Proceedings of the 2014 Winter Simulation Conference
A. Tolk, S. Y. Diallo, I. O. Ryzhov, L. Yilmaz, S. Buckley, and J. A. Miller, eds.

WORKING CAPITAL REDUCTION IN A COMPLEX SYSTEM THROUGH DISCRETE-EVENT SIMULATION

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ABSTRACT

Today more and more companies want to improve their working capital management. However these companies have become more complex. The purpose of this work is to demonstrate how Discrete-Event Simulation can support a working capital management project through a real case study. This work has been done on an aeronautical subcontractor: the issue was (i) to gather knowledge and data to model and calibrate the model (As-Is situation), (ii) to predict the future system's behavior (To-Be situation) and its working capital for the next 2 years, and finally (iii) to submit improvements with the clients. This approach was difficult to follow because of the complexity of the system: nearly 50 activities, 15 external subcontractors, 1,500 references and 120,000 planned orders for 3 years. This study enabled to reveal dysfunctions in order to submit improvement plans.

1 INTRODUCTION

This case study deals with an aeronautical subcontractor that wants to improve its working capital management for the next years with a consequent output rise. Some investments had already been engaged and they knew they had to invest more to improve.

The system here was complex due to flow volumetry: 50 activities, 15 external subcontractors, 1,500 references, 120,000 planned orders for 3 years, lots of operations in the routing, common activities for numerous references, non negligible scrap…

Firstly we tried to define macro routings to simplify the flows (Figure 1). However in this case it was not possible because of the numerous operation sequences and the different cycles and setting-up times. In order to manage this complex system, we used a Discrete-Event Simulation software. This tool enables to manage numerous data with a dynamic dimension (by adding variability and having output data frequently) and with an economic point of view.

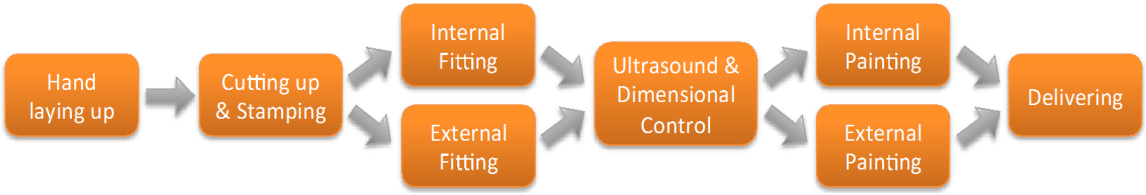

Figure 1: Flowchart of the main operations

After a long treatment of input data, we calibrated the model to the As-Is situation in relation to the working capital we had (1 one year data in the past) with a 92% accuracy (the same ratio each month and working capital in simulation is lower due to the hypothesis chosen). Then we had several simulations with investment they had already made and others we suggested.

2 RESULTS

Without improvement, there would be a 20% rise in the working capital value (from 4.5M€ to 5.5M€) in a two-year horizon ("As-Is Situation" in Figure 1). That is why 20 scenarios were suggested to choose future improvement plans. These solutions dealt with reducing subcontractor lead time, changing flow management, buying critical resources, insourcing or outsourcing activities…

"To-Be Situation" in Figure 1 shows the final improvement plan adopted by the customer with a 34% average working capital reduction.

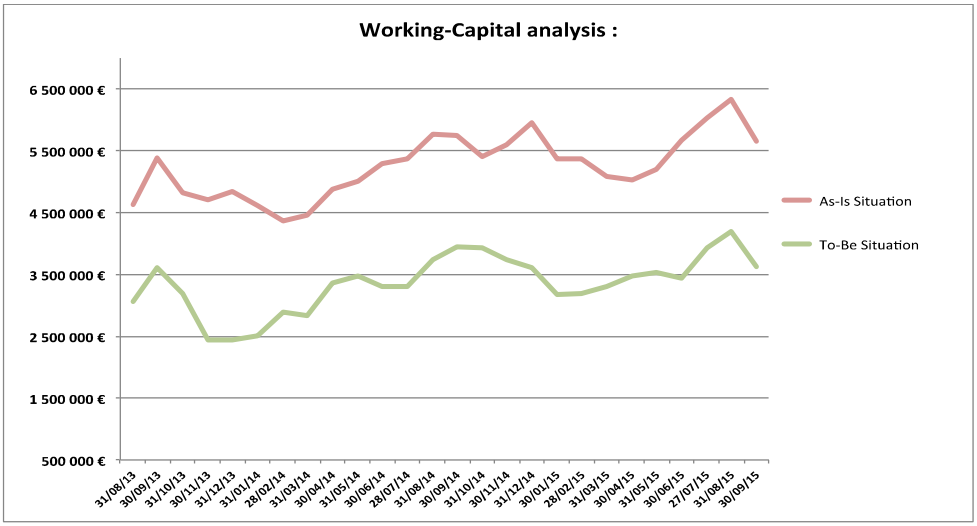

Figure 2: As-Is and To-Be Working Capital scenario

3 CONCLUSION

This project enabled to approve investments already incurred and to start up an improvement plan. It was really appreciated by the customer due to the initial problem complexity and the economic dimension brought by Discrete-Event Simulation. Furthermore Discrete-Event Simulation enables to integrate all services in the project to choose improvements for the next 2 years (it is more meaningful for a financial director to be aware of working capital reduction than the corresponding lead time reduction for a product).

The main complexity in this project was to build the model (with collection and treatment of numerous data) and to calibrate it to be close to the As-Is situation. With this complexity we decided after to try Process Mining (Aalst et al., 2005) and use a "log" file available (a file with production orders events in the past) in order to rapidly have macro routings. Then it enabled to transform the Process Mining model into a simulation model, this time with real values. To conclude Process Mining would allow us to get a model more rapidly and with a better input data quality.

REFERENCES

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