

INTRODUCING A MANUFACTURING EXECUTION SYSTEM AT HAPPY PEN INC.*

Knowledge Dimension:
Technology

Basic Teaching Case
08 2018

*Fictional company name

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Funding

This work is supported by the Interreg CENTRAL EUROPE Programme funded under the European Regional Development Fund (ERDF).

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The introduction of automated machines was yesterday's challenge. Now, the production manager of Happy Pen, the market leader for writing instruments, wonders about the best solution for connecting his existing production machines and how to create a timely manufacturing execution system (MES). But which technologies to choose? Are there providers for an overall system solution? What are the advantages and disadvantages of available technologies? Which system will be able to work in the future, when new machines are added? How will technologies that are up-to-date now develop in the future? Which systems are financially feasible for Happy Pen? Which system suits Happy Pen's requirements of heterogeneous interfaces best?

Happy Pen Inc. - Background Note

Happy Pen Inc. is one of the leading writing and painting instrument manufacturers in Europe. Happy Pen is one of four independent business units of the Happy-Family group of companies. The headquarters are located in Augsburg, Germany. The production sites are spread across Germany, Hungary and Cambodia. The group generated 800 million euros of total turnover with its divisions in 2017. Happy Pen Inc. alone achieved a turnover of 200 million euros. Overall, the group has more than 5,000 employees and 25 sites around the world. Export is an important field of growth in order to maintain the annual growth rate of 4-6%.

Happy-Family is one of the most successful family firms in Germany today. The group's success is based on innovation - constantly looking out for the latest trends, talking to experts, being close to the customers and thinking out of the box thereby are the firm's most important assets. Over the years, Happy Pen has increasingly developed its business model towards the production of more individualised products which should be competitive at the price and delivery time of mass products. This should not only differentiate the company from its competitors, particularly including discounters, but also enable Happy Pen to remain the market leader with regard to quality and originality. As a family firm, it is important that this success does not come at the expense of the employees - work-life balance, fair working conditions and equal treatment are basic principles for Happy Pen.

Current Challenge - Finding a MES for Happy Pen

At the moment, the production at Happy Pen's 300 employee production site in Augsburg (Germany) is based on single machines for the different production steps with manual work before and in-between the processes. Since currently all machines are working independently, the



production manager now wants to connect the existing machines into a timely manufacturing execution system (MES) to increase the overall efficiency of the production. MES are computerised systems for manufacturing that allow the tracking of the production process from the raw materials to the finished goods. This is not only important in terms of quality management, but also makes optimisation decisions much easier. It supports resource scheduling, downtime management and overall equipment effectiveness (OEE). It should furthermore reduce the failure rate and re-work, increase uptime, provide more accurate cost information and reduce inventory. As it works in real time, it enables to control all the elements of the production process. The introduction of MES can also be seen as an intermediate step to further integrate upstream and downstream processes into the production process.

For these reasons, the production manager at Happy Pen now thinks about which MES would be best for fulfilling the needs of the firm. However, the decision is tricky as the existing machines have different generations of different interfaces and protocols. One consideration is to rely on the most popular communication standard discussed in the context on Industry 4.0 (I4.0), namely OPC Unified Architecture (OPC UA). OPC UA primarily is a machine to machine communication protocol for industrial automation developed by the OPC Foundation in conjunction with many partners in the automation industry. It is an open protocol that is freely available and implementable under the GPL 2.0 license and not tied to one operating system or programming language. What makes OPC UA special is its ability to provide an information model which presents all the machine data in a way that makes it directly interpretable by a machine or even a human. With current communication protocols, such as Profibus or Profinet, one always needs to know which byte and bit refers to which information. In OPC UA, every single data point provides its data type, its name, a description and other meta-information which can be used by higher systems to directly process this data. Another advantage is the usage of standard “office” Ethernet, although this simultaneously brings the disadvantage of not being able to transfer signals with deterministic real time¹.

Current machines at Happy Pen do not have OPC UA connectivity yet. It is not clear if retrofit is a suitable option for all current machines or if older protocols also have to be used to directly connect to the MES if OPC UA is not available. Currently, many MES providers are being considered and analysed. However, they do not provide complete solutions - especially regarding machine connectivity and retrofitting. Therefore, more information on OPC UA and retrofitting have to be gathered. Since there is no in-house knowhow available, Happy Pen thinks of acquiring the necessary knowledge from external sources. But which technologies to choose? What are

¹ For more information on OPC UA you can go to <http://www.ascolab.com/en/technology-unified-architecture.html>.



advantages and disadvantages of the range of available technologies? Will all machines have a standardised interface in the future? How can existing machines be retrofitted with modern I4.0 communication protocols? Is this even cost effective? What systems are financially feasible for Happy Pen? Which system suits Happy Pen's requirements best?



Questions for discussion

1. Explain the circumstances that made Happy Pen's manager think of introducing a manufacturing execution system. What other drivers can you think of?
2. What is MES? What are the advantages of such a system? What could be the risks in introducing such a system?
3. What are Happy Pen's specific requirements for such a system? Which connectivity technology does Happy Pen prefer? What other issues can make the implementation of such a system difficult?
4. What are advantages and disadvantages of the preferred protocol?
5. Which other connectivity technologies can you think of? What are their advantages? What are their disadvantages?
6. What is the future of OPC UA and comparable technologies?
7. Which steps should Happy Pen take to come up with a final decision? Are there issues they currently overlook?
8. What could be the next steps after the implementation of a MES?