SUMMARY

In this thesis, a modern production line which implements AGVs, RFIDs, and IR sensors was evaluated by the means of modelling and simulation techniques. Firstly, the production processes were described using IDEF3 diagrams. Secondly, a simulation of the production line was constructed using Arena Simulation. The simulation was run once, with set constant process times. As the third step, the factory system was modelled in Visual Components.

The initial production line showed an overall utilization percentage of 34.3%, produced 720 parts per hour, and had a cycle time of 39.3 seconds per part. The KPI dashboard constructed in Arena provided also statistics on the individual utilization levels of every resource (AGV, human worker, and the machines).

The DMAIC approach was applied to investigate the simulation results. After analysing the report statistics, applying the Pareto principle, it was concluded that the bottleneck lied in the queue created at the bottle filling machine, represented as the Wait Time Per Entity with the value of 153 seconds. The utilization level of 96.4%, though usually a positive indicator, stood out among the rest resources which, by comparison, showed a utilization of around 25%. This led to the conclusion that the production line was unbalanced.

To improve the performance of the production line, a second filling machine was introduced to the system. The new model showed an approximate 35% reduction of the Wait Time Per Entity for the same machine. To further balance the production line, a third filling machine and a second labelling machine were implemented. After this measure we were able to achieve a filling machine utilization of 32.2% and a wait time per entity of 35 seconds, as opposed to the former 153. As such, the utilization levels of all resources have been balanced, for they are now approximately the same, and the Wait Time Per Entity at the filling and labelling machines was reduced. The revised models were once again built in Arena Simulation and Visual Components software. Additionally, an improvement in the location of the waiting area of the AGV was suggested using Visual Components for an estimated reduction in its travel time.

The analysis of the production line yielded good results, as both the issues and the solutions were successfully found. This research may be deemed as yet another proof of concept that the performance assessment of production lines by the deployment of modern software solutions is both feasible and fruitful.

Through the course of the thesis, the author has acquired considerable knowledge on the techniques of assessing a production line and changing it to reach higher productivity levels. This experience has given the author an insight on the field of operations management and has inspired her to pursue this field of research in the near future.