.42% distributed as follows:

- Control (C): 33.21%
- Transportation (T): 6.08%
- Waiting time (TL): 6.13%

Table 1: Flowchart for the current state

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L	Steps	OP	C	T	TL	S	Time
I	1. Out of stock			●			12
	2. Raw material cut	●					2.83
II	3. Go to preparation			●			6.3
	4. Preparation	●					12.98
	5. Go to quilting			●			5.25
	6. Quilting	●					92.2
	7. Go to mounting handles			●			2
	8. Mounting handles	●					61.4
	9. Go to planing			●			1.83
	10. Planing	●					22.6
	11. Go to machine quilting			●			8.85
	12. Quilting	●					52
	13. Go to post Finish			●			8.55
III	14. Quality Control		●				320
	15. Go to mounting clasps			●			0.17
	16. Mounting clasps	●					80
	17.Go to acronym machine			●			3.15
	18. Initialisms	●					86
	19. Dyeing	●					74
	20. Drying				●		30
	21. Go to packaging			●			10.52
	22. Packaging	●					42
	23. Waiting managing				●		29
	24. Shipping/delivery post					●	-

Following the Ishikawa diagram, twenty malfunctions (Fig. 2) are identified and grouped in the four axes: Methods, Material, Workforce and Environment.

After identifying the causes using the Ishikawa diagram, we apply the 5S tool for reducing wastes: Seiri (S1) to eliminate what is unnecessary, Seiton (S2) to range everything, Seiso (S3) to clean up, Seiketsu (S4) to specify necessary procedures and Shitsuke (S5) to evaluate improvement.

We define an affectation function *A* to assign one or many S to each identified dysfunction D related to Ishikawa axes. Then, corrective actions are proposed that will allow improving functional and organizational processes of the firm and also elimination of NAV tasks.

Function *A* is specified by: $\{Di\}_{i=1\ to\ 20} \rightarrow \{Sj\}_{j=1\ to\ 5}$. So,

- For Methods axis, *A* is defined as:

- *A*(D1)=*A*(D3)=*A*(D5)=*A*(D8)=*A*(D9)={S1,S2,S3,S4,S5}

- *A*(D2)=*A*(D4)=*A*(D6)=*A*(D7)={S4,S5}

In this case, corrective actions are: awareness and training workers, work reorganization, tagging zones, control waste quantities, sharing and circulation of information by introduction of a computerized tracking sheet and dedicated procedures.

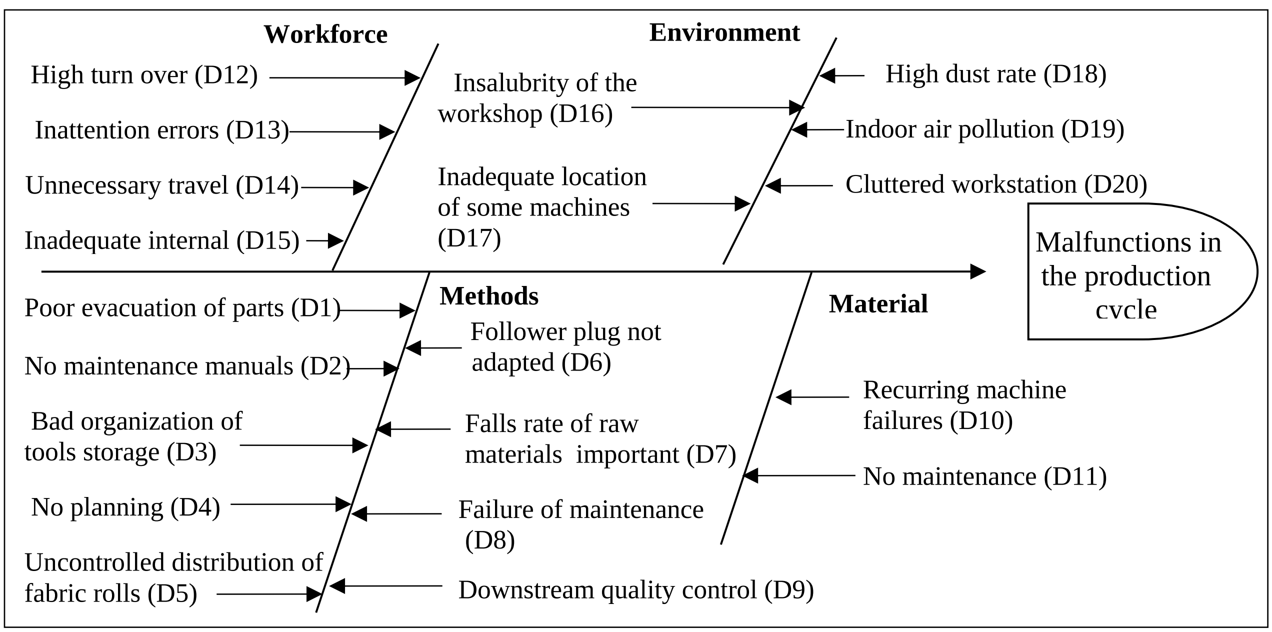

Fig.2. Ishikawa Diagram

4.3 Malfunction identification and proposed corrective actions

- For Material axis, *A* is defined as:

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A(D10)=*A*(D11)={S1,S2,S3,S4,S5}

For this axis, all S are affected and following the 5S definition, setting up an auto-maintenance is necessary to correct malfunctions.

- For Workforce axis, *A* is defined as:

- *A*(D12)=*A*(D13)=*A*(D15)={S4,S5}

- *A*(D14)={S1,S4,S5}

To reduce wastes, the main corrective actions concern an adequate circulation of information and a reorganization of workshops. Using computerization can help achieve these goals.

- For Environment axis, all S are affected to each (D) as :

A(D16)=*A*(D17)=*A*(D18)=*A*(D19)=*A*(D20)= {S1,S2,S3,S4,S5}

To improve environment quality for workers, the establishment of ventilation system, wearing appropriate masks and work clothes.

5. ANALYSIS OF RESULTS AND DISCUSSIONS

5.1 Flow diagram of the future state

After these two steps, the last one maps the value flows and then implements the appropriate action plan. So, considering the propositions of corrective actions, the flow diagram of the future state (Table 2) is developed. The analysis of flow chart and flow mapping for the future state reveals the following:

- The flow index has risen to 73.7% for "AV" operations;
- "NAV" transactions give a melt index of 26.3%.

5.2. Evaluation of the fluidity index

The firm reorganization aims at a contribution of efficiency, and durability and a time saving. Indeed, lasting improvements are possible thanks to formalization, verification and possibly reorganization. Moreover, given the reduction of 50% of the workforce and the financial means to invest in the purchase of new machines, this firm will act on waste (time without AV).

The addition of quality control at each level will make it possible to detect errors from the outset, which will significantly reduce the costs compared to the final control.

The grouping of melt indexes by level (Fig. 3) before and after the introduction of corrective actions reveals that the melt index for "AV" operations has increased for levels 1 and 3, whereas it decreased to level 2.

Table 2: Flowchart for the future state

L	Steps	O	C	T	TL	S	Time
I	1. Out of stock			●			9
	2. Raw material cut	●					2.83
	3. Quality Control		●				1
II	4. Go to preparation			●			4.8
	5. Preparation	●					12.98
	6. Quality Control		●				1
	7. Go to quilting			●			4.15
	8. Quilting	●					80.5
	9. Go to mounting handles			●			0.92
	10. Mounting handles	●					61.4
	11. Go to planing			●			1.83
	12. Planing	●					22.6
	13. Quality Control		●				1
III	14. Go to machine quilting			●			1.05
	15. Final stitching	●					52
	16. Go to finishing station			●			8.55
	17. Mounting clasps	●					40
	18. Go to acronym machine			●			2.35
	19. Initialisms	●					68
	20. Dyeing	●					74
	21. Drying				●		30
	22. Quality Control		●				80
	23. Go to packaging			●			7.22
	24. Packaging		●				42
	25. Waiting for managing				●		10
	26. Shipping post /delivery					●	-

This decrease is explained by the introduction of two quality controls at level 2. Conversely, the flow index for "non-AV" operations has increased in level 1 and level 2 whereas it decreased in level 3. For example for this level 3, the index went from 53.61 to 60.48 for "AV" operations whereas the melt index for "Non-value added" transactions decreased from 89.77 to 85.45.

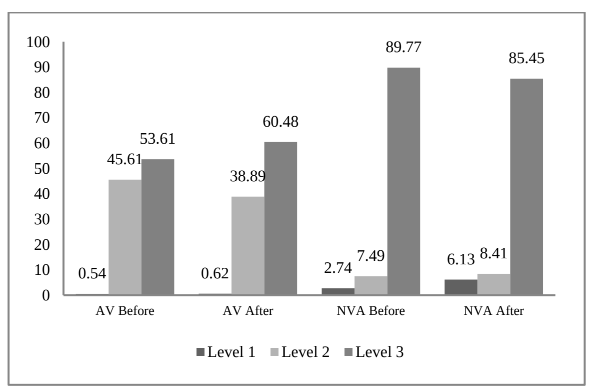

Fig. 3. Flow index by level

Considering all of the operations, the introduction of corrective actions has significantly reduced the time spent on operations that do not add value to the business. Thus, the graphical analysis (Fig. 4) indicates the following:

- The overall creation time of non-value added increased from 437.62 to 162.87, a decrease of 62.78%.

- The overall value added creation time has also decreased by 13.25%. It went from 526.01 to 456.31. This reduction is associated with the time spent on final quality control for each level, to finally bring a better quality product in order to satisfy the customer and to be competitive on the market.

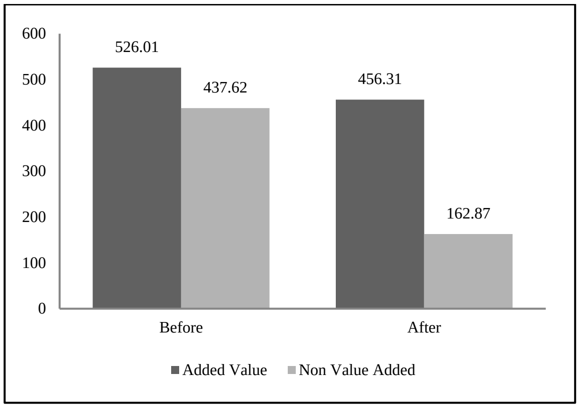

Fig. 4. Overall fluidity index

5.3. Impacts of results

Besides the increasing AV time, it is matter of verifying the effectiveness of the adopted corrective actions and looking for improvement points. Taking into account the economic, environmental social dimension, we propose the following solutions:

- Production is organized in a sequential and fragmented manner on three levels, which leads to dysfunctions. The manager wanted to go from the paper system to a computerized system to follow the production without errors. Indeed, in the paper system, the consequences of the mistakes of some are unknown to others and are passed on to the entire production. Thus, setting up the computerized tracking sheet (Fig. 5) will ensure traceability and a history of all the process operations with their respective Time Elapsed. This helps to avoid errors throughout the manufacturing process, save time and management is more fluid, as shown through the flow index evaluation.

- The introduction of quality control upstream of the "Preparation" stage located at the first level and the "Tapping" and "Final tapping" steps located at the second level, will make it easy to identify defective and damaged products and to engage corrective actions before each step. The hunt for unproductive times is at the heart of the profitability of the firm. Thus, at each level of the factory each worker seeks to improve his work. Therefore, the transition from one level to another is in itself a quality control.

Fig.5. Computerized tracking sheet

- In the continuous improvement spirit, we proposed to the manager to resume the application of the 5S tool that was done before. This method was abandoned because of the workforce reduction (almost 50% in 5 years) and the motivation lack of the workers due to the excessive workload. However, at the end of the obtained results this tool showed its effectiveness by allowing a better circulation of physical and material flows as well as a cleaner working environment by the implementation of adequate corrective actions.

6. CONCLUSION

In this article, we presented the added-value analysis of logistics and its impact on the firm improvement, through a three-step methodology.

We applied the proposed approach to a real Algerian SME specialized in leather goods; we were interested in the internal workings and the firm restructuring in order to adapt a new organization. Following the first step of the methodology, different phases of the manufacturing process are identified using the flow chart. Then using the Ishikawa diagram, we identified the malfunctions generating non-AVs. The 5S tool is applied on these dysfunctions, which led to the generation of a set of corrective actions. The third step consisted in controlling through the corrective actions.

The added value is evaluated giving the fluidity index of flows for the two states, before and after the approach application. The comparing results show the growth of added value and a reduction of the unproductive time. In the case study, we focused on logistics management as adding value. Indeed, logistics in SMEs helps to emerge many practices such as optimizing warehouse flows or monitoring flows.

In future work, we will address the efficiency concept as a performance measure to be part of a continuous improvement process, by removing unnecessary tasks. On the other hand, knowing that the proposed methodology is based on a generic model, its application on others real firms, is under study. Thus, a set of tools to manage the information flows is proposed for ensuring an added value growth of any SME, especially for Algerian firms that have to register in the competitiveness.

The approach thus applied has made it possible to measure the current state and take corrective measures to improve the firm's results. The setting up of the new organization made it possible to identify the dysfunctions, to trace the actions and to improve the work within the factory. Thus, the computerization of the following sheet has contributed a lot to the organization of the plant. Each operation is quickly identifiable, with fewer errors and therefore less time.

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