Root causes analysis by lean tools: case of textile industries in Madagascar

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ABSTRACT

This article concerns the determination of the root causes of the increase in costs, which remains one of the factors of competitiveness, for the case of textile industries in Madagascar by the Lean manufacturing tools. In order to understand all possible causes of the considered problem, a Gemba walk was carried out with a textile company. It is a lean tool that helps to detect and understand the failure causes by direct observation of an activity and by interviewing employees. Other information was collected through internal company documents. These elements contribute in establishing the actual Value Stream mapping and then to list all the problems in each section. This problem list is converted into a problem tree by the five whys tool and this was applied in each section. Linking these sections problem trees leads to the completion of the global problem tree. It is the form that reflects the real aspect of the company's actual situation. In our case, the increase in cost is mainly favored by the delay in production which itself is reinforced by a redundant control, frequent rework, prolonged repair time, frequent breakdown, delay in cutting and excess of work in progress.

Keywords: *Lean, root causes, textile, Gemba walk, five whys.*

1 INTRODUCTION

Competitiveness is measured by factors such as cost, quality, delivery time and flexibility [1]. Because of the high expectation of today's customers, especially in the textile sector, companies must master these variables to have a better place on the competition podium. In Madagascar, companies working in the textile industry are still experiencing difficulties in terms of meeting customer expectation. This because of the losses that appears throughout the production process from cutting to shipping passing through sewing. The traditional method of production is therefore no longer optimal because it limits productivity and efficiency to a lower level and tends to increase the cost. Several factors influence the increase in cost, resulting in a relative loss of competitiveness and a decline in competitive position. In order to control it, it is essential to know what are the main causes that explain this increase in cost? This article brings the proposal of a methodology for determining the root causes of a given problem which in our case is the increase of the cost.

2 LITERATURE REVIEW

Several documents were consulted and served as a basis for identifying the problems. For the cutting section, the supervisor keeps an activity monitoring book. It contains information such as the quantity of fabric cut, the date on which the cut pieces will be sent to the sewing section, the customer, technical information concerning the roll of fabric. The "daysheet" is the first means of communication between all departments of the company. In this document it can be seen the order quantity according to each size and the expected delivery date. Finally, an export report was consulted to learn more about the past and present activities of the company. This one is the most interesting because it contains all most valuable information, in particular the problems that have been encountered in the past. This database constitutes a large part of the company's activity report, so it helps to understand the current situation it is facing.

3 METHODS

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                        ┌──────────────────┐
                        │    Internship    │
                        └──────────────────┘

   ┌──────────────────┐  ┌──────────────────┐  ┌──────────────────┐
   │  Observ activities│  │Interview employees│  │ Consult internal │
   │                  │  │                  │  │    documents     │
   └──────────────────┘  └──────────────────┘  └──────────────────┘
                GEMBA WALK

                        ┌──────────────────┐
                        │ Etablish the VSM │
                        └──────────────────┘

                        ┌──────────────────┐
                        │List problems in each│
                        │     section      │
                        └──────────────────┘

                        ┌──────────────────┐
                        │Identify main problem│
                        │  for each section │
                        └──────────────────┘
                                          5 why's
                        ┌──────────────────┐
                        │Form problem tree for│
                        │   each section   │
                        └──────────────────┘

                        ┌──────────────────┐
                        │Bind all problem trees│
                        │  for each section │
                        └──────────────────┘
                                          Ishigawa
                        ┌──────────────────┐
                        │Etablish global problem│
                        │      trees       │
                        └──────────────────┘
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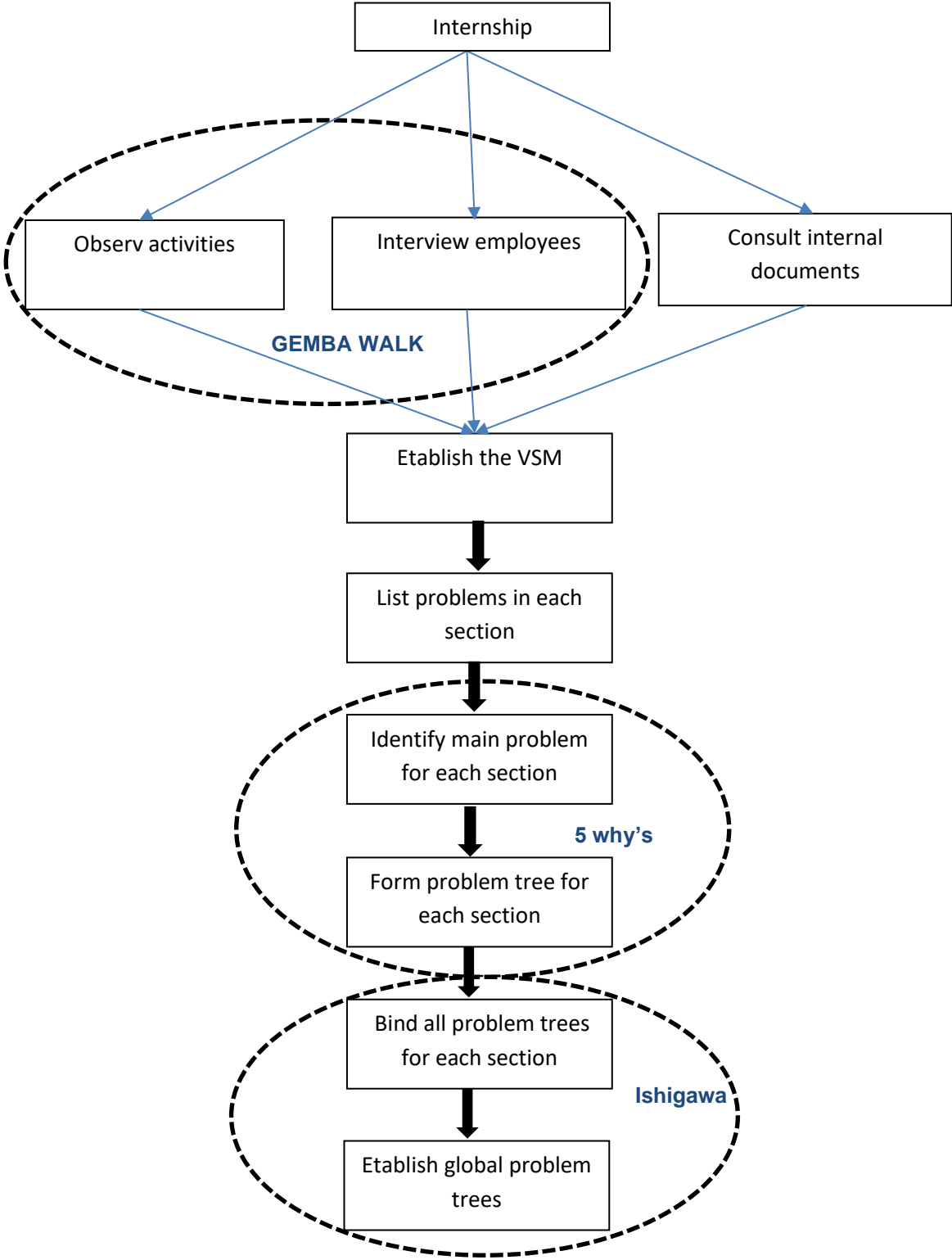
Figure 1. Research process

The search process is shown in the above diagram. It was inspired by the FAST method (Functional Analysis System Techniques) and added some tools from the Lean approach.

The GEMBA WALK: As a combination of Gemba ("the real thing"), Genchi Genbutsu ("go see") and Genjitsu ("real facts"), a Gemba Walk is a very robust Lean tool for observing, interacting, collecting informations and understand how an activity is performed by operators and/or machines [2]. A Gemba Walk is a regular visit to workshops. It is one of the best practices for identifying business issues and communicating with employees so that suggestions for improvement can be identified. The first walks were dedicated to direct observation of the activities without asking the operators questions. The aim is to become familiar with the production process and the technical equipment. The next field visits are intended to interview operators by answering questions following the facts observed. Thus it was possible to create a Value Stream Map that describes in more detail the current state of the company's situation. This also allows to have a listing of the problems in each section [2].

The five whys tool allows each problem list to be covered in a problem tree for each section. It is a tool whose simplicity is less and easy to complete because it does not require any mathematical theory [3]. The principle is simple, by repeatedly using the word "why?" It gives the opportunity to prioritize the problems while finding their connections [3].

Finally, the Ishigawa diagram made it possible to logically link all the problem trees for each section in order to synthesize them into a single global tree [4].

4 FINDINGS

The application of the method described above led to the following results. All list of problem was already converted into a problem trees for each department.

STORE SECTION:
The problems detected are: increase of the necessary time to take the rolls of fabric from the storage boxes, the blocking of financial capital and the blocking of spaces. Indeed, the inefficient layout, the ineffective identification system and the arduousness of the work cause an increase in the time lost during which the rolls of fabric have to be taken to feed the cutting section. For its part, this ineffectiveness of the layout is itself the consequence of the insufficiency of the storage compartments and a poor layout. The lack of handling equipment is the cause of this hardship at work. For the financial case, a certain capital is blocked by too much inventory which is the consequence of a long stock rotation. That is to say, these rollers as raw materials will have to generate income, but they are blocked for a long time and consume space.

CUTTING SECTION:
Excess inventory was observed in cutting section. This is the consequence of overproduction which results in inappropriate planning. Another major problem is the delay. The direct causes are the need of rework (recut), failure to master custom made size and the interruption of the actual cut. An inaccurate dimension or an inadequate roller causes this second time of work. We talk about wrong cut, when the dimensions are not right. It is often caused by operator error following a dark line. Alternatively, the poor visibility of the plot can lead to operator error.

SEWING SECTION:
Three major problems are listed in the sewing section: Delay, the main causes are redundant control, rework, machine breakdowns and unsatisfactory performance of machinists. As in the case of the cutting section, a retouching is necessary when the dimension is inaccurate and the operation is erroneous. In turn, the breakdown is the consequence of the lack of spare machinery or a prolonged repairing time. Often operators are poorly trained, which reduces their performance. An over frequent control causes a delay in production. Excess work in progress is determined by three different reasons, namely: machinery failure, insufficient operator performance and non-compliance with takt-time. The fluctuation of the

production which is also caused by a non-respected takt-time. The objective is to have stable production over time. Implicitly, it is the imbalance of the channel which disturbs the respect of this takt-time.

MAINTENANCE SECTION:

In this section two important issues have been raised. On the one hand, the extended troubleshooting time and on the other hand the repetitiveness of the breakdown. Due to the lack of training, technical skills of the maintenance workers agent is insufficient which is characterized by the slowness of analysis and diagnosis of the breakdown causes. The department's logistics is still unclear. Added to the lack of tools and insufficiencies of replacement machine, we understand why this restart time is so long. The frequent appearance

of malfunctions is explained by the non-application of predictive maintenance. In addition, the parts used are of inferior quality and therefore not very resistant.

The linking and synthesis of these problem trees by section allowed us to create the following global company problem tree. The economic repercussions of the delay in production, and the large quantity of inventories are respectively, the application of penalties and the blocking (immobilization) of financial capital. Instead of transporting by boat, company is obliged to ship product by aviation in order to minimize the delay. Surely too expensive. An increase in cost is then felt.
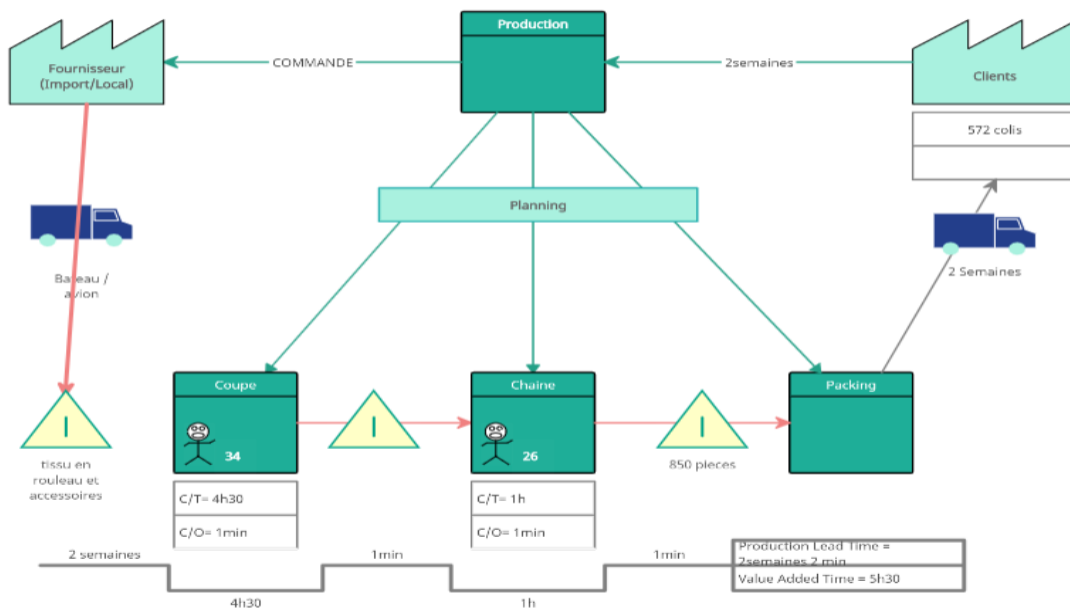
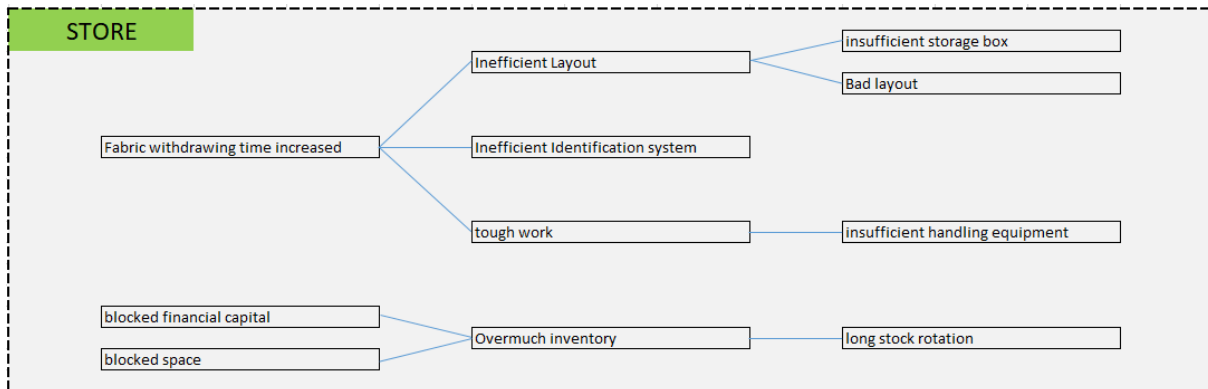**Figure 2.** Value Stream Mapping
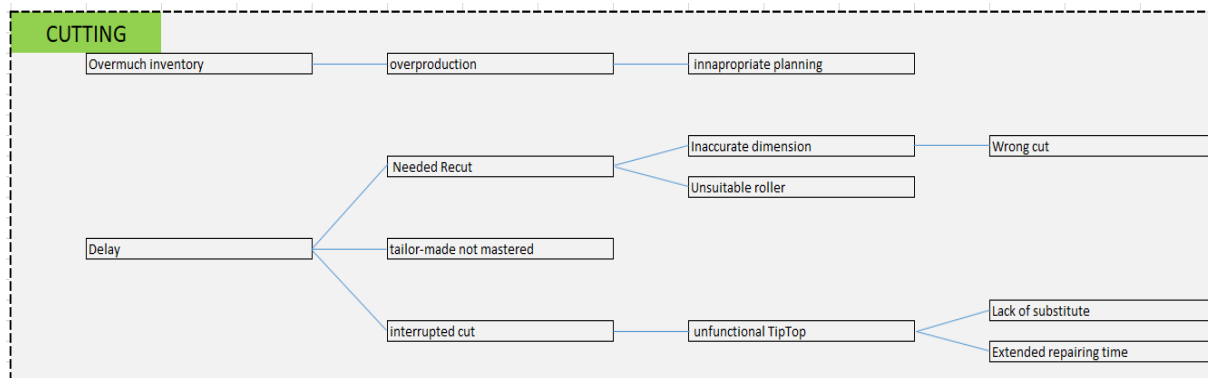
Figure 3. Problem tree in Store departement

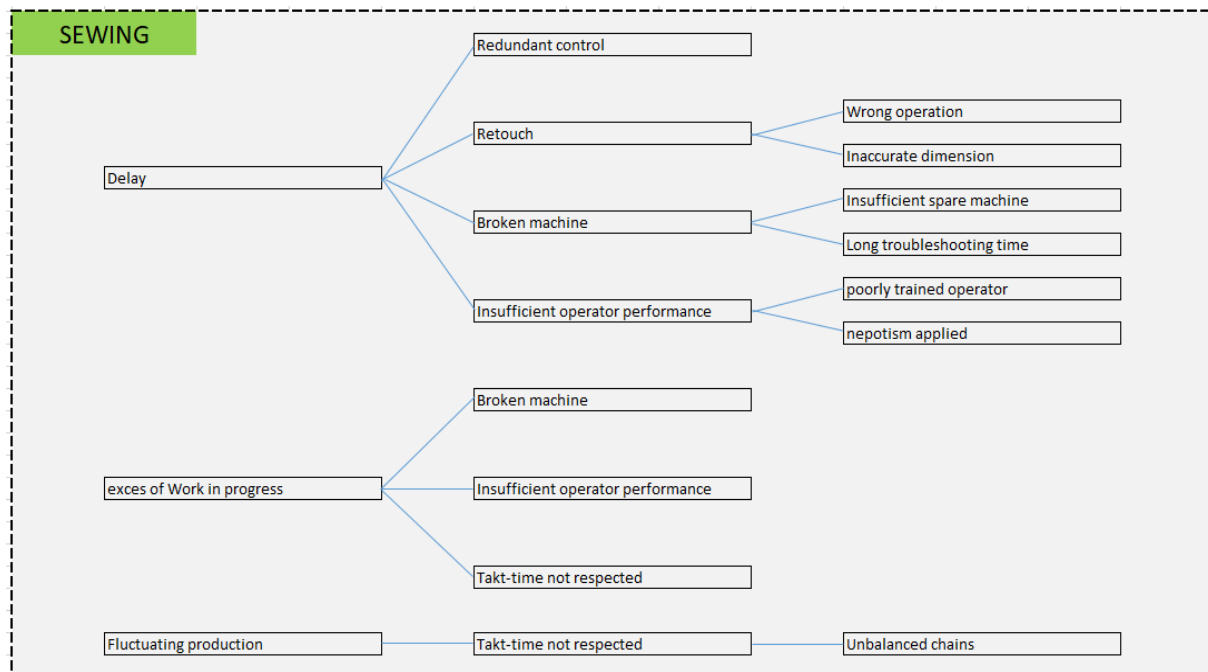**Figure 4.** Problem tree in Cutting departement

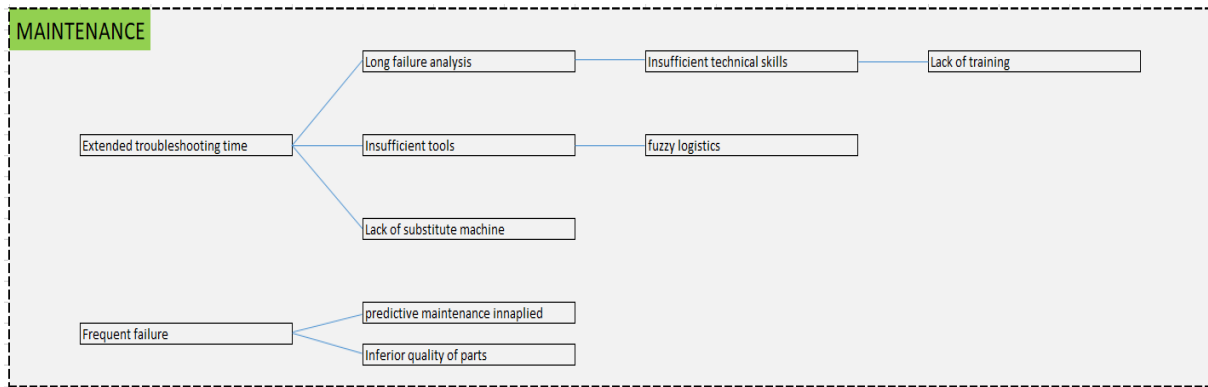**Figure 5.** Problem tree in Sewing departement

Figure 6. Problem tree in Maintenance departement
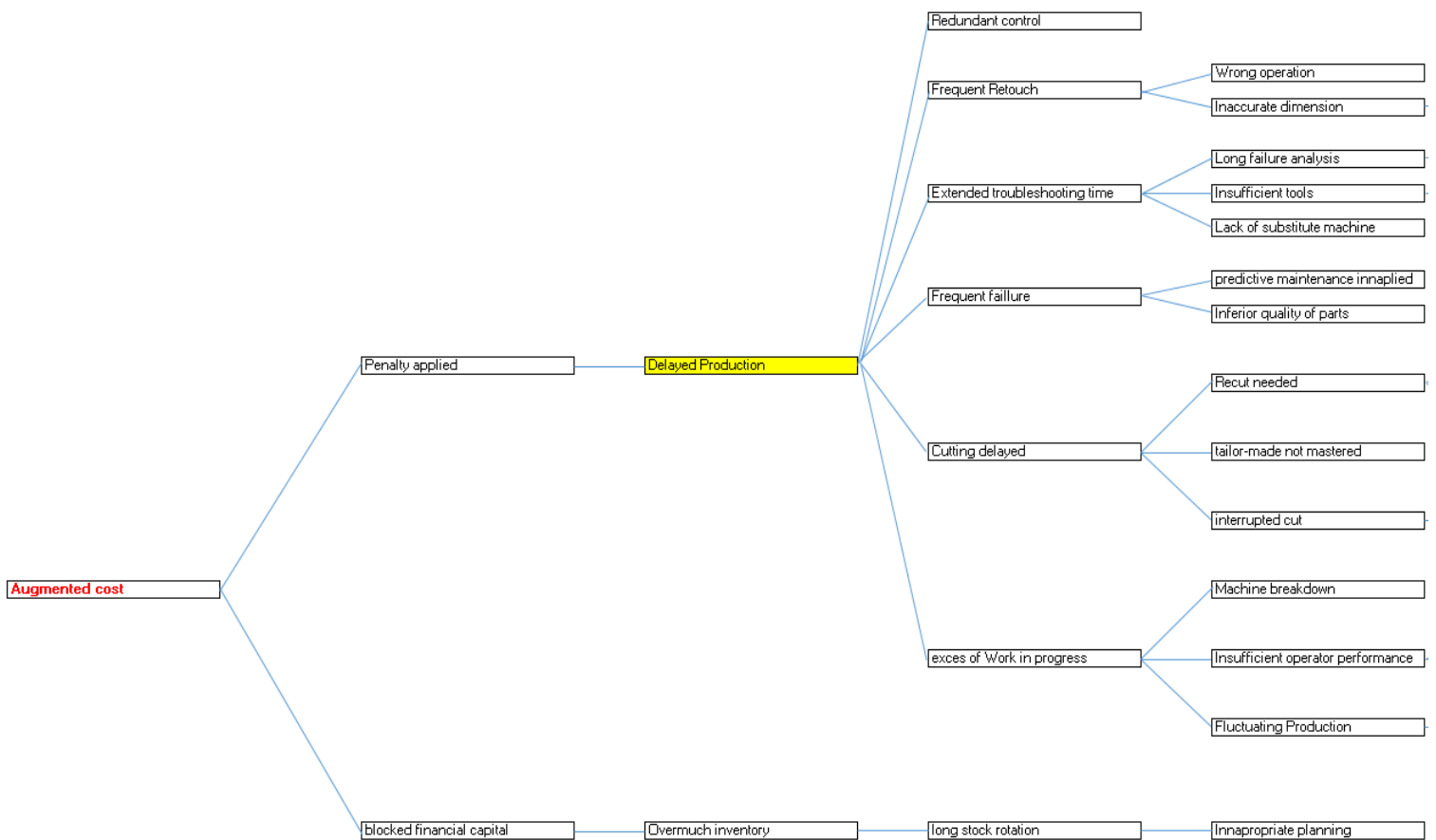

Figure 7. Global Problem tree

5 DISCUSSION

No problem tree has been developed before by a competent persons (experts) for the case of the company under consideration. This is the first version completed so no result comparison is possible. However, after consultation of key peoples in the company, the tree was judged to be 95% accurate and reflects the real situation. According to managers, some additive serious problems cause must be considered and have a major impact in terms of production delays. In particular, the absence of workers who may be without a reason, rest, leave or illness. This lack can be filled and sometimes not, which has a serious impact on production. Another point raised is the excessive variability of the model which also disrupts the production rate. In other words, in a week the order can change several times. This speed of change is not completely controlled by the production operators. Also, adaptability, which reflects flexibility, needs to be inserted in the problem tree. In terms of quality, apart from the inaccuracy of the dimensions, the fabric defect also promotes a waste of time. It should also appear in the frequent retouch element.

In the field of maintenance, some details are given by the manager who nevertheless validated the result. According to him, the problem of the lack of tools is an individual problem. Indeed, complete tools have been allocated to each maintenance operator agent and it is everyone's duty to manage them individually. Some of them steals or loses and does not replace these tools hence the lack. To this is added, the lack of lack of will self-directed learner (to learn by yourself). Finally, this frequency of failure is sometimes the consequence of behavior linked to the dishonesty of the machinists or to false handling during the operation. Thus, a breakdown is not always due to mechanical cause.

In their investigation on *"Lean Manufacturing Model of Waste Reduction Using Standardized Work to Reduce the Defect Rate in Textile MSEs,"* [5] Nicole Barrientos-Ramos, Luz Tapia-Cayetano, Fernando Maradiegue-Tuesta, and Carlos Raymundo developed a problem tree within a textile factory setting. Although the components and structure of this problem tree largely coincide with those found in other studies, there are a few distinctions. Essentially, the conclusions drawn in this article are in line with those of similar research endeavors.

6 ACKNOWLEDGEMENTS

7 CONCLUSION

The problem tree has clarified the root causes related to the increase in costs in the company. Being the first version developed, the tree in question deserves a slight adjustment to be more precise. Brief, we see that it is the non-conformity of the delivery time which is one of the most decisive factors among the other problems encountered. Once this difficulty is resolved, the company can save a considerable amount of its turnover while at the same time improving its competitiveness. It is in this perspective that our future research leans towards this fairly frequent production delay problem which itself is the effect of six other direct causes.

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