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INDUSTRIAL SURVEY REPORT¹

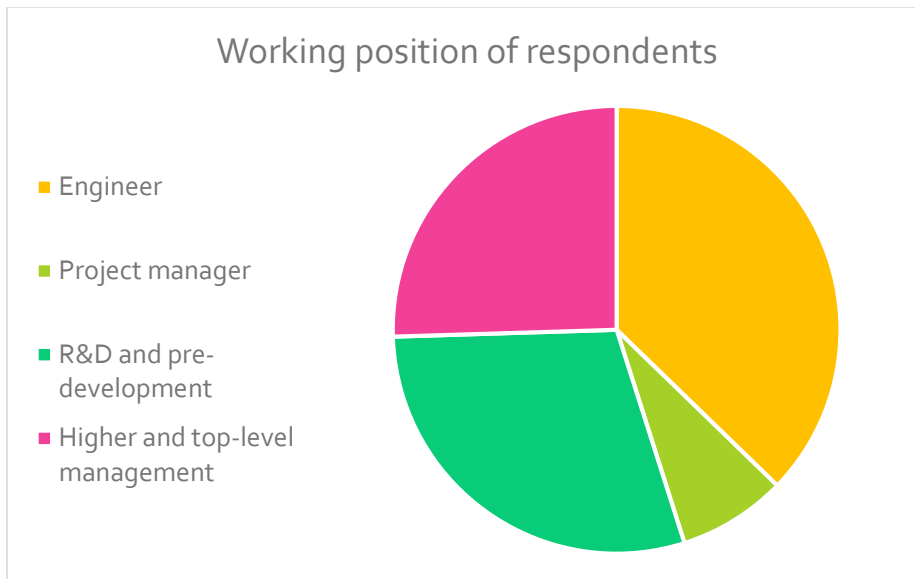
Prepared by: dr. Nikola Vukašinović, dr. Roman Žavbi, dr. Vanja Čok

Ljubljana, Vienna, spring 2018

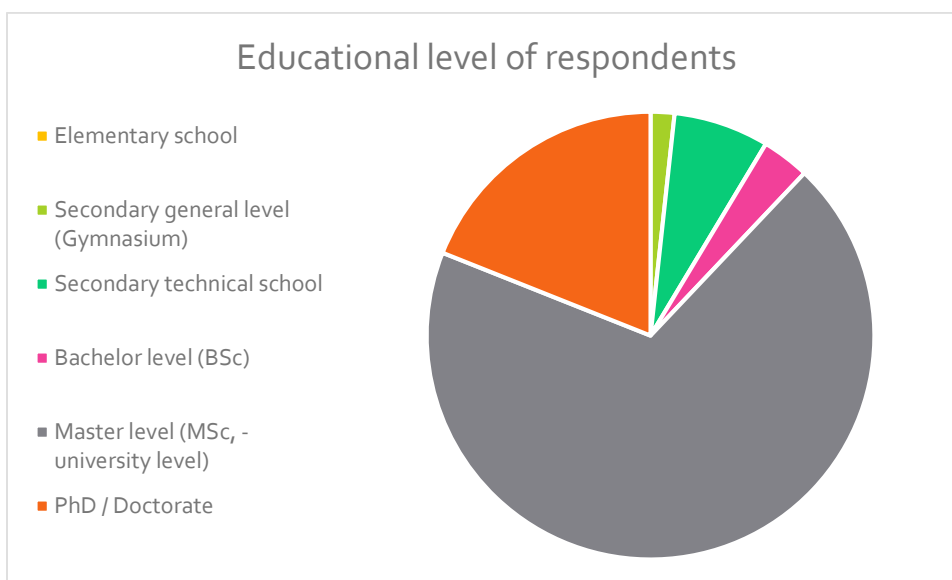
¹ This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use, which may be made of the information contained therein.

INTRODUCTION

This report presents the main findings of the industrial survey, performed concurrently by all CASPROD project partners as a part of intellectual output. The survey was designed for the purposes of new master study curriculum preparation in order to identify the needs for new engineers in Austria, Croatia and Slovenia. In the research, 58 people participated so far, who are from various fields of knowledge and company positions, but mostly from different fields of mechanical engineering.

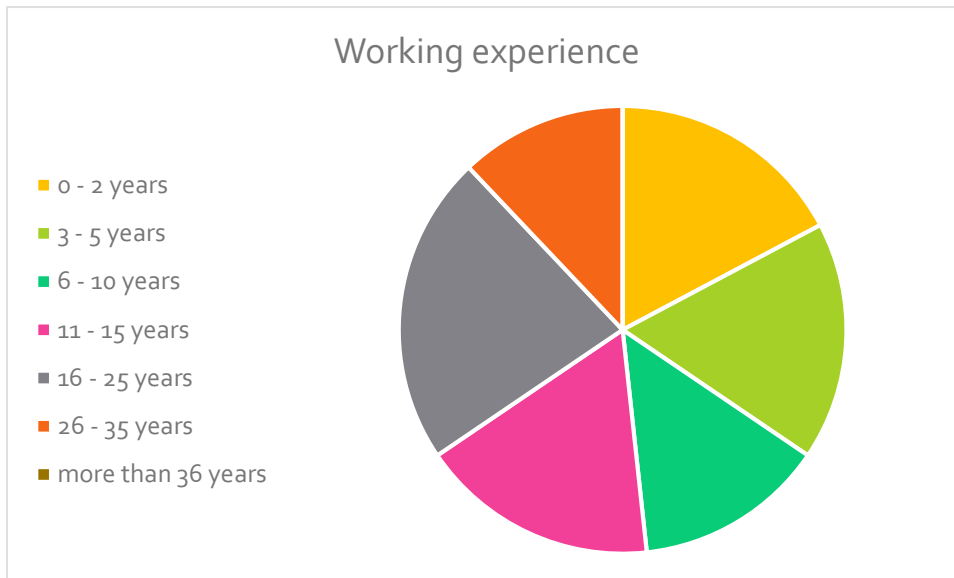


Educational level of respondents showed, that more than 88% of respondents are highly educated, having achieved master or even PhD level. Almost $\frac{3}{4}$ of all respondents hold master degree, which shows there is a large pool of population that requires master level for their job positions. Particularly interesting is also a large amount of PhDs, showing the trend and needs for this level of knowledge and experience. We believe, both these shares will only increase in the future.



Unfortunately the unbalanced gender representation in engineering is reflected also in this survey, where only 6,9% of respondents were female.

Age distribution chart shows, that approximately half of the respondents are within their first decade of working experience connected to engineering. Since education programs do not change rapidly, we can derive that half of the respondents can critically evaluate the knowledge given at universities on master level, while at the same time the younger generations are usually more familiar with new trends and technologies.



The respondents had to answer three thematic sets of questions:

- questions about competences of fresh master engineers
- questions about the trends in product development process
- and questions about smartness of the products

The answers are presented on the following pages, giving also our interpretation of the results.

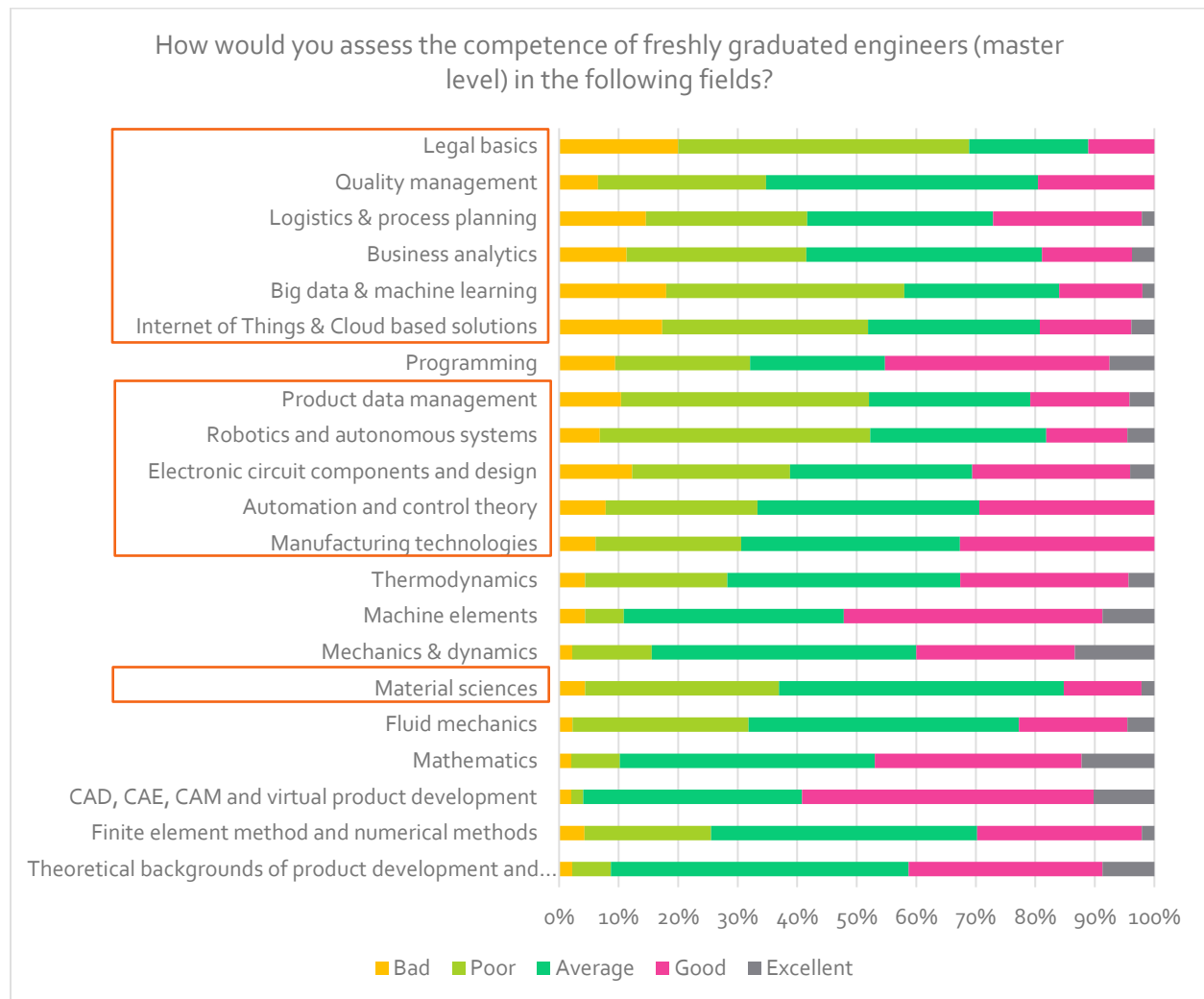
COMPETENCES OF FRESH ENGINEERS

The first set of questions asked participants of the survey about their opinion, how good are the competences of freshly graduated engineers in different traditional and emerging engineering skills, as well in some basic transverse skills, e.g. legal basics and business analytics. As expected, the traditional knowledge was well represented, especially the knowledge of machine elements and various CAD technologies. Both subjects are usually taught on a bachelor level, so making a new engineering curriculum would not negatively affect the results. There are also some traditional engineering subjects which should be reorganized or changed as they do not perform well: particularly material science. This subject usually gives very fundamental knowledge about materials, with a huge emphasis on steel and

iron, however engineers, who are dealing with product development need deeper knowledge on principles of proper material selection and availability and properties of different construction materials.

There was a significant lack of transitive knowledge; therefore we emphasize improvements in that field – especially by implementing subjects about entrepreneurship, innovation, legal basics, management and business.

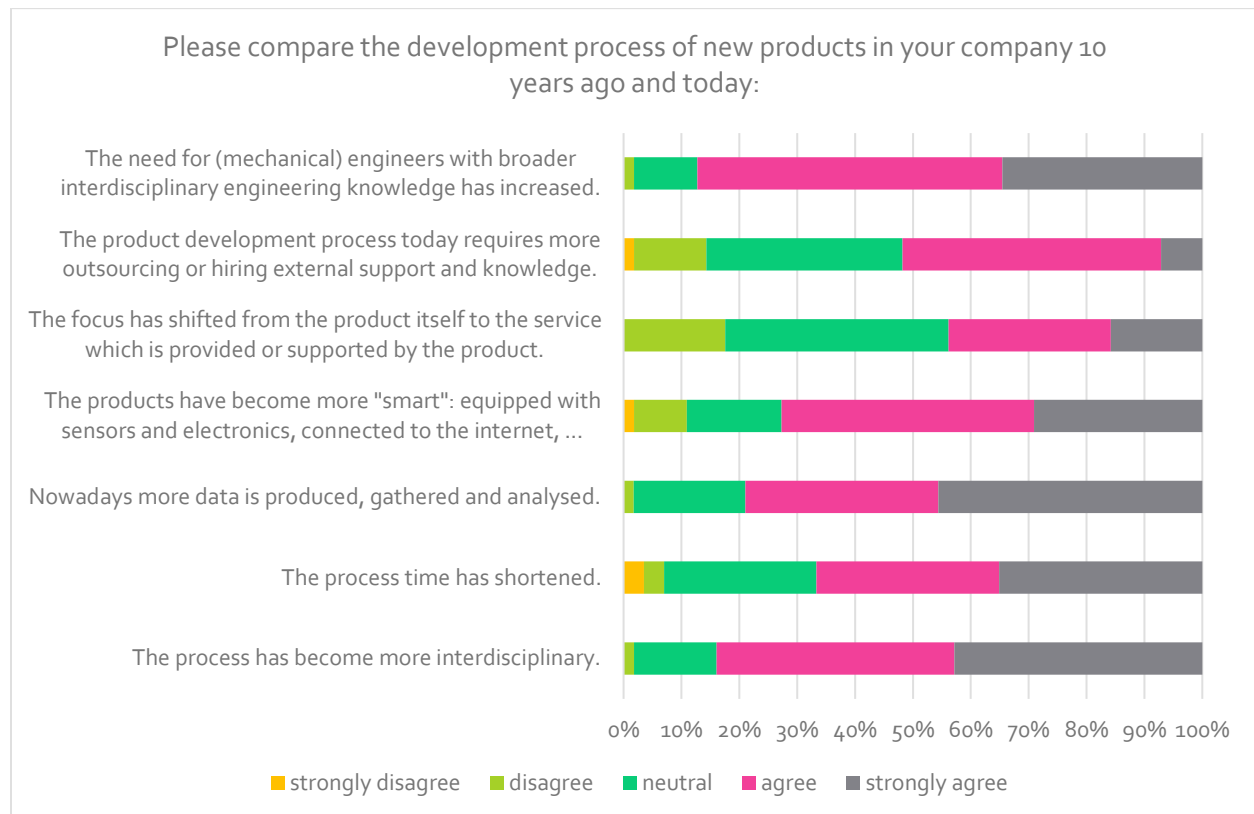
The third field of emphasize are new and multidisciplinary knowledge: both of which are only seldom taught at traditional mechanical engineering master courses. This knowledge should cover at least: big data, machine learning, IoT and cloud base solutions, robotics, electronics, product data management and automation.



TRENDS IN PRODUCT DEVELOPMENT PROCESS

The second set of questions investigated, how the has product development process changed in the past 10 years. the purpose of this question set is to identify the trends in product development, so the newly

developed curriculum would respond properly to these changes. There are two main identified shifts in product development process: (1) the increased interdisciplinarity of the process; (2) and the shorted development cycle. Both shifts result in needs for outsourcing different sub-tasks and in need to gather and analyze more data in shorter time. There exist successful tools and methods to tackle these changes, however, the students usually meet them for the first time only when they get first industrial experience. Other research showed also a trend when a product is no longer a focus of company's business model and a source of income, but the service the company can provide with these products². The survey showed that less than 50% respondents agree with that, but the number who do not agree with this statement is less than 20%. This suggest that the engineers are becoming aware about this trend.



SMARTNESS OF THE PRODUCTS

The third set of questions explored how the companies adapt to increasing smartness of the product. The respondents are strongly aware that smart technologies are inevitable for the improvement of their products in the future. Almost 50% strongly agree with the statement, while almost 90% agree or strongly agree that this will be the future. Furthermore, almost 50% of respondents admits that their products already consist of some level of smart technologies and 60% of respondents say their companies has a strategy to add value to the products by implementing smart technologies.

² See: CASProD_Review_Final.pdf

These results show positive trends in observed industry. However, on the other hand, there are some concerns how to implement them. Namely, more than 50% of respondents say the companies will have to reorganize their development teams, processes, while 40% think this will require also reorganization of business model and organization of the company. More concerning could be the answer that the company does not have capacities to implement smart technologies, but only 20% of respondents think so, while more than 50% think the opposite.

