Trends in Croatian Manufacturing : What about Servitization?

Survey Results and Trends (2015 – 2018)

Authors:

Jasna Prester
Iztok Palčić
Božidar Matijević
Ivan Kumić
Ivana Rašić Baškarić

Publisher:

University of Zagreb, Faculty of Economics and Business

Trg J. F. Kennedy 6, 10000 Zagreb, Croatia

Tel: +385 1 2383 333, Fax: +385 1 233 5633

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Associate professor Jasna Prester, PhD

Proofreader prof. George Onofrei, PhD

Reviewers / Editorial Board:

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BUILDING COMPETITIVENESS OF CROATIAN MANUFACTURING

Extracts from reviews

Professor Blaženka Knežević, PhD., University of Zagreb, Faculty of Business and Economics

The theme from this book is relevant and under-explored in central and Eastern Europe. Accordingly, we recommend publishing this work so managers can gain insights into current state and trends in servitization of production. Additionally, operations managers and service operations managers will gain a good insight into the current state in these two fields, and a foundation for future research.

Professor Ivica Veža, PhD., University of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture

Research shows that manufacturing is "conditio sine qua non" a foundation of any economy and that developed countries investing into manufacturing will raise the standard of living of their citizens. It is important to emphasize that manufacturing in Croatia should use more Intellectual capital and services in their transition to Industry 4.0. Rewiever of this scientific manuscript also leads a Croatian Scientific Foundation project (Innovative Smart Enterprise - INSENT), and together with the team obtained a result that Croatian manufacturing is currently at level 2,15 (from Industry 1.0 to Industry 4.0).

Professor Dragana Grubišić, PhD., University of Split, Faculty of Business and Economics

This scientific monograph is a valuable and important work, both for those in the scientific, as well as in the practical/manufacturing sphere. Although the book is scientific, it is written in plain language to be understood by everyone involved in the production. This is one of the few works in Croatia which systematically analyzes the developments in the manufacturing sector in the World and in Croatia, and forecasts trends to 2018.

Professor Ivan Strugar, PhD., University of Zagreb, Faculty of Business and Economics

In Croatian literature production does not appear so often so this book is extremely welcome, especially because it deals with a dynamic interplay of production and services. We live in an age of the Internet, information technology, intelligent remote-controlled systems, robots, virtual reality, in an age when for the first time in the history 4 generations of people live .. in our region growing interest of young people are tourism and trade, while production is considered far more difficult path to business success. The

view that the production company could successfully operate only by high government protection, and not the disastrous privatization, generated in public reserved, if not negative attitude towards manufacturing and thinking that possibilities of success in manufacturing with high international competition is slim. However, the situation in Croatian manufacturing is changing confirmed by statistical bulletins, but also by information the authors give in this book. Although the book is the result of work on a scientific project and is based on a very meticulous scientific approach, it is still very interesting and instructive reading not only students and scientists, but also for everyone involved in production, economy or politics, therefore, the general public. Production was always a key activity, but now when we talk about the growing importance of services in manufacturing, one understands that this has huge implications for mankind. So, never was and is not now, manufacturing a secondary activity. According to its importance, production is a key determinant of social development. The sixth chapter is especially valuable because it gives a very detailed analyze and explains the use of various digital services in the context and possible effects on competition and associated financial indicators. In this way, the reader can assess the whole picture, which technological and organizational conditions must be fulfilled in order to be able to provide advanced services, to foster better business results and competitiveness.

CONTENT

Foreword

Idea for this book came during my visit to Fraunhofer Institute for Systems and Innovation ISI, Karlsruhe, Germany. This is my forth time I came here and every time I get delighted with work atmosphere. People actually talk about what they work on. People go to lunch together, are mutually very polite and appreciate each other. It is not that they love each other, but there is a culture of behavior. I came here to work on three articles on which I have been working for past three years and they were all rejected. That's the reality of academic work. Those from academia will know what I talk about. How much rejection can you take?

First four days at Fraunhofer ISI, I was analyzing data for Slovenia and Croatia. I found interesting trends comparing to last round in 2012.

But, I could not go further. To analyze the data for other countries and to see are those universal trends I need Angela Jäger. Angela works only 20 hours a week (50 % of working hours). That means I have to wait for her for a couple of more days. Waiting for her I started analyzing Global Manufacturing Research Group (GMRG) data, also on subject of servitization, and again something interesting came out.

Finally Angela came. We talk. I told her excitedly everything I found in the data and trends that reviled themselves. I'm currently all in books that Germans call Industry 4.0 and Americans; The Fourth Industrial Revolution. I need that because I teach students and I have to prepare them for their future jobs – which nobody yet know what they will look like. I need it also for research – what are the dominant research questions on which there is still no answer. And so we talk, and I tell her about my concern that technology will replace many human jobs. Angela, as any wise person, talks on ground of facts (European Manufacturing Survey – EMS), says that in Germany despite robotization, there is no trend in decreasing employment. And so we talk on. She asks me what have I done with analysis of Croatian 2015 data? I told her: "I published it online on the Projects site". She was horrified. Germany is a country of rules, and you just can't – just publish online. For everything that one does there should be a clear goal, and choose strategy and tactics accordingly. This free reviling of valuable data was understandable to her. But, I tell her: "In Croatia nobody wants to hear about manufacturing, as if it was something dirty from which you have to run away." Even in that study we showed how manufacturing is important to society (ok, the link is here

http://web.efzg.hr/dok/OIM/jprester//hzz%202014/2016/Doprinos%20BDP%2001042016_8%20Maja%20izmjene.pdf) and why a country should cherish its manufacturing. Here at Fraunhofer ISI, about 20 people follow trends in manufacturing. But not just for following trends, but to recommend how to remedy some negative trend. Then they publish their research findings and recommendations, it gets documented, they obtain an ISBN number and becomes a document on which other experts will refer to, even with opposite views and recommendations. More diverse wives, greater is the probability of finding a good solution to the problem.

So Angela talked me into writing a book. A booklet actually. It would be really a pity that the work my colleagues and I have put into the EMS project gets washed away in ocean of Internet space. I think hard, hard for a couple of days, because after writing three books I know how hard it is to publish a book. But then I decided, and this is it. Let us prepare for Industry 4.0 where digital services will dominate.

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If you thought that everything in this book will be nice and rosy, you are wrong. This is a scientific book, written on ground of survey results and we bring only general conclusions. This is not a book "How to implement Industry 4.0".

But why a free book? Well, reading all the books in this field talking about unprecedented change, which is hard to follow even for most resilient persons, then we ask you this. If we publish today results from 2015., how much of that would still be valid in 2018.? How much are you prepared to offer for a book, if you want to read at all about manufacturing, can toss away after few years. We say 0. Besides, it is our duty as academicians to help Croatian manufacturing in any way we can.

We will present The Global Manufacturing Research Group (GMRG) and European Manufacturing Survey (EMS) research findings. (GMRG) (www.gmrg.org) is an international community of researchers studying the improvement of manufacturing supply chains worldwide, and EMS is European organization exploring manufacturing, led by Fraunhofer Institute for Systems and Innovation ISI from Karlsruhe. The book is scientific and is based on rigorous scientific methodology. Even though for conclusions, we will use advanced models such as structural equation modelling, the explanations will be provided in simple terms so everybody can understand, even those not interested in statistics and how the results were

obtained. First we present results grounded on simple statistics to see why manufacturing is important after all and why at Fraunhofer ISI or in any other institute in developed countries have so many people track changes in manufacturing. After that we focus only on one segment – servitization. In 2009. when servitization started to be written about in academic journals, everybody thought that manufacturers will become service providers, because services generate better return on sales, because services are not that affected by economic downturns and the like. Even whit this hype, the reality folded differently. And why this is and what is actually happening with servitization, we will explain through this book and our research.

First, through GMRG survey we present results on servitization in the whole World. Then through EMS research we show exactly what those services manufacturers offer are, are they widespread in Croatia. After that we give recommendations what could Croatian manufacturers do to stay at the global competitive game.

Finally through conclusion, we give a summation of the whole work, so that is enough to get a clear view even for those who only read summaries.

Jasna Prester

Foreword to the English version

The English version of the book was done on demand of Croatian Science Foundation during their evaluation visit on 09.11.2016.

It was suggested that in order to ensure that the book is of appropriate quality and that Croatian Nationl foundation name is on a work of good quality they asked that in Englis translation be and foreign English speaking autor who wold contribute to the readability and possible enhance the book.

We asked professor George Onofrei to help us out with the English version of the book. Professor Onfrei enhanced the original English version for the clarification and enhanced readability for the Eniglish audience.

Professor Onofrei added a significant contribution to the book and we especially thank him for this generous work.

Acknowledgements

First of all we want to thank the Croatian Scientific Foundation which helped and financed GMRG and EMS meetings for the whole team, coming to Fraunhofer ISI and all other activities related to the project 3535 “Building Competitiveness of Croatian Manufacturing”. The second most important person in process of writing this book is Angela Jäger who argumentatively convinced us to write this book.

Than we want to thank our reviewers, professor Dragana Grubišić form Faculty of Economics and Business, University of Split, professor Ivan Strugar and Blaženka Knežević from Faculty of Economics and Business, University of Zagreb, and professor Ivica Veža, University of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, who are all our long term associates, who found time to thoroughly read the unedited book. With that said, even more thanks to them is required as they helped this text to become more readable and accessible.

1. Why is manufacturing important?

All goods are subject to trade. According to World Trade Organization (WTO), 80 % of international sales are sales of goods and only 20 % of sales are services (Global teach-in, 2012). Manufactured goods are also necessary for services. Although in most countries service industry represents around 70 % of GDP and jobs, it depends on the type of manufactured goods. For example, retail, warehousing and transport (which in Croatia amounts to approximately 20%) are based solely on sales, exchange and transport of goods. Even typical services such as flying, telecommunications and software depend on a physical product (plane, telephone and hardware for signal transmission, computers). The same is present in health industry, which in US contributes around 8% of GDP, is based on usage of sophisticated apparatus for diagnosing and treatment, and medicine which also had to be produced (Roosevelt Institute, 2016.).

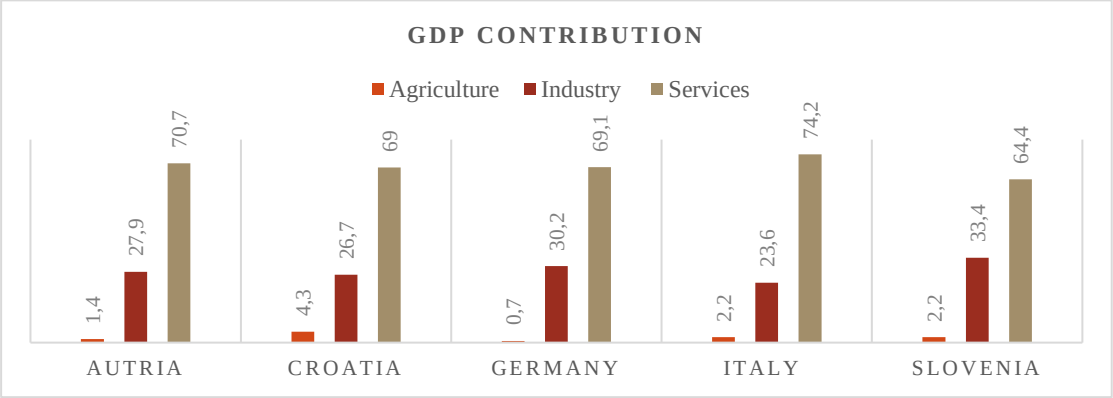
There is also an appraisal that every job in manufacturing creates three more jobs in other industries. Apart from that, manufacturing creates value which is then transferred to spending in other sectors (Manufacturing Institute, 2016). Manufacturing has the largest multiplier effect because the goods have to be transported, stored, exposed on shop shelves and sold (Industry Week, 2016). Also, it is important to emphasize that manufacturing jobs are no more a monotone job of making pieces for which no skills and knowledge are necessary. On the contrary, it is estimated that today's manufacturing is based on substantial engineering knowledge, which than also creates innovative products, generating new value and jobs (Manufacturing Institute, 2016.).

Business growth depends on goods and less on services. In manufacturing new value is added and by increasing productivity, growth is achieved. As a contrast, services tend to have a very slow growth of productivity and are influenced, directly or indirectly by technological advances of the equipment on which they work (Manufacturing Institute, 2016.). In conclusion, we can state that prosperity of a country depends on its manufacturing sector (Roosevelt Institute, 2016.).

To get a clear view of Croatian manufacturing, CIA Fact book (CIA Fact book, 2016.) was used. The aim was to investigate how Croatian manufacturing compares to Slovenia, Austria, Germany and Italy (see Figure 1).

In Figure 1 agriculture, industry and services contribution to GDP are presented. It can be observed that Croatian manufacturing (industry) does not lag behind other countries, although industry contribution to GDP is higher in Germany and Slovenia.

Figure 1. Percentage GDP contributions of selected countries



Source: CIA Factbook, 2016.

Predictions of Industry 4.0 (as the Germans refer to), or The Fourth Industrial Revolution (as the Americans refer to), suggests that manufacturing as we know it today it will be very different in the future. We will print our own food on our home 3D printers, with mobile applications we will share cars to come to a point B, where we will work as a self-employed person. The factories will be completely automated with no human employees. And if we need something from a shop, we will order it by Internet and a drone will deliver it to our doorstep in a matter of minutes.

World known companies (such as Adidas and Nike) have completely robotized factories that make sneakers to customer order and not in Asia, but in their home countries near their customers, because they no longer depend on cheap labour force (Poslovni dnevnik, 2015.). However, the reality is that companies that can afford such sophisticated robotics are still rare. The fact is that robots are still expensive, regardless of advances in robotics field (Selko, 2014). The price of robots will fall and especially in component parts, such as sensors. But, the expensive part is reading from those sensors and programing them (Brynjolfsson and McAfee, 2014). That part is still expensive and it will take certainly another five years before such robots become more affordable, in terms of price and knowledge of programmers who will manage them. We are talking about mass production which requires upfront large investments. It might be that in the future it will be cheaper to produce in robotized mass production then via commercial 3D printers. 3D printers still have their shortcomings. They are slow in comparison to mass production as we know it today. There is a limit in the number of materials these 3D

printers use, suggesting that mass production will not be replaced by 3D printers in near future. But, 3D printers are extremely useful for single unit production where a matter of hours is not a question (Bhadrapur, 2014). 3D printers are already in use for artificial bones, teeth or rapid prototyping. The commercial 3D printers are still expensive and only financially better standing hospitals or manufacturing companies, that innovate, can afford them.

For now advanced technologies such as robots and 3D printers are not widespread. So, let us get back to reality. Companies in the first place need to make profit, and then there has to be a will from the owners to reinvest the profit back into manufacturing. Let us assume for a moment that companies' owners do have a long term view for their company and decide to reinvest money into new equipment or other business priorities. The profits they make are not huge, in fact profits are usually limited and have to be carefully redistributed. That means that every responsible manager or owner seeks a quick return by looking at how many years it takes to break even. That necessities careful assessment of potential technology, contacting several suppliers, assessing all the offers by cost benefit analyses and only then a decision will be made. If the cost benefit analysis shows that such an investment is too risky, management can decide to abandon this decision, if not, this state of the art equipment is bought.

To be competitive, it means to be better than competition. According to Porter (1998.) there are only two strategies: to be cheapest (that can do only mass production) or be different (called differentiation). Croatia has only 60 manufacturing companies with over 500 employees which could eventually enter the mass production (first three companies are Ina, Pliva and Vindija) from 17.386 manufacturing companies registered in Croatian Chamber of Commerce (HGK, 2016). That means that the rest of companies (17.326), excluding those 60 mass producers, have to compete by differentiation.

How to be different? It depends what the manufacturing company does. It can use novel materials, add a new functionality to an existing product or provide an additional service that is bundled with their product. For example, BMW proclaims that it will differentiate itself from competition by adding mobile services. A BMW owner using his phone, will be able to adjust temperature in the car prior to entering. Similarly, Audi and Mercedes are offering similar services (McKinsey Global Institute, 2015.).

It might happen that global companies present in the East, will backshore their manufacturing into home countries, using sophisticated technology, not depending on cheap labour force. In that way they will be closer to their serving markets and transportation costs will be reduced.

But, that does not change the situation for Croatian manufacturers. They have to continue to provide excellent quality at a competitice price relative to Chinese competitors. They have to differentiate from their competition and currently their differentiation strategy is exceptional quality. That is a huge challenge but Croatian manufacturers are currently sucesfull with this strategy. The proof is in the growth of industrial production for the 24nd consecutive month in a row (DSZ, 2016.). This growth means that Croatian manufacturers make and sell more products. Also, manufacturers generate 87% of Croatian exports (DSZ Izvoz, 2016.) and to be able to export, the companies have to be competitive in the markets they operate.

Therfore, if differentiation is a only viable strategy for Croatian manufacturers, let us analyse how to be different. The literature suggests to servitize, or to offer additional service that complements the product offered. Therefore in this work we will explore servitization. “Servitization” is a new term even though the concept is old, and means providing services that accompany the product. The terms servitization and accompanying services will be used interchangeably and a description of these services will be outlined.

2. Services that accompany manufactured products

The concept that a manufacturer also offers a service is not new. Schmenner (2009) cites two examples that Chandler (1977) described in his research. The first case is the company McCormik that produced harvesting machines. In 1850s besides producing machines, McCormik had a large sales force that visited farmers and offered machinery (marketing). But they also offered financing for those machines, as well as maintenance and repair services. The second case is that of Singer, manufacturer of sawing machines. The Singer shops were little workshops where besides displaying the sawing machines, women could learn how to use them, or give in their machine for repair. Today we have popular cases such as Rolls-Royce (Neely, 2008; Neely et al., 2011; Bustinza et al., 2015) that introduce the service "Pay by the hour". In other words, Rolls-Royce does not sell its engines, rather sells their usage time. Rolls-Royce takes care of engines, repairs them and does all the rest. There is the example of Nobel Corp. who no longer sells explosive but the "service of the blast" (Schmenner, 2009.; Martinez and Turner, 2011.). There is an example of ship motor company, which similarly to Rolls-Royce, sells the usage of its ship engines (Slepniov et al., 2010.).

Renowned German truck company MAN offers service called "Pay by the kilometre", Toyota instead of forklifts offers a service of "warehouse management". Also, Xerox instead of photocopying machines, sells services of "Document management" (Baines et al., 2007.). Westerman et al. (2014.) describe an Asian manufacturer that does not sell paint rather the service of painting walls. Oliva and Kallenberg (2003.) describe the case of IBM who from a hardware manufacturer transformed itself to an overall service provider (IBM offers education, maintenance and repair, upgrade, office solutions). In all those examples, the manufacturer generates more than 50 % of sales through that additional service.

So, why services in manufacturing? Main reasons came from service operations management. It was shown that services generate stable revenues and are not affected by cyclical crises or economic downturns (Sands and Ferraro, 2010.; Fitzsimmons et al., 2011.). Services are popular because they yield higher returns than manufacturing (Brax and Jonsson, 2009.; Gebauer and Fleisch, 2007.). Also, additional services promote buying of the company's manufactured product (Wise and Baumgartner, 1999.; Visnjic and Van Looy, 2009.). Besides that, services create long term relationships with the customers, and in doing so raise revenues from existing customers, but that relationship also presents a barrier to entry to newcomers into

their market (Baines et al. 2009.; Baines et al. 2011.). Such “complete offering” and not just selling the product is harder to copy and differentiates the company from its competitors (Mathieu, 2001.; Oliva and Kallenberg, 2003; Neely, 2008; Chesbrough, 2011; Baines et al., 2007.). All these arguments suggest that manufacturers should offer services and in that way generate additional stream of revenues (Quinn, 1992.; Opresnik et al., 2013.). By adding additional services, the manufacturer moves along the value chain, more closely to its customer and places the company in a better market position (Slepniov et al., 2010.; Martinez et al., 2010.).

As it will be seen in next section there is no definition or categorisation of services that manufacturers offer. Services vary from basic types, necessary to put the product into function, to advanced services that do not sell the product, rather its functionality (Neely, 2008.; Falk and Peng, 2013.). Categorisations are hard because of the raising number of services manufacturers offer. The second reason is that not all services have the same function in selling of the product, therefore service complexity varies.

In the literature we can find several terms that describe a manufacturer that offers services and there is little consensus. Severeal authors (Vandermerwe and Rada, 1988.; Wise and Baumgartner, 1999.; Oliva and Kallenberg, 2003.; Slack, 2005.; Schmenner, 2009.; Rothenberg, 2007.) describe this phenomenon as “servitization”; de Brentani and Ragot (1996.); de Brentani (1989.); Rothenberg (2007.) refer to it as industrial services; Tukker and Tischner (2006.) names it “Product service system” (PPS); Markeset and Kumar (2005.) call this phenomenon functional sales, while Stremersch i dr. (2001.) tags it a “Complete service contract”. From this discussion it can be seen that even though the phenomenon is not new, there is still no consensus on how to best define it. One clearer classification of services manufacturers is offered by Baines and Lightfoot (2013.), and shown in Table 1. This is the most cited classification that groups services according to their complexity.

Table 1. Categorisation of services manufacturers offer

Type	Defined by	Organizational stretch	Examples of services offered
Base services	An outcome focused on product provision	Based on an execution of production competence (i.e. we know how to build it)	Product/equipment provision, spare part provision, warranty
Intermediate services	An outcome focused on maintenance of product condition	Based on exploitation of production competences to also maintain the condition of products (i.e. because we know how to build it we know how to repair it)	Scheduled maintenance, technical help-desk, repair, overhaul, delivery to site, operator training, condition monitoring, in-field service
Advanced services	An outcome focused on capability delivered through performance of the product	Based on translation of production competences to also manage the products performance (i.e. because we know how to build it we know how to keep it operational)	Customer support agreement, risk and reward sharing contract, revenue-through-use contact

Source: Baines and Lightfoot, 2013

It should be mentioned that there are other categorisations. For example, Lehtonen and Kostama (2014) formed the so called „COIN“ model:

- **C**ustomer interface services
- **O**perative services
- **I**mproving services
- **N**etwork services

Smith et al. (2014) on the other hand, modify the categorisation by Tukker (2004) and outline three types:

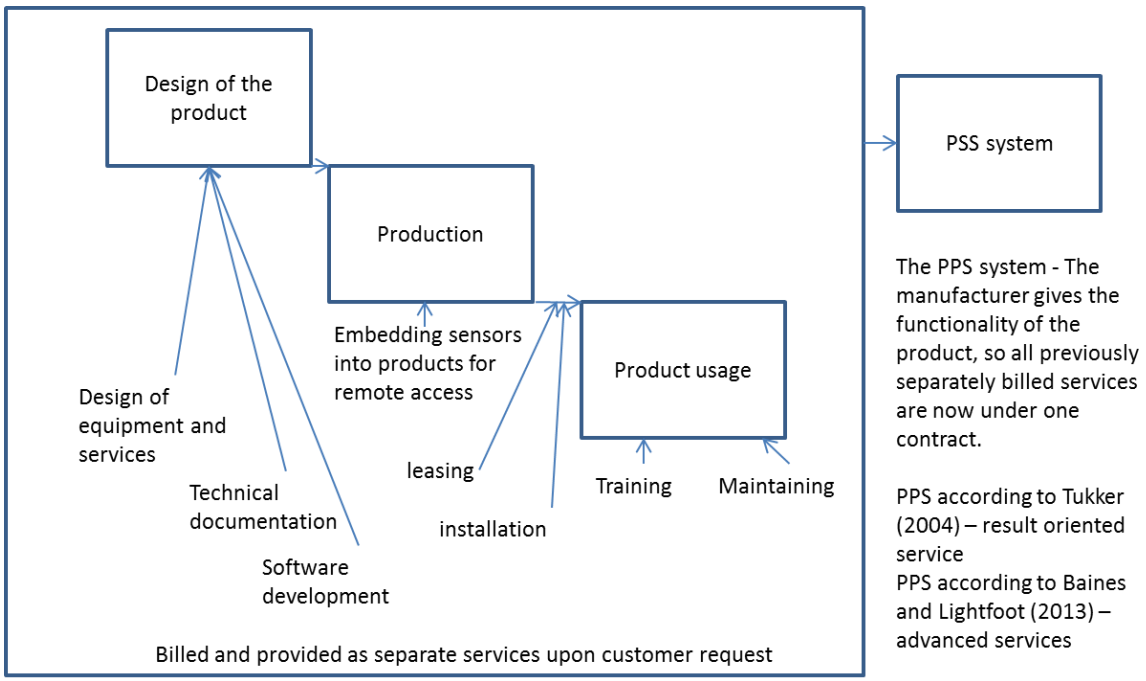
- product-oriented services, where the ownership of the “material product” is considered as transferred to the customer and a service arrangement is provided to “ensure the utility” of the artefact over a given period of time;

- use-oriented services, where ownership of the "material product" is retained by the service provider who sells the "function" of the product to the customer, such as leasing of office equipment;
- result-oriented services, where the service provider sells "results" rather than "functions".

Tukker's (2004) categorization was most cited, but it was criticised because it could not encompass all services manufacturers offered, especially services aided by digital technology.

Even though, Smith et al. (2014) use other names for the services manufacturers provided, the services they describe are similar to categorisation of Baines and Lightfoot (2013). But there are differences which do not enable comparison and generalisation. For example, Tukker (2004.) under the services that help using the product, lists leasing, rent of equipment, giving a service to a larger customer base (pooling of services), while Baines and Lightfoot (2013.) list those services under advanced services, because it is the manufacturer that has to take care of repair and maintenance and everything necessary for normal functioning of products. The buyer signs a contract for the usage of products (either in terms of hours used, number of pieces manufactured, number of kilometres travelled or the like), while the manufacturer takes care of the rest. Falk and Peng (2013.) were the first to explore digital services, such as on-line education, embedding sensors for remote control, surveying functioning of equipment remotely, software development and remote installation. However, Tukker's (2004.) categorization, even though it does not include all the latest services, has a good built in feature, that views services from a life cycle approach (from design of the product to the use). In Figure 2 we present services manufacturers offered, found in the literature and arranged them according to Tukker's (2014.) life cycle approach.

Figure 2. *Services manufacturers give and their placemant in life cycle approach*



As can be seen in Figure 2., services that accompany products differ from "pure services" in several ways.

"Pure services" are often simultaneously offered and consumed. This characteristic of pure services is also called contact with client, line of visibility, moment of truth and so on. For pure services this contact with the client is high, while on the contrary, in industrial services this contact is low, because the service is prepared in advance and delivered within the agreed time scale.

Servitized offerings highly depend on the product which is used, while in pure service settings the accompanying product might be only a document or a bill.

Services that accompany a product are specified in detail, and they are highly tangible, unlike pure services that in great part depend on the subjective perception of the client.

These differences are important for the delivering of the product. Since the customer contact is low, it is possible to standardise the service offering (Chase, 1978.). If standardisation is possible, then, knowledge from Operations management can be applied (Chase et al., 1992.). In servitization settings, the client specifies what he wants and it is up to the manufacturer to satisfy those needs. From all services presented in Figure 2., only training has higher contact with the client. But that is also specified and prepared in advance (number of lectures hours,

content of education,..). If the training sessions are given on-line, even that contact is indirect. However, the preparation of lectures is time consuming and has to be done properly, so the duration of the service is long, but the customer contact is low and enables standardisation.

If we look again at the left side of Figure 2., one can see that majority of services can be offered on demand, and clients will not need all the services. The ability to provide only some services from the total of available services is called service modularity. On the other hand, service modularity additionally augments the efficiency of service provision (Sundbo, 1994.). This means that services can be provided cost effectively. However, there is a problem highlighted in the literature. Personnel that deal with clients have to have excellent knowledge of the product but also social skills. The reason why field employees have to posses knowledge about the product is evident, because if the technician cannot solve customer problem, and the production is stopped, that would cost the customer a lot and probably this customer would be lost. The problem of social skills is only recently mentioned by (Baines i Lightfoot, 2013.) as a part of the issue of servitized companies. Why exactly, we will show throughout the next sections. For now we can only say that on grounds of current research there is a need to invest in social skills of technical employees (in fact into all employees), develop intellectual capital of the company, from which social capital is only one component.

It was already said that services accompanying products are not that tacit, and usually specified in details in contracts (Spring and Araujo, 2009.). For example contracts for education and training define number of teaching hours as well as the content. The same is with maintenance contracts. The client company can contract maintenance and repair in which is defined how often will the manufacturer visit client's site, what will be maintained and how the maintenance will be done. For breakdown situations it is contracted in which time frame will the malfunctioning be repaired, how it will be repaired and how the repair will be paid.

On the other hand (right side of Figure 2.) PPS systems have to cover all services presented in the left part of Figure 2. Spring and Araujo (2009.) give example of auto paint manufacturer who doesn't sell paint rather the service of painted cars. The auto paint manufacturer has its own painting line, or uses the client's painting line. The auto paint manufacturer has to keep strictly to colouring declarations, and also providing all technical documentation that will also go to end customer. If the auto paint manufacturer has its own painting line he has already skilled painters, but he has to be prepared to educate new employees and provide service of training to new paint-line employees. The paint manufacturer has to carefully maintain the paint

line, as any problem will cause the stopping of the line, which in turn means less cars painted. That is not only a problem for the auto paint manufacturer who loses revenue, but also for his client who in turn, also loses customers and revenue. Often, in contracts there are also penalties defined. With, such a PSS contract, the auto paint manufacturer bears a higher risk. They not only bear the risk of line breakdown, but the costs of maintenance and repair. As the (auto paint manufacturer') payment is tied to number of painted cars, it means they depend on success of sales of end product – the cars. But, in economic downturns sales usually stagnate and the auto paint manufacturer bears this risk too. By such contract large companies as Rolls-Royce, ABB, Alstom and others operate. But those manufacturing companies are so sure in the functioning of their products that they can afford to bear these risks. This is why such contracts and PPS systems are still rare. Erkoyuncu et al. (2013.) listed all the risks that manufacturer has to take if they will work this way and offer advanced service contracts. Those risks include operational risks, risks regarding maintenance, risk of not having enough field employees at a specific moment, risk of lack of education of employees, or not enough engineers. Financial risks are that the client will not be able to afford that product after all, business uncertainties as volatility of interest rates, volatility of price of incoming material, wage raises, inflation. The fact is that, the less services a manufacturer offers, less will they be exposed to these risks. But the problem is in competition, because if competition offers these services, and they don't, then are immediately in worse competitive position. However, it is advised to managers who decide to servitize (either by necessity or willingness) to carefully assess all the risks and then evaluate the price for their service offering. If a company does not adequately asses their risks, and do not provide continual operational functioning, they might even incur losses. In fact, Edvardsson et al. (2013.) showed that 43% of companies that were offering advanced services actually filled for bankruptcy. Similar results obtained Baines and Lightfoot (2013.); Kreye and Jensen (2014.); van Gool (2014.). Exactly for this reasons these advanced services are not widespread (Settanni et al. 2014.).

The aforementioned uncertainties, can be reduced if the manufacturer carefuly monitors its products. For example, tracking breakdowns enables the manufacturer to better predict breakdowns and to be ready to repair broken products, to have enough spare parts, and enough field technicians. Apart from that, if the manufacturer sees repeating occurrence of some faults, this may trigger design and engineering department of the company to come with a better solution or improved product. Wang et al. (2011.) in their research state that Rolls-Royce's employees and technicians continuously monitor and have access to all information concerning

the usage of their engines. That helps Rolls-Royce to continuously improve its engines. Grubic (2014.) in his survey finds that 10% of UK companies monitor remotely their products using various software solutions.

It would be inappropriate to discuss service's revenues without taking into account the complexity of the accompanied offered product. First authors that found a relationship between revenues and complexity of the product were Boyt i Harvey (1997). Erkoyuncu et al. (2013.) clearly show that complex products offer more possibilities to add services and thus generate more revenues. Dachs et al. (2014.) on grounds of *European Manufacturing Survey (EMS)*, show that already 86,5 % of European manufacturers are servitized and that there is a clear and significant difference in revenues whether it is a simple or a complex product. They show that on average, complex products generate 13,6 % of revenues, while simple products generate 10,6 % of revenues. But the research related to service revenues is still messy and underexplored. For example, Visnjic et al. (2012.) show that as a manufacturer offers more services, his service revenues start to fall.

Service revenues that come from services that manufacturers offer are still not researched enough, because more often the service is billed in the price of product, thus making it difficult to estimate percentage of revenues stemming from these services. Some authors came across a so called "Service paradox" (Brax, 2005.; Gebauer et al., 2004.; Neely, 2008.), that is, service revenues tend to decrease instead to rise. The authors give a possible explanation: with a rise in number of service offered, a company should reorganize (which is seldom done), and thus, the quality of service offer falls, resulting in customer loss and accompanied revenues. Fang et al. (2008.) in an interesting hypothetical example show that there is a critical point in service revenues (20% - 30% of revenues) after which service revenues start to rise. Until that point, service revenues may fall and the whole servitization strategy is questionable.

Given potential benefits and paradoxes, servitization is being heavily explored by academia. The dominant research questions are related to :

- How to improve the terminology and models used to describe servitization (Goedkoop et al., 1999; Mont, 2000; Tukker, 2004; Baines et al., 2007; Spring and Araujo, 2009),
- How servitization impacts economic success (Samli et al., 1992; Anderson and Narus, 1995; Anderson et al., 2006; Fang et al., 2008; Neely, 2009; Visnjic and Van Looy, 2009),
- How to innovate and design successful offerings (Coyne, 1989; De Joeng and Vanmeulen, 2003; Gebauer and Friedli, 2005),

- The relationships needed with partners in service offering (Galbraith, 2002; Edvardsson et al., 2008),
- The transformational issues facing manufacturers seeking to servitize (Roscitt, 1990; Oliva and Kallenberg, 2003; Mathe and Stuadacher, 2004; Davies et al., 2006; Windahl and Lakemond, 2006),
- How to foster business growth through servitization (Martin and Horne, 1992; Wise and Baumgartner, 1999; Gebauer et al., 2008),
- Innovative solutions provision that include service offerings (e.g. Galbraith, 2002; Miller and Hartwick, 2002; Windahl and Lakemond, 2006; Davies et al., 2006),
- How to increase company' growth through after-sale marketing accomplished through technicians that perform the service (Cohen et al., 2006).

3. Services, employees, companies and competitiveness

Services are provided by employees, and employees form a company. Therefore, it is necessary to explore the role of employees in the quest for competitiveness. Sources of competitive advantages are constantly being researched as there is still no definitive or simple answer about what makes one company more competitive than another. Currently, the most promising theory of competitiveness is the Dynamic capabilities theory originated by Teece et al. (1997) and Eisenhart and Martin (2000). The question of competitiveness is even more important today in an era of global competition. But, there is still no consensus on what constitutes dynamic capabilities that create competitive advantage (Teece, 2014).

Empirical validation of dynamic capabilities as a source of competitive advantage and performance is scarce. The capabilities that are empirically tested are all named differently, and yet the majority of constructs have all the elements of Teece's (2014) definition of dynamic capabilities (sensing, seizing and reconfiguring). Sensing means that the company senses changes in its environment, seizing or regrouping existing resources to answer the changes in the environment, and reconfiguring resources to make use of opportunities sensed in the environment. Teece (2014) proposes that a company has to have strong "ordinary capabilities" upon which dynamic capabilities build on, and in that way a competitive advantage is achieved. Winter (2003) explain that "ordinary capabilities" are necessary for day to day functioning. These are various capabilities of a company that, according to Grant and Verona (2015) are hard to measure. A capability is the capacity to undertake a particular activity, and thus, can be observed only when it is performed. Naor et al. (2014.) state that in order to see how capabilities affect performance, it is absolutely necessary to unbundle constructs in order to study their direct relationships. However, this is not an easy task because of different definitions and methodologies. For example Wu et al. (2010) researched the gap concerning the measurement of operations and dynamic capabilities. Although they defined their variables operations capability, their operationalization of operations capability involves dynamic capabilities as well as organizational culture. They provided a sound methodology for construct generation. However, their contribution is only theoretical. They divided constructs into five categories and based their constructs on the classic prior works of (Teece et al., 1997; Swink and Hegarty, 1998; Sen and Egelhoff, 2000; Schroeder et al., 2002; Subramaniam and Youndt, 2005). This last work is especially important because it empirically proves that intellectual capital of a

company enhances innovation. But, there is again, a problem in terminology. Wu et al. (2010.) use the term organizational culture and use the constructs from Subramaniam and Youndt (2005) – where they are termed intellectual capital.

Ordinary capabilities are generally: administrative capabilities, operations capabilities and governance capabilities and are rooted in (1) skills of personnel, (2) facilities and equipment, (3) processes and routines including technical manuals, and (4) administrative coordination needed to get the job done. Ordinary capabilities are considered high if a company has a skilled workforce and advanced equipment (Teece, 2014). According to Teece (2014) these ordinary capabilities can be measured in terms of increased quality, time to market and efficiency and by themselves do not present a competitive advantage as many market players can achieve the same capabilities.

Wang and Ahmed (2007) give examples of quality control and the introduction of Total Quality Management (TQM) into a company, as an example of ordinary and dynamic capability. Quality control is a reliability-oriented process needed for day to day activities, while implementing TQM in a company brings change and advancement in improving the overall functioning of the firm. TQM creates continuous improvement of every aspect of the firm's functioning and as such is dynamic in nature. Helfat and Winter (2011) use the example of the company Intel. The firm's ability to continuously innovate is a dynamic capability but it entails investments into R&D, education of their highly skilled workforce and development of routines for even faster innovation. Investment into R&D, education and state of the art equipment represent ordinary capabilities according to Teece's (2014) definition, because every company can do it if it has enough financial resources. But Intel's ability to constantly innovate is a dynamic capability not easily copied by competitors.

Teece (2014) states that dynamic capabilities applied to ordinary capabilities in a unique fashion create an inimitable resource (capability) that then forms a competitive advantage. However, Teece (2014) states that dynamic capabilities by themselves are not enough to create competitive advantage, rather requiring a fast recombination of resources in line with its strategy. Teece (2014) illustrates it with the Toyota Production System (TPS) that enabled Toyota competitive advantage for decades, but, with the introduction of TPS components in various other companies and industrial settings, it became an ordinary capability.

Teece (2014) cites Collins (1994.) as the first author stating that dynamic capabilities are second order capabilities and described them as the ability to learn (learning how to learn). Teece

(2014) divided dynamic capabilities into: (1) sensing opportunities from the market, (2) seizing, that is, mobilizing resources to address opportunities (asset orchestration) and (3) continued renewal – transforming (learning and reconfiguration). According to Teece (2014), developing dynamic capabilities is top management's job. They are the ones that first can sense changes in the environment, but the job done resides in fast accomplishment of simple tasks. However, a fast response from workers resides in the organizational culture, which again is a top management task to build it. According to Teece (2014), this organizational culture is a valuable asset, as it cannot be easily replicated. The author warns that over time, these dynamic capabilities become ordinary capabilities when other companies manage to duplicate the organizational culture.

Macher and Mowery (2009) explored dynamic capabilities (represented by deliberate learning mechanisms). Wang et al. (2015) define dynamic capabilities as assimilating external new knowledge with internal existing knowledge; and the ability to undertake internal transformation and update its prior knowledge. Of course, there is an assumption that a company and its employees already possess some knowledge, in which case the learning process is faster. This transformative capability allows a firm to use internal knowledge for novel and unanticipated applications (innovation), ultimately triggering novel progression of knowledge whilst making the most of existing knowledge.

As previously stated, it can be seen that dynamic capabilities center around learning; however learning is difficult to quantify/ measure. Many authors (Stadler et al., 2013.; Grant and Verona, 2015.; Ellonen et al., 2011.) analyse several measurement propositions for measuring dynamic capabilities but conclude that there is no reliable instrument. Pisano (2015) not only criticize that there is no instrument, but that there is also no unified definition as to what dynamic capabilities are. In fact, the author states that there is still no clear definition of dynamic capabilities. The research argues that authors have put more effort into defining dynamic capabilities (which is important too) instead of the question of how to build these capabilities. According to Pisano (2015) a theory has sense only if it provides sound managerial advice (assuming it has empirically proven advice).

In searching the literature for measuring dynamic capabilities, the model developed by Wang et al. (2015) was deemed apropriate. They adopted Teece's (2007) definition of dynamic capabilities (sensing, seizing and reconfiguration) but unfortunately they researched only how newspaper companies entered the on-line market. Today, this is neither new, nor generalizable.

Protogerou et al. (2011) state that dynamic capability do not directly increase business performance or competitive advantage, rather that dynamic capability mediates on ordinary capabilities and through this effect of dynamic capabilities on ordinary capabilities, benefits are achieved. They state that the competitive advantage will be produced by ordinary capabilities, when under the influence of dynamic capabilities. Protogerou et al. (2011) adopted the Teece (1997) terminology of dynamic capabilities as coordination, learning and strategic response, but the limitation of their work is that they researched marketing and technological capabilities of the 271 manufacturing companies in Greece. The contribution is in their findings: that dynamic capabilities are second order capabilities. That means that dynamic capabilities do not influence directly performance rather indirectly affecting ordinary capabilities. Dynamic capabilities, then, in statistical terms are a moderating or mediating factor. That is in line with Schilke (2014) and Teece (2014), that dynamic capabilities have a mediator role in competitiveness and the relationship may not be linear.

Simon (2010) supported Teece's (2014) view that it is up to the top management to create the organizational culture, which is a important factor in building dynamic capabilities. Simon (2010) calls organizational culture a dynamic capability. Deeper analysis of his work showed that many of the variables for measuring organizational culture are taken from Subramaniam and Youndt (2005). That would not be a problem except, Subramaniam and Youndt (2005), define their constructs as Intellectual capital and show that this intellectual capital presents a competitive advantage through increased innovation. Due to the lack of a sound measurement model for dynamic capabilities, we preferred to adopt Subramaniam and Youndt (2005) model of Intellectual capital as a dynamic capability (many research operationalize culture and dynamic capabilities through Subramaniam and Youndt (2005) measurement model). The Subramaniam and Youndt (2005) model clearly shows that Intellectual capital raises innovation, and this model is already validated through conceptual and empirical literature. First, it will be described what constitutes intellectual capital, and how employees and their knowledge enter into the story of dynamic capabilities.

According to Subramaniam and Youndt (2005) intellectual capital is the sum of all knowledge a company posses, that can be used to create a competitive advantage and consists of three components:

- the human capital, that is, the knowledge possessed at the individual level;

- the organizational capital that lies in the structure and formal rules of firms, knowledge databases, patents; and
- social capital (internal and external) that represents informal networks of interrelationships and the knowledge that can be accessed through them.

For the completeness of this work we provide Subramaniam and Youndt (2005) measurement model (see Table 2), in order to comprehend what is being measured, what is the connection to knowledge and dynamic capabilities. Measurement is performed on 7 point Likert scales from 1- strongly disagree, to 7- strongly agree.

Table 2. Measurement model for intellectual capital

	Internal social capital	Subramaniam and Youndt (2005.), Lee et al. (2011.)
ISC	There is ample opportunity for informal conversations among employees in the plant.	
ISC	Employees from different departments feel comfortable calling each other when need arises.	
ISC	People are quite accessible to each other in the plant.	
ISC	We are able to discuss problems and tough issues openly.	
	Structural capital	Subramaniam and Youndt (2005.)
STRUC	Standard operating procedures are in place.	
STRUC	Much of this plant's knowledge is contained in manuals, archives, or databases.	
STRUC	We usually follow the sequence of written procedures and rules.	
STRUC	Processes in our plant are well defined.	
	Human capital	Subramaniam and Youndt (2005.), Lee et al. (2011.)
HC	Employees in this plant are highly skilled in their respective jobs.	
HC	Employees in this plant are considered among the best people in the organization.	
HC	Employees in this plant are experts in their particular jobs and functions.	
HC	Every employee in this plant has useful experience.	
	External social capital	Subramaniam and Youndt (2005.)
ESC	This plant and its major external partners have common understanding about what activities are best for our relationship.	
ESC	This plant and its major external partners have shared objectives and visions.	

ESC	This plant and major external partners share common language and codes (e.g. special vocabulary, abbreviation, and technical terms).	
ESC	This plant and its major external partners have common understanding about the same concepts (e.g. good, fast, cost, quality).	
ESC	This plant and its major external partners have similar behavioural rules and norms.	
ESC	This plant and its major external partners have common values and culture.	

Source: Subramaniam and Youndt (2005), Lee et al. (2011)

This measurement instrument will be used in the next chapter where manufacturing companies that offer services will be explored. According to the literature, this dynamic capability (Intellectual capital) acts indirectly upon ordinary capabilities. The argument to use Intellectual capital as a dynamic capability is as follows: External social capital deals with interrelations between the company and its external partners (buyers and suppliers). Through this external communications, employees sense threats and opportunities from the environment. That is valid for top management as well as for employees in boundary spinning roles such as marketing and purchasing. The second component of Teece's (2014) model is seizing, that is, to do react to the opportunity or threat. That can be found in the Internal social capital component, that the employees can freely talk and find solutions to problems. This requires a culture in the company that fosters problem solving instead of ignoring problems. Finally, reconfiguring and problem solving, regrouping of resources to seize opportunities and decrease threats is included in the Structural and Human capital of the company. From this discussion, we state that the Subramaniam and Youndt (2005) instrument satisfies conditions laid out by Teece (2014) in regards to defining dynamic capabilities (sensing, seizing, reconfiguring). The second argument is in Subramaniam and Youndt (2005) work that proves that indeed intellectual capital fosters innovation. Innovating is not easy, and it is exactly because it is not easy and takes time, it cannot easily be copied and thus can present a dynamic capability.

Offering an accompanying service to a product, can also be considered as a dynamic capability. Services are not created overnight, rather it requires design and development, and afterwards continual improvement. For successful service offerings (from initial offer to first positive financial results of this strategy) the whole process can last from four up to ten years (Baines

and Shi, 2015.). Servitization is a process of continuous improvement and as such may fall in the domain of dynamic capabilities. It will be shown, that the Intellectual capital plays a crucial role in the difference displayed by the companies that offer services and those that don't, and how this Intellectual capital affects competitive position. But to display results of that analysis it is first necessary to describe the sample and the methodology used.

4. Methodology of GMRG research – servitization in the World

Investments into equipment, human capital and the rest present ordinary capabilities, because every company that can afford it, can invest. Therefore, the first premise is that if a company wants to be competitive it has to first invest into ordinary capabilities. Ordinary capabilities will be high if a company has leading edge technology and skilled employees. However, there is an assumption, that the investments yield desired results (which might not always be the case). For example, Contingency theory postulates that two companies might make equal investments but the results will not be the same and will in fact depend on contingency or situational factors. For the purpose of this study contingency factors (usually size, or any factor that cannot be changed quickly) are neglected. The level of investment into ordinary capabilities is captured by the measurement instrument depicted in Table 3.

Table 3. Measurement of ordinary capabilities (1-did not invest at all, 7- invested to a great extent)

Investment Areas
1. Quality management programs (e.g., TQM, Six-Sigma)
2. Cost reduction programs (e.g., Target Costing)
3. Manufacturing lead time reduction programs
4. Planning/scheduling processes and methods
5. Processing technologies (e.g., FMS, automation)
6. Flexible workforce
7. Supplier development
8. Workforce training and development
9. Environmental impact of operations
10. Integrating manufacturing and design processes
11. Plant information flows automation
12. Work place health and safety
13. Customer service
14. Customer process integration
15. Supplier process integration

Source: GMRG (*Global Manufacturing Research Group*)

Respondents had to evaluate to what extent their company invested in the last two years in these fifteen areas. Investment areas include employees, quality, technology, relationships to customers and suppliers, etc. Those are examples of ordinary capabilities because they are needed for day to day operations. Since dynamic capabilities affect these ordinary capabilities, the higher are ordinary and dynamic capabilities, better will be the results in terms of competitiveness, financial results and profit margin. The full proposed model is presented in Figure 3.

Figure 3. Hypothesized model and relationships

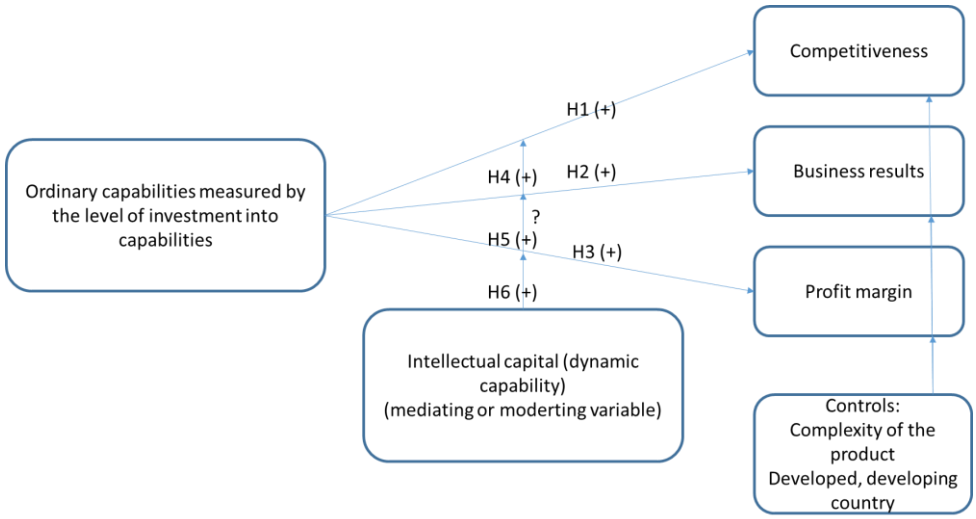


Figure 3 translates into the following hypotheses:

H0: Intellectual capital is moderating ordinary capabilities to results (competitiveness, business results, profit margin), that is a second order variable

H1: Ordinary capabilities measured in terms of investment into capability enhance competitiveness

H2: Ordinary capabilities measured in terms of investment into capability enhance business results

H3: Ordinary capabilities measured in terms of investment into capability enhance profit margin

H4: Intellectual capital moderating ordinary capabilities enhance competitiveness

H5: Intellectual capital moderating ordinary capabilities enhance business results

H6: Intellectual capital moderating ordinary capabilities enhance profit margin

To test the model AMOS and SPSS 22 was used. In the SPSS table division of the GMRG sample was performed according to the variable that measured percentage of sales generated by services. If that field was blank or zero, it was supposed that the company does not offer service and such a company is coded as 0 - not servitized. If the company had revenues from services greater than 0, the company was coded as 1- servitized.

Data gathering

In verification of any model with lots of variables that are tested through structural equation modelling there is a rule that the data sample has to be five times larger than the number of entered variables. That is why Global Manufacturing Research Group (GMRG) V is ideal for such complex analysis because in the sample, there is almost one thousand companies from all over the world. Croatia joined the GMRG group in 2008 and conducted surveys in 2009 and 2012. This data is a sub-sample of the round V GMRG data collection effort taken place in 2012. The Global Manufacturing Research Group (GMRG) (www.gmrg.org) is an international community of researchers studying the improvement of manufacturing supply chains worldwide. The GMRG consists of leading international academic researchers from over 25 countries. These researchers developed the GMRG survey instrument to understand manufacturing practices around the world. This survey instrument facilitates a global comparison of the effectiveness of manufacturing practices (Whybark, et al., 2009). Where possible, existing constructs and measures were used to ensure their validity. Since 1985, the GMRG has completed five rounds of the worldwide survey. Questionnaire is developed in English, and then translated to each country's language, tested on a small sample, back translated and additional corrections are made. When translating the questionnaire into the language of the respective country, particular attention is paid to translation equivalence of the questionnaire versions by rigorous translating and back-translating rounds by language and subject matter experts (Douglas and Craig, 1983). The unit of analysis for the survey is the manufacturing site or plant, and all data are collected from plant managers as key informants within that site, who often consult others in their firm. These managers are targeted since they are deemed to possess a comprehensive knowledge of the plant's operations, in addition to having insight into related functions. The managers are advised to solicit input from other functions, such as marketing and finance, when appropriate. Data is collected by individual members of the GMRG, who are requested to apply the most appropriate approach and the most suitable population frame depending on the country-specific circumstances (Whybark, 1997). This flexibility is afforded to the researchers owing to the complexity and length of the questionnaire, often requiring the key respondent to consult with other individuals within the firm, or the compilation of historical data and the calculation of indices. For example in Croatia the questionnaire is sent by postal mail, addressed to the Chief Executive asking him to allow the survey. All manufacturing companies in Croatia with more than 10 employees were targeted

and there were 2716 companies in the population. Therefore the questionnaire was sent to all of them without the necessity of sampling. That is the advantage of a small country. In larger countries with a higher number of manufacturing firms, sampling had to be performed. Since the questionnaire is very long individual data gatherer can decide which approach is most suitable for his/her country. As such, most questionnaires are completed during an on-site visit (43 %) by the researcher, followed by Internet (29 %) and mail surveys (23 %) (Schoenherr and Narasimhan, 2012). The GMRG survey is tested for common method bias in accordance with Conway and Lance (2010). Conway and Lance (2010) propose that if questionnaire is well designed, there should be no common method bias, that is, the responders adequately assess the situation in the company. The researcher should not reveal to the responder causal relationships he/she wants to test. Questions that will later become a construct should not be posed together, rather scattered across the questionnaire to avoid bias. Because GMRG instrument was designed with all these prescriptions in mind, it can be said that GMRG data does not suffer from common method bias.

After the data is collected additional tests were performed. Non response bias was tested using $\chi 2$ statistics on the first fifteen and last fifteen answers, according to methodology proposed by Armstrong and Overton (1977.). As there were no significant differences in response, it can be said that GMRG data does not present issues related to non-response bias.

Vickery et al. (1993) and Klassen and Whybark (1999) show same as Conway and Lance (2010) that managerial estimations are a valid source of information. However, to maximize validity, observable measures were used and perceptual measures reflected manager's estimations.

The questionnaire had five modules from which the Core module is obligatory for every data gather. Other modules were Internal manufacturing practices, Innovation, Supply Chain Management, Organizational culture. Every data gatherer (and there can be more than one per country) decides which modules he/she collects in accordance to his/her research interests. Every data gatherer had to collect minimum of 30 responses. After the gathering process, the data gatherer gets data form other data gatherers but only for modules he/she collected. Overall, GMRG data gatherers managed to obtain 1008 responses, but due to some missing values the analysis was performed on the sample of 988 companies.

Measures

For structural equation modelling, first a confirmatory factor analysis has to be performed. Confirmatory factor analysis checks for adequate convergent validity and average variance extracted for each construct. Also factor loadings to a constract have to be checked. Finally, the overall goodness of fit has to be adequate. Results from confirmatory factor analysis for the model (Figure 3) is presented in Table 4.

Table 4. Confirmatory factor analysis for the model proposed in Figure 3.

			Estimate	S.E.	C.R.	P
	Ordinary capabilities – investment areas in last two years in terms of money, time, employees. 7 point Likert scale ranging from 1- not at all to 7 – to a great extent.					
Investment into capabilities CR=0,928 AVE=0,561 Cronbach Alpha =0,930	<---	Work place health and safety	0,706			
	<---	Plant information flows automation	0,694	0,054	20,355	***
	<---	Integrating manufacturing and design processes	0,734	0,053	21,466	***
	<---	Environmental impact of operations	0,667	0,051	20,895	***
	<---	Workforce training and development	0,657	0,048	19,437	***
	<---	Supplier development	0,598	0,052	17,571	***
	<---	Flexible workforce	0,637	0,052	18,691	***
	<---	Processing technologies (e.g., FMS, automation)	0,672	0,059	18,631	***
	<---	Planning/scheduling processes and methods	0,739	0,05	21,404	***
	<---	Manufacturing lead time reduction programs	0,709	0,054	20,037	***
	<---	Cost reduction programs (e.g., Target Costing)	0,624	0,053	18,095	***
	<---	Quality management programs (e.g., TQM, Six-Sigma)	0,629	0,061	17,859	***
	<---	Customer service	0,69	0,039	24,17	***
	<---	Customer process integration	0,722	0,053	21,166	***
	<---	Supplier process integration	0,693	0,052	20,333	***

	Dynamic capabilities – Intellectual capital - from Subramaniam and Youndt (2005). Measured on 7-Likert scale (1- not at all valid, 7- absolutely valid for our plant)					
Intellectual capital CR= 0,919 AVE=0,492 Cronbach Alpha =0,917	<---	There is ample opportunity for informal conversations among employees in the plant.	0,375			
	<---	Employees from different departments feel comfortable calling each other when need arises.	0,574	0,114	13,063	***
	<---	People are quite accessible to each other in the plant.	0,631	0,121	12,87	***
	<---	We are able to discuss problems and tough issues openly.	0,642	0,139	12,556	***
	<---	Standard operating procedures are in place.	0,643	0,162	10,51	***
	<---	Much of this plant's knowledge is contained in manuals, archives, or databases.	0,553	0,167	9,9	***
	<---	We usually follow the sequence of written procedures and rules.	0,585	0,16	10,142	***
	<---	Processes in our plant are well defined.	0,381	0,228	8,418	***
	<---	Employees in this plant are highly skilled in their respective jobs.	0,608	0,137	10,38	***
	<---	Employees in this plant are considered among the best people in the organization.	0,62	0,154	10,414	***
	<---	Employees in this plant are experts in their particular jobs and functions.	0,687	0,152	10,761	***
	<---	Every employee in this plant has useful experience.	0,578	0,14	10,203	***
	<---	This plant and its major external partners have common understanding about what activities are best for our relationship.	0,712	0,143	11,441	***
	<---	This plant and its major external partners have shared objectives and visions.	0,738	0,166	10,986	***
	<---	This plant and major external partners share common language and codes (e.g. special vocabulary, abbreviation, and technical terms).	0,673	0,17	10,597	***

	<---	This plant and its major external partners have common understanding about the same concepts (e.g. good, fast, cost, quality).	0,7	0,157	10,831	***
	<---	This plant and its major external partners have similar behavioral rules and norms.	0,723	0,165	10,79	***
	<---	This plant and its major external partners have common values and culture.	0,707	0,173	10,777	***
	Competitiveness is a compound variable that was measured on a 7 point Likert scale asking responders to rate them self against their competitors. It involved following measures (1- much worse, 7 much better:					
Competitiveness CR= 0,869 AVE=0,492 Cronbach Alpha =0,882	<---	1. Labor unit costs	0,374			
	<---	2. Total product unit costs	0,464	0,097	13,143	***
	<---	3. Raw material unit costs	0,411	0,094	10,732	***
	<---	4. Product performance	0,562	0,137	9,783	***
	<---	5. Product conformance to customer specifications	0,622	0,148	10,053	***
	<---	6. Pre-sales service and after sales service	0,631	0,17	10,119	***
	<---	7. Delivery speed	0,663	0,174	10,326	***
	<---	8. Delivery reliability	0,656	0,167	10,264	***
	<---	9. Response to changes in delivery due dates	0,69	0,176	10,359	***
	<---	10. Production volume flexibility (increase/decrease volume)	0,685	0,174	10,343	***
	<---	11. Production variety flexibility (increase/decrease product mix)	0,668	0,177	10,25	***
	<---	12. Number of new products introduced each year	0,429	0,143	8,705	***
	<---	13. Lead time to introduce new products	0,46	0,148	9,062	***
	<---	14. Lead time to implement new or change existing processes	0,535	0,15	9,689	***
	<---	15. Lost time accidents	0,31	0,138	7,184	***
	<---	16. Consumption of scarce resources	0,398	0,126	8,4	***
	<---	17. Discharge of hazardous materials	0,38	0,141	8,189	***
	Business results is measured by three components on a 7 point Likert scale. However, the scale varied from 1- decreased by more than 25 %, 4- stayed the same, or 7 – grew more than 25 %.					

	Profit margin is a continuous variable that ranges from negative to 100. It is computed as revenues minus all costs (material, labor, overhead).					
Business plus profit CR= 0,760 AVE=0,498 Cronbach Alpha =0,849	<---	1. Total sales of goods and services	0,853			
	<---	2. Profitability	0,867	0,034	27,864	***
	<---	3. Market share	0,711	0,03	23,706	***
	<---	Profit mrgin (revenues - all costs)	0,092	0,662	2,689	0,007
Model fit χ^2/df=2,299, GFI=0,898, NFI=0,906, RFI=0,895, CFI =0,944, REMSA=0,036, PCLOSE=1						

As it can be seen in Table 4, all threshold values are all in acceptable range (χ2/df<5),GFI>0,8, REMSA<0,1 PCLOSE >0; <1, and the model fits well (Hu and Bentler, 1999).

Composite reliability (CR) statistics indicates strong construct reliability in most cases; all CR values are well above 0.7 (Fornell and Larcker 1981). The results also indicated acceptable discriminant validity for the measures at both the construct and item levels. We interpret these fits as strong, especially given the multi-country, multi-industry and highly varying size of the organizations and plants represented in this data set.

The average variance extracted (AVE) for each construct variable should be greater than the squared correlation of the construct with any other construct, indicating acceptable construct discrimination (Fornell and Larcker 1981). All AVE (convergent validity) should be greater >0,5 in line with Hair et al. (2010). Even though some values of factor loadings are less than 0,7, and some AVE <0,5 we did not exclude any single variable from our proposed model. Results for AVE are in range from 0,492 to 0,561 which is considered adequate. All factor loadings have to be over 0,7 which is valid for most of the variables. There is a prescription to exclude all variables with factor loadings less than 0,7. But, since the deviation from prescription is small it was not done, because the overall model fit is good. Besides, this analysis can be considered as another replication of validity of Subramaniam and Youndt (2005) model.

Common method variance (CMV) is a crucial question when both the dependent and focal explanatory variables are perceptual measures derived from the same respondent. Four approaches are recommended in the literature as methods that researchers should use to avoid or correct CMV (Chang et al., 2010; Podsakoff et al., 2003). In this work all four preconditions were fulfilled.

1. Using different sources for independent and dependent variables (in this research increase in revenues, market share and profits are an objective value generated by the bookkeeping/accounting unit of the company, so are investments into R&D, training and technology, whereas other perceptual measures are self-rated on seven point Likert scales).

2. In the design phase of the questionnaire the questions are in different sections, and different scales are used, so this prescription is also fulfilled. The core part of the questionnaire gathers financial data, whereas other modules gather perceptual measures. Eggers and Kaplan (2013) state most managers have an accurate mental representation of their organization's capabilities.

3. Complicated specifications of regression models reduce the likelihood of CMV. Specifically, respondents are unlikely to be guided by a cognitive map that includes difficult-to-visualize interaction and non-linear effects. This is less likely the more complicated the model. Intellectual capital, dynamic capabilities and the performance outcomes of a company are not a linear (Eisenhardt and Schoonhoven, 1996) and it is hard to visualize, so this prescription is also fulfilled.

4. A post hoc Harman one-factor analysis is often used to check whether variance in the data can be largely attributed to a single factor. The post hoc Harman one-factor analysis was performed and the results indicated presence of loading to more factors.

Results

First a brief overview of the sample is provided. There are 308 companies from developed countries, 463 companies from developing countries and 217 companies from transition countries. The division to country category are from last report of World Economic Forum - Competitiveness report for 2016. (WEF, 2016). In Table 5 countries are displayed (column 1), in which category of competitiveness of the country they belong to (column 2), and composite measures of competitiveness already presented in Table 4 (columns 4 and 5). Competitiveness as a variable was measured in comparison to competitors, in terms of usual competitive factors in manufacturing, such as costs, quality, delivery on time, innovation or ecology in accordance to advise given by Peng et al. (2008.) and Nand et al. (2014.). Variable competitiveness (column 4) was constructed as a composite variable in AMOS, checked the goodness of fit and then the calculated value was imputed into SPSS for further analysis.

Fifth column presents business results, where business results were measured as: (1) decreased more than 25 % in last two years, (4) stayed approximately the same, (7) increase of more than 25 %.

The sixth column presents average revenues from services, and this is also the variable by which the sample was divided into servitized and unservitized companies.

Seventh column represents average profit margin (calculated as revenues minus costs for materials, labour and other fixed costs).

Eight column presents age of technology, which is important because provision of services needs up-to-date technology for delivering services. The lower the value in the column Technology age the newer is the manufacturing equipment: (1) 0 - 4 years old, (2) 4-5 years, (3) 6-7 years, (4) 8-10 years, (5) 11-15 years, (6) 16-20 years, (7) more than 20 years old. This was assessed since provision of services, unlike pure services, depend on technology used. The more modern is the technology more features and services can be rendered. It was also looked at how much companies on average invested into technology in the last two years. This is especially important since technology advances fast. Here, the higher the number, the higher investment was made. The legend is as follows (column 9): (1) less than 3 % of sales, (2) 3-4 %, (3) 5-7 %, (4) 8-10 %, (5) 11-15 %, (6) 16-20 %, (7) more than 20 % of sales. Finally the average size of companies in researched countries are presented in (column 10).

Table 5. Descriptive statistics of the sample

Country	developed or developing	N	Competitiveness	Business results	Revenues from services	Profit group	Technology age	Investment into technology in 2 last years as % of revenues	Number of employees
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Australia	Developed - stage 3 - innovative economies N=308	71	2,28	3,94	17,11	2,05	2,80	2,31	275
Canada		4	2,84	3,39	2,00	2,00	4,00	3,00	134
Czech Republic		1	2,47	5,15	95,00		4,00	3,00	105
Germany		45	2,53	4,09	12,71	1,90	3,42	2,40	1941
Ireland		30	2,46	3,61	8,63	2,10	3,67	1,63	251
Netherlands		2	2,37	3,54	7,50	2,50	3,00	3,00	66
USA		155	2,48	4,24	27,28	2,03	4,37	2,85	428
Croatia	Transition economies N=217	99	2,58	3,57	26,91	2,03	4,04	3,33	91
Hungary		38	2,44	4,28	11,44	1,56	4,13	2,90	258
Poland		80	2,48	3,78	43,65	1,61	2,90	2,66	65
China	Developing economies N=463	102	2,54	4,34	22,52	1,89	3,51	4,12	5614
India		57	2,81	5,06	21,24	2,11	4,11	3,70	1225
Korea		81	2,42	4,08	41,23	1,93	3,35	3,07	561
Nigeria		20	2,65	2,44	30,59	1,76	4,90	4,45	152
Taiwan		40	2,64	3,96	15,15	1,91	2,08	2,13	1148
Ukraine		50	2,21	4,05	6,62	1,88	5,22	2,26	185
Vietnam		113	2,46	4,17	45,73	1,95	2,24	3,17	330
Total		988	2,49	4,07	25,89	1,92	3,56	3,00	1027

From Table 5, it can be seen that the total average of business results (column 5) is 4,07 which actually means that business results are approximately the same in last two years, or put another way, there is no growth or fall of revenues, profits and market share. This actually shows that even if companies did start to provide services, and gained a certain part of revenues by that provision, it did not affect growth of business. That means that services are provided for other reasons than financial, that is, probably to stay competitive. Table 6. displays differences in results depending whether the company is servitized or not.

Table 6. Main indicators of servitized and non servitized manufacturing plants

Indicator	Servitized	N	Mean	Std. Deviation	Std. Error Mean	Sig.
Competiveness	Not servitized	319	2,45	0,37	0,02	0,01
	Servitized	669	2,51	0,40	0,02	0,01
Business growth/fall	Not servitized	319	4,07	1,02	0,06	0,93
	Servitized	669	4,06	1,20	0,05	0,93
Revenues from services	Not servitized	206	0,00	0,00	0,00	0,00
	Servitized	669	33,86	33,62	1,30	0,00
Profit margin (Revenues - all expenses for material labor and overhead)	Not servitized	158	20,22	23,46	1,87	0,01
	Servitized	484	13,71	30,58	1,39	0,01

Note: red marked are components that are statistically significantly different between the two groups of enterprises with theoretical significance level of 5 %.

From Table 6 it can be seen that 68 % of companies in the sample offer services and generate share of revenues by service provision. This high percentage of servitization of companies now calls for a different research methodology, that is more appropriate to research servitization through surveys instead of case based research (which was appropriate when servitization was not widespread). Student T-test was applied to groups of servitized and non servitized companies, and it can be seen from Table 6. that there is a statistically significant difference at level $p<0,5$ in all indicators except *Business growth/fall*. Of course there is a difference between *Revenues from services*, but that is expected because by this variable the sample was divided into servitized and non servitized. It can be seen that on the average servitized companies can make up to 33,86 % of sales by providing services. From Table 6 it can be seen that there is not a statistically significant difference in *Business growth/fall*. It means that servitized companies do not enjoy significantly larger profits, revenues or market share. It is interesting to note from Table 6 that profit margin is actually higher for unservitized companies. This, seemingly contradictory result will be explained when a division into development of countries is performed. Then an explanation will be provided. For now, summarising up Table 6, it can be

seen that indeed servitized companies are more competitive than their non servitized counterparts.

In the introduction section, it was highlighted that prior research suggested that companies should servitize to gain better revenues. However, following research did not see a positive trend in revenues. It was also stated that building a servitized system can take from four to ten years. Therefore in the analysis it is necessary to look into the standard operating procedures and see if there is a difference between servitized and unservitized companies.

Table 7. depicts investments depending on whether the company is servitized or not. For each row (Investment fields), Student t-test is performed. It can be seen that companies that are servitized invest more, but, significantly higher are: 3. Manufacturing lead time reduction programs, 4. Planning/scheduling processes and methods, 5. Processing technologies (e.g., FMS, automation), 6. Flexible workforce, 7. Supplier development, 11. Plant information flows automation, 13. Customer service, 14. Customer process integration, 15. Supplier process integration.

Table 7. Investment areas in manufacturing companies, building ordinary capabilities

Investment area	Servitized	N	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed) T- test
1. Quality management programs (e.g., TQM, Six-Sigma)	Not servitized	283	4,14	1,79	0,11	0,31
	Servitized	665	4,27	1,68	0,06	0,32
2. Cost reduction programs (e.g., Target Costing)	Not servitized	285	4,50	1,55	0,09	0,83
	Servitized	664	4,52	1,52	0,06	0,83
3. Manufacturing lead time reduction programs	Not servitized	284	4,12	1,57	0,09	0,00
	Servitized	662	4,50	1,47	0,06	0,00
4. Planning/scheduling processes and methods	Not servitized	283	4,43	1,45	0,09	0,01
	Servitized	664	4,70	1,41	0,05	0,01
5. Processing technologies (e.g., FMS, automation)	Not servitized	283	4,08	1,63	0,10	0,02
	Servitized	663	4,36	1,61	0,06	0,02
6. Flexible workforce	Not servitized	285	4,12	1,52	0,09	0,00
	Servitized	664	4,55	1,47	0,06	0,00
7. Supplier development	Not servitized	284	3,83	1,51	0,09	0,00
	Servitized	662	4,18	1,52	0,06	0,00

8. Workforce training and development	Not servitized	280	4,32	1,47	0,09	0,07
	Servitized	651	4,50	1,41	0,06	0,08
9. Environmental impact of operations	Not servitized	283	4,12	1,61	0,10	0,16
	Servitized	661	4,28	1,58	0,06	0,17
10. Integrating manufacturing and design processes	Not servitized	280	4,03	1,48	0,09	0,00
	Servitized	663	4,46	1,55	0,06	0,00
11. Plant information flows automation	Not servitized	283	4,18	1,56	0,09	0,00
	Servitized	662	4,54	1,56	0,06	0,00
12. Work place health and safety	Not servitized	284	4,94	1,30	0,08	0,97
	Servitized	665	4,94	1,44	0,06	0,97
13. Customer service	Not servitized	284	4,84	1,49	0,09	0,00
	Servitized	664	5,16	1,30	0,05	0,00
14. Customer process integration	Not servitized	283	4,20	1,57	0,09	0,00
	Servitized	663	4,69	1,51	0,06	0,00
15. Supplier process integration	Not servitized	278	3,96	1,54	0,09	0,00
	Servitized	645	4,38	1,51	0,06	0,00

Note: red marked are components that are statistically significantly different between the two groups of enterprises with theoretical significance level of 5 %.

Table 7 now provides a complete picture of differences between servitized and unservitized companies. Provision of services requires automation and flow of information (including digital flow of information). Also, Customer service department is important. The age of equipment is not that significant, but what is statistically important is the amount invested into technology in last two years. It is shown, that servitized companies invest on average 5-10 % of revenues into new technology, compared to unservitized companies that invest only up to 5 % in new technology.

Looking back at Table 7, into investment areas of ordinary capabilities that are statistically significantly different between servitized and unservitized companies, it can be seen that those are in areas concerning technology, communication within and outside the company, that there is a need to form Customer support centre, and that strong integration with customers and suppliers is necessary. That means, apart from advanced information technology, employees that communicate with customers and suppliers, not only have to have higher technical knowledge, but have to have also high social skills for proper dissemination of information and we can state that Intellectual capital of the company plays an important role. Therefore, in Table

8. components of Intellectual capital are displayed and again using Student T-test differences in intellectual capital components between servitized and unservitized companies are investigated.

Table 8. Intellectual capital components for servitized and non servitized manufacturing companies

Intellectual capital component	Servitized	N	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
1. There is ample opportunity for informal conversations among employees in the plant.	Not servitized	158	5,16	1,27	0,10	0,95
	Servitized	427	5,16	1,29	0,06	0,95
2. Employees from different departments feel comfortable calling each other when need arises.	Not servitized	158	5,41	1,20	0,10	0,44
	Servitized	430	5,32	1,28	0,06	0,43
3. People are quite accessible to each other in the plant.	Not servitized	158	5,52	1,08	0,09	0,85
	Servitized	430	5,50	1,23	0,06	0,84
4. We are able to discuss problems and tough issues openly.	Not servitized	158	5,34	1,31	0,10	0,63
	Servitized	429	5,39	1,31	0,06	0,63
5. Standard operating procedures are in place.	Not servitized	157	5,38	1,25	0,10	0,90
	Servitized	430	5,39	1,29	0,06	0,90
6. Much of this plant's knowledge is contained in manuals, archives, or databases.	Not servitized	158	4,85	1,44	0,11	0,22
	Servitized	430	5,02	1,44	0,07	0,22
7. We usually follow the sequence of written procedures and rules.	Not servitized	158	5,11	1,41	0,11	0,22
	Servitized	430	5,27	1,33	0,06	0,23
8. Processes in our plant are well defined.	Not servitized	158	5,18	1,43	0,11	0,08
	Servitized	430	5,57	2,69	0,13	0,02
9. Employees in this plant are highly skilled in their respective jobs.	Not servitized	158	5,17	1,06	0,08	0,13
	Servitized	429	5,33	1,15	0,06	0,11
10. Employees in this plant are considered among the best people in the organization.	Not servitized	158	4,89	1,12	0,09	0,06
	Servitized	429	5,10	1,28	0,06	0,05
	Not servitized	158	5,04	1,03	0,08	0,04

11. Employees in this plant are experts in their particular jobs and functions.	Servitized	428	5,25	1,18	0,06	0,03
12. Every employee in this plant has useful experience.	Not servitized	158	5,25	1,09	0,09	0,64
	Servitized	427	5,30	1,23	0,06	0,63
13. This plant and its major external partners have common understanding about what activities are best for our relationship.	Not servitized	157	4,92	1,09	0,09	0,05
	Servitized	427	5,12	1,12	0,05	0,04
14. This plant and its major external partners have shared objectives and visions.	Not servitized	158	4,68	1,09	0,09	0,00
	Servitized	427	5,07	1,22	0,06	0,00
15. This plant and major external partners share common language and codes (e.g. special vocabulary, abbreviation, and technical terms).	Not servitized	158	4,66	1,29	0,10	0,03
	Servitized	428	4,93	1,28	0,06	0,03
16. This plant and its major external partners have common understanding about the same concepts (e.g. good, fast, cost, quality).	Not servitized	158	5,13	1,01	0,08	0,76
	Servitized	428	5,17	1,22	0,06	0,74
17. This plant and its major external partners have similar behavioral rules and norms.	Not servitized	158	4,86	1,13	0,09	0,18
	Servitized	428	5,01	1,22	0,06	0,16
18. This plant and its major external partners have common values and culture.	Not servitized	158	4,53	1,27	0,10	0,00
	Servitized	428	4,89	1,28	0,06	0,00

Note: red marked are components that are statistically significantly different between the two groups of enterprises with theoretical significance level of 5 %.

Marked red are statements that are statistically different between servitized and unservitized companies. First two components: 8. Processes in our plant are well defined and 11. Employees in this plant are experts in their particular jobs and functions, are extremely important (significantly different) and show that there have to exist clear work rules, and also skilled employees for each work field. Another important set are the statements 13., 14., 15., 18. which deal with external communication with buyers and suppliers. Table 8., shows that what Teece (2014.) calls dynamic capabilities (sensing, seizing, reconfiguring) can be read through these

statements. The components relating to detecting opportunities from the environment (sensing), can be recognized in all the components of Table 8. concerning communication with external partners (statements 13., 14., 15. and 18. related to customers and suppliers). Then, mobilization and coordination of resources necessary to take advantage of opportunities (seizing) is facilitated by clear rules and procedures of production and of course capable employees (statements 8. and 11.). Simply, the opportunity from the environment should be answered quickly, and there is no time to discover how the work should be performed. Reconfiguration is perhaps most present in the statement 4. of Table 8 (employees can openly discuss difficult issues). When employees would not be able to talk openly about the challenges, most likely, problems and issues would not be solved. So, the ability to talk openly is extremely important to solve problems and exploit opportunities. Providing additional services therefore does not allow the companies to close into themselves, but on the contrary, should be able to talk with customers and suppliers. But again, not to any customer and supplier, but selected few, with whom they can establish shared norms, vision and culture. Literature suggested a recommendation of forming the Customer relationship department. This is a good recommendation, but it should be remembered that only the formation of the department is not enough. The department must have good relationships with other areas of the company, in order to solve customer's problems and offer the provision of additional services.

In the introduction of this chapter, the proposed model was introduced in Figure 3. Hypotheses were laid out. In particular, the hypothesis H0: Intellectual capital is moderating ordinary capabilities to results (competitiveness, business results, profit margin), that is, Intellectual capital is a second order variable. So, it has to be tested: does intellectual capital influence directly ordinary capabilities and in this way enhance results, or intellectual capital affects ordinary capabilities indirectly. This test is technically a little more demanding. The complex variable of competitiveness, intellectual capital and investments (ordinary capabilities) that have been calculated using Amos, now have to be standardized in SPSS.

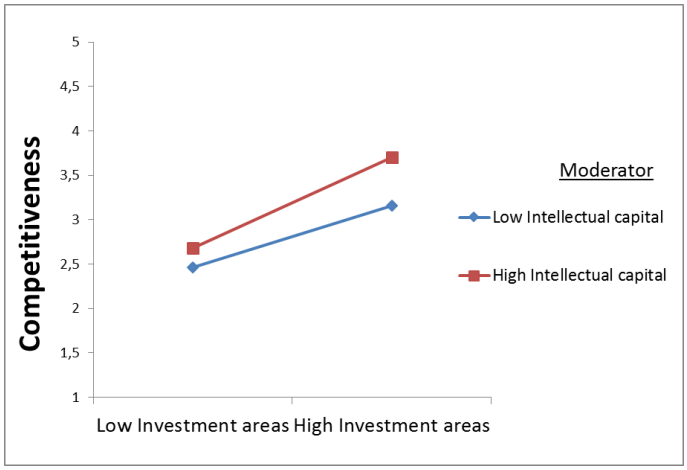
After all variables are standardized, they are used to calculate interaction effects (indirectness). This is done by calculating a new variable in SPSS that is the product of the standard values of the investments (ordinary capabilities) and intellectual capital. Once these variables are calculated in SPSS table and the table saved, AMOS is run again. Now, the basic model has an additional interaction term. Again, significance and goodness of fit is checked, especially because there is an additional variable. If the model fit is satisfactory, the unstandardized values

of relationship are entered into drawing tool for interaction effects (Gaskin, 2016). In this case, the procedure had to be repeated twice, first on a sample of companies that do not offer supporting service, and then on the sample of companies offering supporting services. When the model was checked on the sample of companies that do not offer services, not only the model did not fit well, but also the interaction variable was not statistically significant. Therefore, on the sample of companies that do not offer services, intellectual capital does not moderate competitiveness and no interaction effect is present. This means that ordinary capability, under the influence of intellectual capital in companies that do not offer services, do not have any impact on dependent variables. That is, even if the company has high intellectual capital, and low-ordinary capabilities (and vice versa) the results show no effect on the dependent variable. There is no positive or negative effect, because the model would have shown either effect. The dependent variables were competitiveness, business result (raise / fall) and profit margin. However, when the same procedure is repeated on a sample of companies that offer additional service, model shows good fit, the interaction variable has a significant positive effect on the dependent variable. In other words, ordinary capabilities influenced by intellectual capital increase dependent variable, in this case competitiveness of the sample of servitized companies.

By performing both analyses of interaction on both samples (servitized or unservitized), it was shown that Intellectual capital has a strong positive impact – only on competitiveness. On other dependent variables, business growth/fall or profit margin, there were no interaction effects, that is, the mediator variable was not significant. It cannot be said that there is a negative relationship, because the model would have shown that. Therefore, from the above analysis the only result that emerges is that intellectual capital enhances competitiveness of servitized companies.

The next step in moderation analysis is evaluating the strength of the moderation effect. The results are shown on Figure 4.

Figure 4. Moderation effect of Intellectual capital for servitized companies



From Figure 4 it can be seen that the "High Intellectual capital" line is steeper than the "Low Intellectual capital" line. It means that as the ordinary capabilities raise (measured through investments into ordinary capabilities), so will the competitiveness, but if a company possess higher Intellectual capital, this increase in competitiveness will be higher than in the case of lower Intellectual capital. Therefore, Intellectual capital enhances the influence of ordinary capabilities on competitiveness.

With the previous analysis H0 hypothesis is confirmed, that Intellectual capital is a moderating variable, though only for servitized companies. The fact that the hypothesis was not confirmed on the unservitized sample only means that intellectual capital in that case does not influence ordinary capabilities. And the main difference in ordinary capabilities of servitized and unservitized companies were in: 3. manufacturing lead time reduction programs, 4. planning/scheduling processes and methods, 5. processing technologies (automation), 6. investment into flexible workforce, 7. supplier development, 11. plant information flows automation, 13. investment into customer service department, 14. customer process integration, 15. supplier process integration in manufacturing through automation and coordination, as seen in Table 7.

To keep the argument about competitiveness clear it was necessary to check is there a difference in servitization among developing and developed countries. In this part of analysis, transition countries are excluded from the sample. The division into developed, developing and transition

countries was done according to World Economic Forum - Competitiveness report for 2016 (WEF, 2016.) and the results are displayed in Table 9.

Table 9. Main indicators of companies according to the development of the country in which they operate (developed and developing)

Indicator	Developed country	N	Mean	Std. deviation	Std. Error Mean	Sig.T-Test
Competiveness	NO	463	2,51	0,38	0,02	,022
	YES	308	2,44	0,41	0,02	,025
Business results(raise/fall)	NO	463	4,20	1,22	0,06	,141
	YES	308	4,08	0,92	0,05	,120
Servtization revenues	NO	382	26,84	32,77	1,68	,023
	YES	286	21,10	31,55	1,87	,022
Profit margin	NO	321	17,42	27,05	1,51	0,607
	YES	171	18,76	28,66	2,19	0,614
Technology age	NO	463	3,37	1,86	0,09	,001
	YES	308	3,79	1,71	0,10	,001
Investment into technology in 2 last years as % of revenues	NO	463	3,29	2,04	0,10	,000
	YES	308	2,55	1,75	0,10	,000

Note: red marked are components that are statistically significantly different between the two groups of enterprises with theoretical significance level of 5 %.

As it can be seen in Table 9, developed countries have higher profit margins even though the difference is not statistically significant. By contrast, developing countries display higher competitiveness and a larger share of service revenues. Technology is older in developed countries, and developing countries invested more into technology in the last two years. Developing countries on average invest 3,29 which is by the legend already displayed by Table 5: (1) <3 % of sales, (2) 3-4 %, (3) 5-7 %, (4) 8-10 %, (5) 11-15 %, (6) 16-20 %, (7) more than 20 % of sales, on average from 5-7 % of revenues. Business results (raise/fall) are

approximately the same in developed and developing countries. Competitiveness is higher in developing countries. This is a paradoxical result. One possible explanation is that in developed countries, manufacturing companies are well established and have strong brands, and manufacturing companies in developing countries, lacking these two important factors (reputation) have to invest more into differencing themselves, and thus a higher competitiveness index (remember this competitiveness index was measured in standard manufacturing measures of cost, quality , etc. in comparison to competitors).

Since Croatia, according to World Economic Forum - Competitiveness report for 2016 (WEF, 2016) falls into category of transition countries the same analysis was performed between developed and transition countries (Table 10). There are three transition countries in the sample (Croatia, Hungary and Poland) and as in the previous analysis, transition countries display a higher competitiveness. In comparison to transition countries, business results of manufacturing companies in developed countries have fallen, in contrast to companies in transition countries which stagnated (no raise, but no fall either) in last two years. Share of revenues generated by services are higher in transition countries as was the case of comparison of developed and developing countries. But, again, manufacturing companies in developed countries have significantly better profit margins in comparison to manufacturing companies in transition countries. Possible explanation is the same as for manufacturing in developing countries, that is, they have to differentiate much stronger in order to survive. Transition countries have significantly invested more into technology in two last years as was the case with developing countries (5-7 % of sales). The manufacturing technology, though, is of similar age in transition and developed countries.

Table 10. Main indicators of companies according to the development of the country in which they operate (developed and transition)

Indicator	Developed or transition country	N	Mean	Std. deviation	Std. Error Mean	Sig.T-Test
Competiveness	Developed	308	2,44	0,41	0,02	0,031
	Transition	217	2,52	0,38	0,03	0,028
	Developed	308	4,08	0,92	0,05	0,001

Business results(raise/fall)	Transition	217	3,77	1,20	0,08	0,002
Servtization revenues	Developed	286	21,10	31,55	1,87	0,001
	Transition	207	30,75	33,50	2,33	0,001
Profit margin	Developed	171	18,76	28,66	2,19	0,001
	Transition	150	6,87	32,28	2,64	0,001
Technology age	Developed	308	3,79	1,71	0,10	0,297
	Transition	217	3,64	1,57	0,11	0,29
Investment into technology in 2 last years as % of revenues	Developed	308	2,55	1,75	0,10	0,004
	Transition	217	3,01	1,89	0,13	0,005

Note: red marked are components that are statistically significantly different between the two groups of enterprises with theoretical significance level of 5 %.

Analysing only the question of competitiveness from Table 9 and Table 10 it can be concluded that competitiveness of manufacturing companies in developed countries is threatened from developing and transition countries. However, developed countries still have higher profit margins (significant higher from transition countries) and higher from profit margins from developing counties although not statistically significant.

A section of the first chapter was devoted to complexity of the product. A company which produces complex products can offer more services and on average have higher share of revenues form services in comparison to manufacture of simple products. Therefore, the analysis of service revenues without taking into account complexity of the product would not be complete. Table 11 displays main indicators depending does the manufacturing company produce a simple or a complex product. The hypothesis is grounded on Dachs et al. (2014) that companies producing complex product would report higher share of revenues from services. Analysis was again divided into comparison between developed and developing, and developed and transition countries. The main argument for this analysis is the premise that in developing and transition countries dominates labour intensive production.

As can be seen from Table 11, in terms of competitiveness there is no difference if a company manufacture simple or complex products (in developing and developed countries). This maybe be explained by Porter's (1998) generic strategies. Manufacturing of standard simple products in large quantities and usage of economies of scale is usually a characteristic of Porter's Cost leadership strategy. Manufacturing of small batches of complex products are more frequently considered as Porter's differentiation strategy. That fact that there is no difference in competitiveness, may mean that both strategies are equally viable, and present in both groups, and are equally profitable. That's why those strategies are called "generic" strategies.

Business results (raise/fall) are somewhat better for complex production in developing countries in comparison to developed countries. Before interpreting this result it should be noted that in developing countries dominates mass production (407 companies) in comparison to only 83 companies that produce complex products. In developed counties such high discrepancy in manufacturing type is not present. In mass production category there are 172 companies, while 61 companies produce complex products. Share of revenues generated by services do differ in developing countries, while in developed countries there is no difference in share of revenues depending on the complexity of product. In other words, there is no difference in share of service revenues if a company produces complex or simple products in developed countries, but interestingly, in developing countries, higher share of revenues by service generate companies that produce simple products. This finding is completely contradictory to Dachs et al. (2014.) who states that complex products generate more revenue (even though it has to be kept in mind that Dach et al. (2014.) research was performed solely on European countries). Again, this finding can be explained by the higher number of companies producing simple products (376 companies) in contrast to only 75 companies producing complex products in developing countries.

Table 11. Main indicators for simple and complex products (developed and developing countries)

	Complexity	Developing countries			Developped countries		
		N	Mean	Sig. Dif.	N	Mean	Sig. Dif.
Competiveness	simple	407	2,501	0,485	172	2,45	0,323
	complex	83	2,5338	0,47	62	2,5124	0,263
Business results	simple	407	4,0327	0,004	172	4,0851	0,389
	complex	83	4,4605	0,006	62	3,9674	0,394
Servtization revenues	simple	376	28,6459	0,036	162	19,4228	0,785
	complex	75	19,6947	0,009	56	20,75	0,772
Profit margin	simple	290	19,01	0,160	91	2,03	0,981
	complex	57	13,10	0,151	34	2,03	0,981
Technology age	simple	407	3,64	0,999	172	3,86	0,536
	complex	83	3,64	0,999	62	4,02	0,541
Investment ino technology in 2 last years as % of revenues	simple	407	3,26	0,657	172	2,58	0,272
	complex	83	3,36	0,666	62	2,31	0,268

Note: red marked are components that are statistically significantly different between the two groups of enterprises with theoretical significance level of 5 %.

Profit margin is not statistically different in manufacturing companies that offer simple or complex products. There is no difference in developing or developed countries. That only means that Porter's generic strategies are equally profitable. Simple and complex products are manufactured on manufacturing technology that is approximately of same age (legend for technology is as follows: (1) 0 <4 years old, (2) 4-5 years, (3) 6-7 years, (4) 8-10 years, (5) 11-15 years, (6) 16-20 years, (7) more than 20 years old). Since technology ranges from 3,64 to 4,02 that would fall in category of 6-8 years old. However, developing countries show a higher business results (rise in market share, revenues and profitability) if they offer complex products in comparison to companies in developing countries that offer simple products. The same difference is not evident in developed countries. In developed countries manufacturing of simple products generate higher increase in business results, even though the difference is not statistically significant.

Given that Croatia is a transition country, it was investigated how the main indicators perform if the manufacturers produce a simple or complex product in transition and developed countries. If one looks at Table 12, it can be seen that there is only one significant difference in competitiveness. That is, manufacturers of simple products are more competitive in transition countries. That, on the other hand is in line with current theory. Producers of simple products use services to differentiate from competition. Other indicators do not differentiate, even in case of service revenues. Companies producing complex products do realize higher shares of revenues from services in transition countries but that difference is not statistically significant at level p<0,5.

Table 12. Main indicators for simple and complex products (developed and tranistion countries)

	Complexity	Developed countries			Transition countries		
		N	Mean	N	Mean	N	Mean
Competiveness	simple	172	2,45	0,323	172	2,5205	0,02
	complex	62	2,5124	0,263	12	2,2575	0,04
Business results	simple	172	4,0851	0,389	172	3,8054	0,636
	complex	62	3,9674	0,394	12	3,9804	0,732
Servtization revenues	simple	162	19,4228	0,785	165	31,777	0,099
	complex	56	20,75	0,772	9	12,3333	0,001
Profit margin	simple	91	2,03	0,981	111	6	0,25
	complex	34	2,03	0,981	8	19,75	0,163
Technology age	simple	172	3,86	0,536	172	3,6	0,752
	complex	62	4,02	0,541	12	3,75	0,749
Investment ino technology in 2 last years as % of revenues	simple	172	2,58	0,272	172	3,04	0,837
	complex	62	2,31	0,268	12	2,92	0,859

Note: red marked are components that are statistically significantly different between the two groups of enterprises with theoretical significance level of 5 %.

Bustinza et al. (2015) show that the location of the manufacturer relative to his customer in supply chain, has a positive impact on the market share and consequently obtain better business results. A manufacturing company that sells to another supply chain partner will obtain lower revenues simple because every supply chain partners adds his margin, and yet the final price should be acceptable to the end customer. Further down the supply chain, the manufacturer will be a supplier and in a lower supply chain position, therefore also suffering from lower service sales. As can be seen from Table 13, there is no significant difference in share of service revenues, whether the manufacturer is a supplier and sells to another manufacturing company. But, if a manufacturer sells directly to his customer than there is a statistically significant difference in the share of service revenues. If a manufacturer sells directly to his customers, share of revenues obtained by services is higher (38 % versus 29 %). This analysis shows the importance of supply chain position. If a manufacturing company sells directly to his customers, the firm has better information about customers' needs and act accordingly and there is not such a high pressure to differentiate. Interestingly, if the government is the buyer, and the manufacturer offers services (a complete solution), these servitized companies obtain greater share of revenues through services. That is in line with Raddats et al. (2016) conclusion that governments prefer complete solutions and even do not want to own products, rather, they prefer to buy functionality that the equipment offers.

Table 13. Supply chain position and share of revenues generated by services

% of sales	Offer additional service	N	Mean	Sig. T-test
Business to business (B2B)	NE	273	58,7363	0,918
	DA	661	59,0325	0,922
Business to customer B2C	NE	260	38,0615	0,002
	DA	635	29,2968	0,004
Business to government B2G	NE	249	3,1245	0,000
	DA	614	6,7216	0,000

Note: red marked are components that are statistically significantly different between the two groups of enterprises with theoretical significance level of 5 %.

The above analysis was necessary to test the following hypotheses:

H1: Ordinary capabilities measured in terms of investment into capability enhance competitiveness

H2: Ordinary capabilities measured in terms of investment into capability enhance business results

H3: Ordinary capabilities measured in terms of investment into capability enhance profit margin

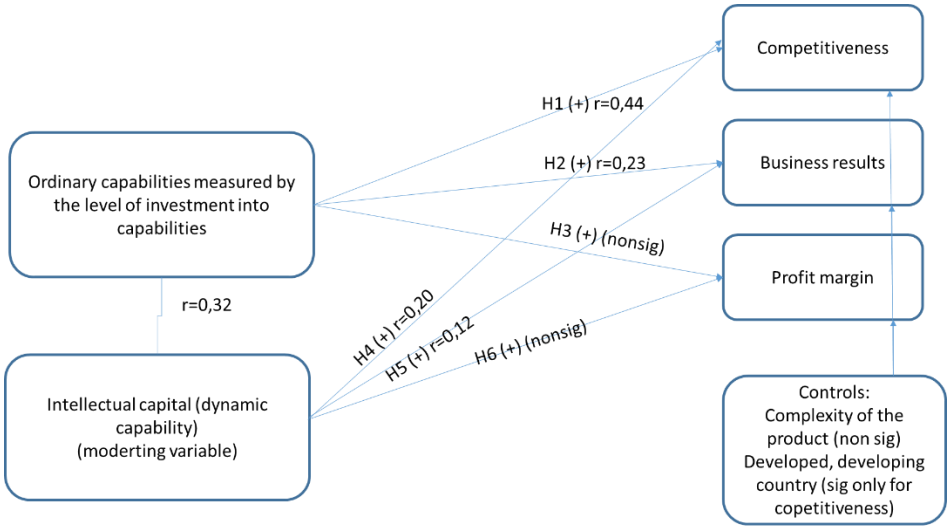
H4: Intellectual capital moderating ordinary capabilities enhance competitiveness

H5: Intellectual capital moderating ordinary capabilities enhance business results

H6: Intellectual capital moderating ordinary capabilities enhance profit margin

Results of hypotheses testing is given in Figure 5.

Figure 5. Hypotheses testing results only on the servitized sample



From Figure 5 it can be seen that hypotheses H1, H2, H4 and H5 are confirmed, that is, ordinary capabilities and Intellectual capital positively affect competitiveness and business results. Hypotheses H3 and H6 are not confirmed, but that only means that profit margins are affected by other factors than just these two (ordinary capabilities and Intellectual capital). Even though in Figure 4 it can be seen that Intellectual capital is a moderating variable, here in Figure 5 it is presented as an ordinary independent variable, in order to display the direct effects. The numbers by the hypotheses marks are standardized regression weights. They display the strength of the relationship. As standardized coefficients are normalized, it means that their values are in range [-1,1]. Therefore, the strength of each influence can be seen. For instance, it can be seen that ordinary capabilities have a stronger relationship to competitiveness (r = 0,44) and business results (r = 0,23), in comparison to Intellectual capital that has regression

coefficient r = 0,20 to competitiveness and only r = 0,20 on business results. All regression coefficients are positive which confirmes positive influence of ordinary capabilities and Intellectual capital on competitiveness and business results.

GMRG survey results conclusion

This study showed that services that are provided with the product dominantly affect competitiveness. According to Anderson (2009) manufacturing today, as opposed to software industry, falls into category of commodities. With increased competition the price of commodities is falling. This finding is backed up by literature that servitization is done for competitive reasons and not to acquire additional revenues. That on the other hand means that manufacturers are under additional pressure to provide services, without being compensated for, and its rather a survival strategy.

It would be wrong to think that in Internet era manufacturing is not important. We all have to eat, we use mobiles and computers, we have to wear clothes. Therefore, manufacturing is still necessary but it is changing by providing additional services. The question is how should manufacturers provide these services cost effectively. As seen in Figure 1, manufacturing contributes with approximately 20 % of GDP, and there is also the multiplier effect. All the products have to be transported and sold. A rough estimation is that the multiplier effect of manufacturing is of order of three (MT, 2016.; Gold, 2014.). Therefore, manufacturing is not only important for products we daily consume, but also creates jobs in services, where the majority of the population is employed. But manufacturers are under great pressure today.

What are these pressure and issues manufacturers face? Take for example Google Corporation. The majority of their software is free. They are financed only by ads placed on their search engine. And, since everybody is using Google, people (and customers) now expect such a conduct from everybody including manufacturing. Customers demand service for free in return for using the manufacturer's product. If a customer is satisfied with the manufacturers offer, he/she will recommend that manufacturer to friends and business associates. Therefore,

manufacturer sole benefit from adding services is positive word of mouth, which is interestingly, important even in the Internet era.

An additional problem facing the manufacturers is Moore's law, which states that the price of computer components fall significantly every two years. But, this law does not apply to manufacturing even though consumers think that. Even if a manufacturer bought the state of the art equipment for example for ore extraction, the price of ore, even if, it is a commodity, cannot fall under a certain price. That is, a manufacturer using ore as an input, cannot bring the costs down because they still have material expenses that do not follow Moore's law. So input materials do not fall and in some cases even go up because of scarcity of this resources. But, the software industry is completely different. A software program, once made, can be installed to endless number of computers or mobiles with no additional costs. Besides that, there is a seemingly endless choice of software and mobile applications on Internet. Customers are used to cheap software solutions. Here lays the problem for manufacturers. Customers expect the same thing that is happening in software industry to apply to manufacturing too, that is reducing prices. But that is impossible because Moore's law applies only to computer components and not classic manufacturing. Manufacturers have to explain over and over to their customers that the price of their products cannot go down each two years, as the customers are used to in information technology sector.

What that all means for a manufacturer in Croatia that manufactures part for Mercedes, Audi or the like? They have to provide all services Mercedes asks for, otherwise they lose the contract. Then, they have to offer superior quality, because if their component fails, the final product fails, which is an enormous reputation problem for Mercedes known as a reliable car. Croatian manufacturers are aware of that. And, apart from services and quality, Croatian manufacturers have to be price competitive because the competitors are numerous.

It was seen in the analysis that companies that servitize on average invest more into technology. It was seen that apart from good technological background, there has to be a good communication flow inside the company and with external partners, to satisfactorily provide the complete solution. Now, we need to investigate which services manufacturers provide and analyse in detail the situation in Croatian manufacturing.

5. Services in Croatia

EMS (*European Manufacturing Survey)* methodology

Contrary to GMRG survey, EMS survey is conducted solely in Europe. There are fewer companies in the population since the cut-off criteria is 20 employees, which is because EMS survey tries to capture standardized manufacturing practices. In smaller companies, good manufacturing practices also exist but they may not be official due to smaller number of employees, therefore it was decided by the EMS consortium to track practices only in companies with more than 20 employees.

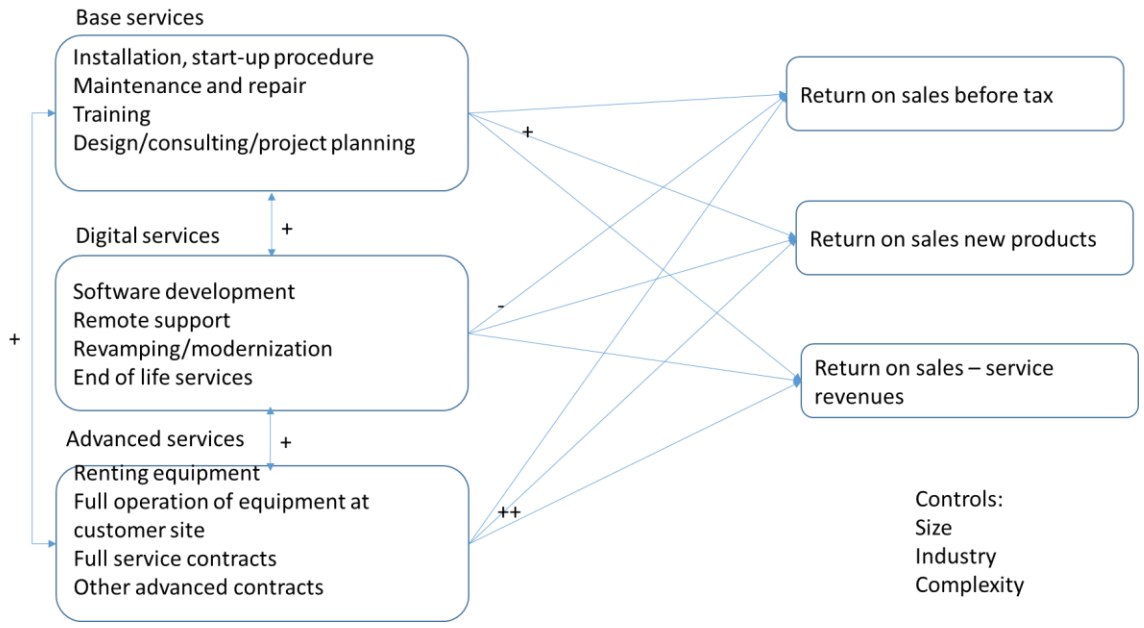
Contrary to GMRG research, where it was only possible to track share of service revenues, here in EMS research it is possible to see in detail what those services are. This allows for a more in-depth analysis to see which services are most important to manufacturing companies.

This part of research will show that some services not only do not generate revenues but also require investments. Those investments, should be made from other sources of revenues, such as new products' revenues, profit margin or services that generate revenues.

Theoretical foundation for the model that will be tested, is influenced by work of Lerch and Gotsch (2015) and Gotsch (2015). Lerch and Gotsch (2015) conclude that digitalization of services contributes to new products development. The main argument is that tracking digitally the functioning of products, manufacturing company actually use that information to improve products, thus innovating. Grubic (2014) shows that digital tracking is no more an isolated phenomenon. In 2011, more than 10 % of UK manufacturers tracked their products remotely.

The following model will be tested on Croatian sample.

Figure 6. Testing model



As can be seen from Figure 6., *base services* will have small or insignificant contribution on dependent variables (profit before tax, share of revenues from new products, share of revenues by services). *Digital technology* (services) will even have a negative effect on dependent variables, and it is hypothesized that they will require investments. The main benefits are expected from *advanced services*, which will have a significant positive effect on profit before tax, generate new ideas for products, therefore generating shares of revenues from new products, and since these services can actually be billed – will generate share of revenues by services.

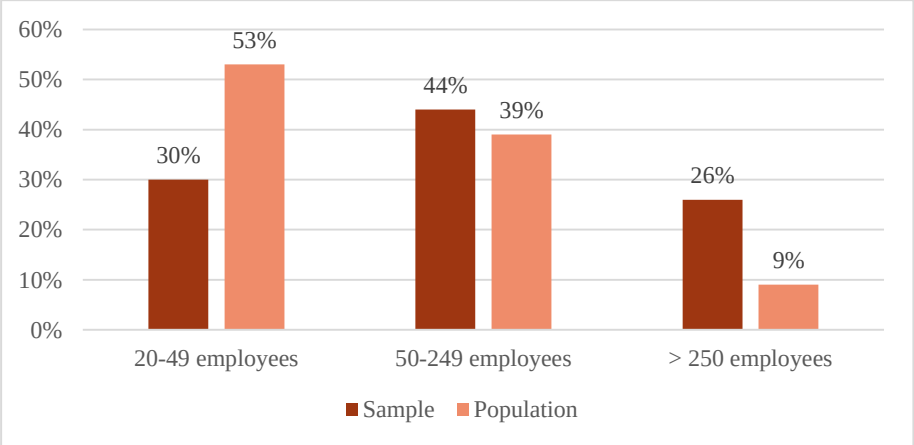
Data gathering

The questionnaire "Survey of Croatian Manufacturing 2015" was launched in September 2015. It was sent by mail to Chief Executive Officers of manufacturing companies. A census was performed and the questionnaire was sent to all 1641 manufacturing companies with over 20 employees from the Croatian Chamber of Commerce Registry. After 15 days there was almost no answer to the survey so the survey method had to be changed. For every company, the official site was visited and if there was an e-mail contact for the Chief Operating Officer, the questionnaire was sent to him/her and asked to fill in the survey. If there was no e-mail address for the Chief Operating Officer, than the survey was sent by e-mail to the management of the

company. This procedure largely prolonged the whole survey project and the collection of questionnaires ended in December 2015. With this procedure, 106 questionnaires were collected, which is a 6,5 % response rate. Owing to the complexity of the questionnaire (8 condensed pages) the return rate is satisfactory and similar return rates are obtained in other countries that participate in the EMS project. In all countries there is a fall in response rates since last rounds. Nonresponse bias was checked with χ^2 test between questionnaires gathered in first fifteen and last fifteen days, and there were no significant difference in answers. Therefore it was concluded that the sample does not suffer from non-response bias. As the main reason for not answering the questionnaire, companies reported that they have already too many mandatory surveys that they have to fill and that sometimes they have a person only for completing mandatory questionnaires.

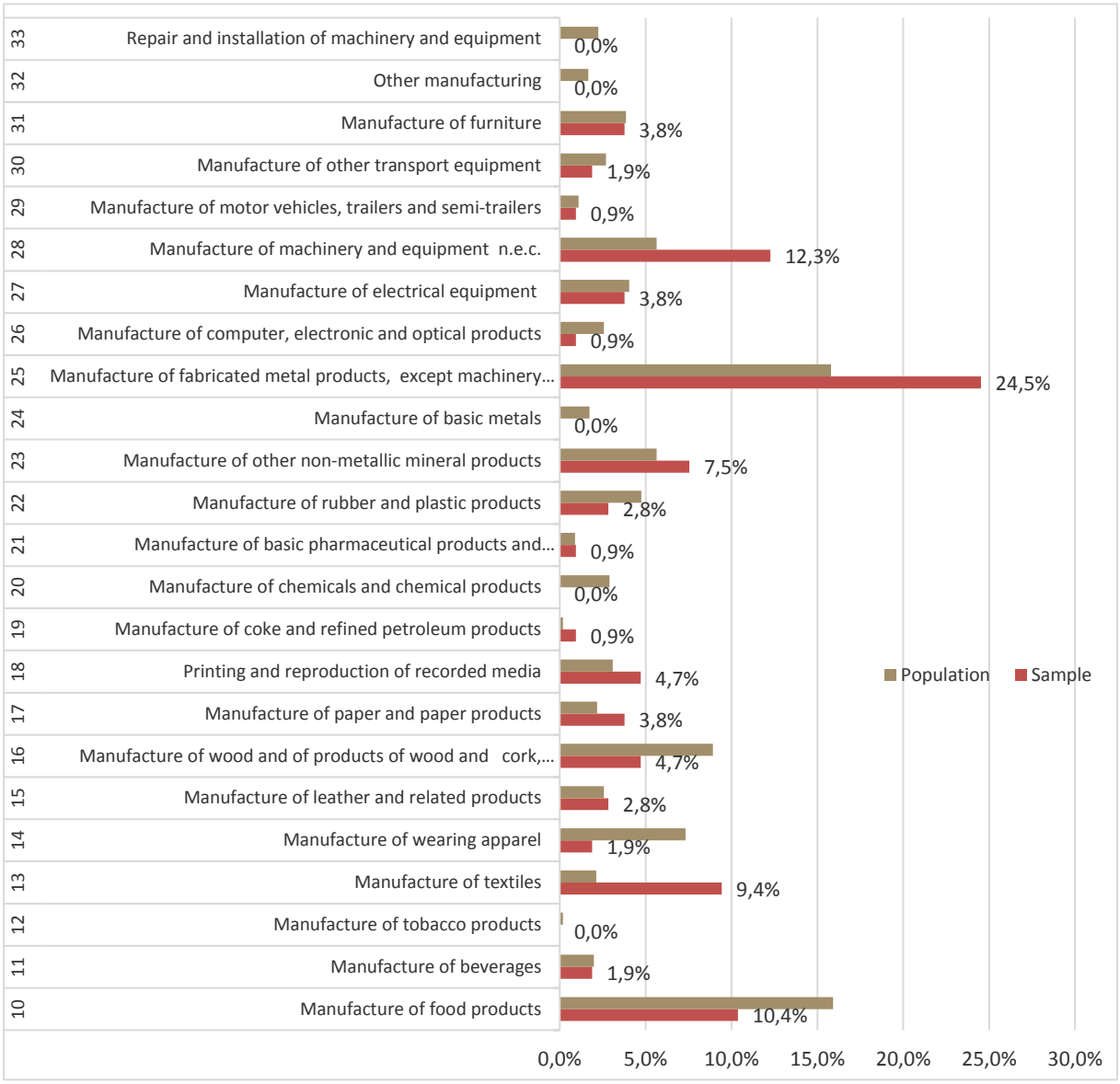
After validating the data, representation check was performed. It was checked whether the conclusions that will emerge from the statistical analysis could be generalizable for the whole population (the manufacturing sector in Croatia). Representativeness check was performed using Sprinthall (2011) methodology. It consists of evaluating z – scores (z-test) according to size and industry. The z-scores were all in acceptable range therefore the results could be generalizable, even though Sprinthall (2011) states that no test can guarantee that a sample is generalizable. Figures 7 and 8 present population and the sample, according to size and industry.

Figure 7. Population and sample according to size



Source: EMS CRO 2015 and HGK (Croatian Chamber of Commerce)

Figure 8. Population and sample according to industry



Source: EMS CRO 2015 and HGK (Croatian Chamber of Commerce)

The sample is representative by both criteria even though there are some differences. For example, very few companies from food industry answered, and there is a higher response rate from metal processing industry. According to size, there was a higher response rate from larger companies in comparison to small companies.

Next the sample is analysed by several categories and those are: by complexity of products, batch size, type of production, and by product development type (Figure 9.).

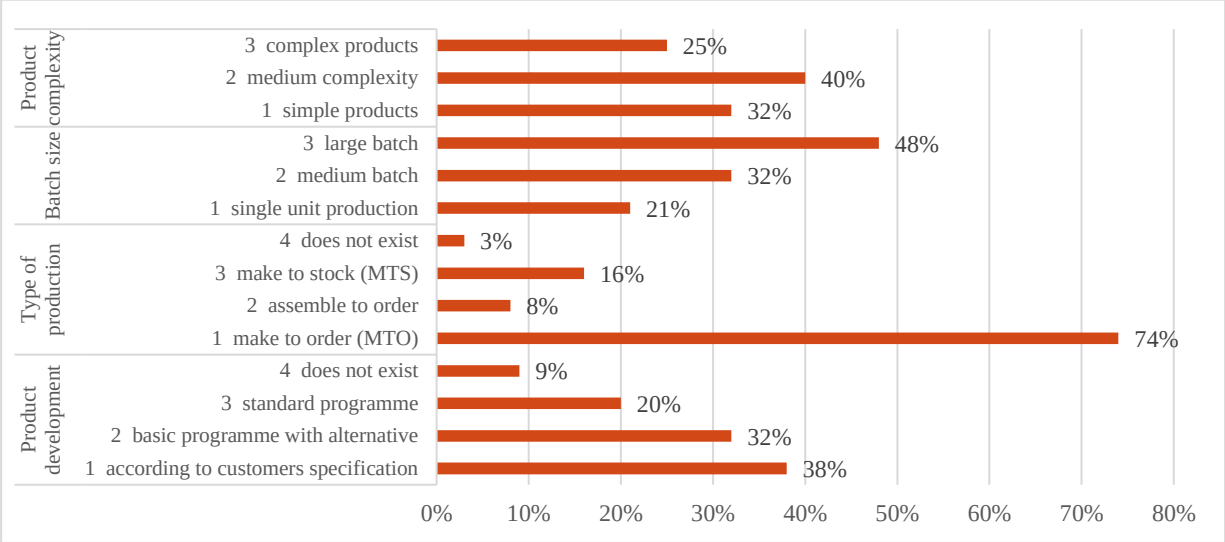
It is important to asses complexity of products because, the more complex the product is, it needs higher engineering knowledge, and then better revenues for this engineering know how. The survey results show that 32 % of companies produce simple products (which is not surprising since food and metal processing are dominant in Croatian manufacturing). There are 25 % of companies that produce complex products. Production of machines and complex equipment is in the third place as a sub industry in Croatian manufacturing sector.

Batch size shows that on fifth of Croatian manufacturing companies (21 %) manufacture unique or single unit production. A third of companies (32 %) manufacture small to medium batches (20 to 1000 products a month) and almost half of companies (48 %) manufacture large batches (more than 1000 products a month) which is a characteristics of mass commodity production.

By the type of production, it is dominantly according to the customer order (74 %), which shows that Croatian manufacturers are flexible enough that can start with production only after the customer order. Only 8 % of companies manufacture components that are being assembled upon customers' orders. 16 % of companies produce to stock, and then push them to the market by marketing.

Croatian manufacturers develop products according to customer specifications in 38 % of cases, which necesites flexibility and skilled engineers. 32 % of companies produce a standard portfolio of products that clients choose from. Such type of product development is fast but the limited by the options the manufacturer offers. 20 % of companies produce a standard product portfolio, without the option of customization.

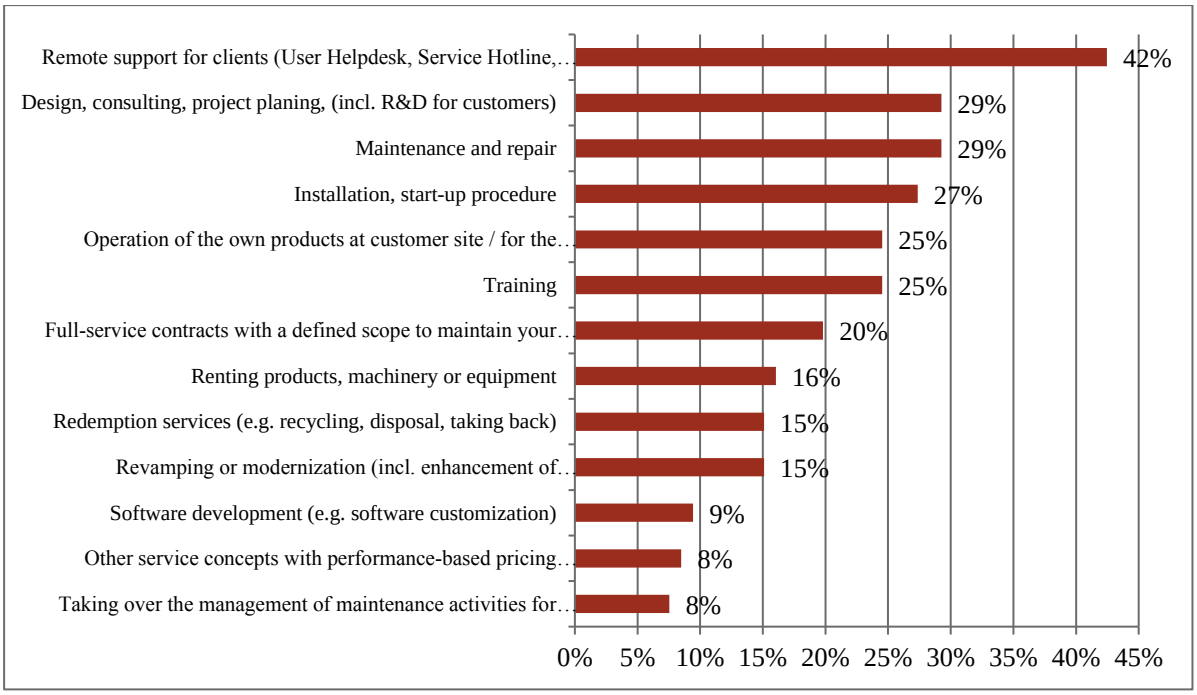
Figure 9. Characteristics (features) of production of the analyzed companies



Source: EMS CRO 2015.

In the sample, 30 companies (28,3 %) do not offer any services, while 76 companies (71,7 %) offer additional service. In the following Figure 10. it will be displayed which services they are.

Figure 10. Percentage of companies offering additional services



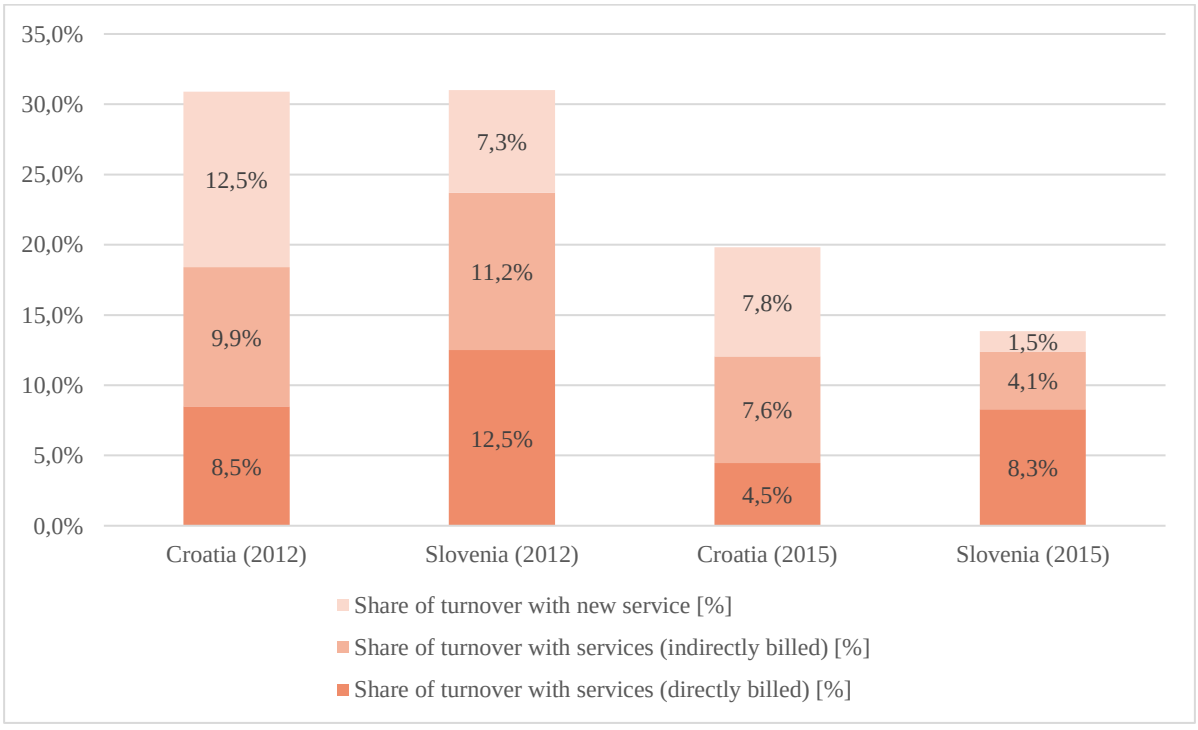
Source: EMS CRO 2015

According to Figure 10 it can be seen that in 2015, 42 % of companies offer remote support which is a significantly higher percentage that Grubic (2014) reports. If we look at the question of remote services, only by companies that provide some services, the percentage is even higher (59 %).

Analysing longitudinal data of Croatian servitization from 2009 to 2015, it can be seen that untill 2012, the share of service revenues increased, then after 2012 the share of service revenues start to fall. The question was, is that a Croatian phenomenon? or is it present in other countries too. Since for Slovenian EMS partner was interested in the phenomenon too, they gave permission to analyse Slovenian data too. Therefore, in the following paragraph, it is presented a comparison of share of service revenues for Slovenia and Croatia.

Interestingly, share of revenues generated by services fall in comparison to 2012, for Slovenia as well as Croatia and this can be seen in Figure 11.

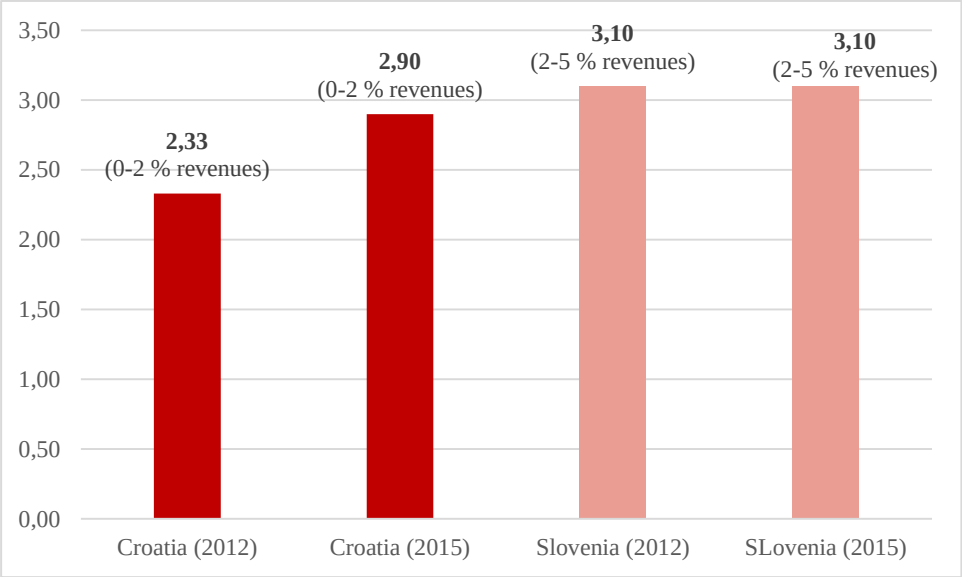
Figure 11. Share of service revenues for Croatia and Slovenia in period from 2012 to 2015



Source: EMS CRO 2012 and 2015, EMS SLO 2012 and 2015

As it can be seen from Figure 11 in Slovenia this fall of share of revenues by services is even more pronounced than in Croatia. This might suggest that companies need to servitize to stay competitive and not for additional revenues generation. Even if these services may be not billed (directly or indirectly through the price of the product), profits before tax increased in Croatia and stayed the same in Slovenia as can be seen in Figure 12.

Figure 12. Return on sales before tax in Croatia and Slovenia



Source: EMS CRO 2012 and 2015, EMS SLO 2012 and 2015

Measures

In Figure 6, the testing model was presented, in which services are divided into three categories (base, digital and advanced). Categorisation was adapted from Baines and Lightfoot (2013). Some services in their model were moved into base services because they are now widespread, but at the time Baines and Lightfoot (2013) proposed their model those services were considered as advanced services. Also a group of digital services is added which did not exist in the original categorisation.

It is customary when categorisations are performed (as in our case grouping services into categories) a confirmatory factor analysis is performed. The factor analysis should display in the data that those groups are really different and form distinct factors. But, the confirmatory factor analysis that we performed did not give meaningful factors. The factors that emerged cannot be explained by existing theory. Factor analysis works so as to form factors that are mutually independent (low correlation between factors). The results of our factor analysis displayed three independent groups of services. But, that is contrary to our hypothesis that base and digital services are necessary for the provision of advanced services. That means that we imply the correlation between our groups of services, and confirmatory factor analysis thus cannot be used for grouping.

Because of implied correlations we reviewed our model of grouping variables by similarity of the service, therefore the analysis using structural equation modelling is not appropriate. The services were grouped in respect to the product's lifecycle. Advanced services cannot be provided without base services, and the same holds for digital services. So, the implied correlations are reasonable.

Additional proof that structural equation modeling cannot be used is shown in Table 14. Composite reliability (CR) and average variance extracted (AVE) are not within the prescribed ranges.

Table 14. Discriminant Validity, Reliability, Convergent Validity and Correlations of groups of services

	CR has to be >0,7	AVE has to be >0,5	MSV AVE has to be > MSV	**DIGITAL**	**BASE**	**ADVANCED**
DIGITAL services	0,484	0,239	0,596	0,488		
BASE services	0,508	0,340	0,630	0,772	0,583	
ADVANCED services	0,622	0,262	0,630	0,578	0,794	0,511

Source: EMS CRO 2015

As can be seen from results displayed in Table 14 Discriminant Validity, Reliability, Convergent Validity are all under the threshold level, so it was necessary to choose a different method. We decided to use simple regression analysis. Variables on the right hand side of Figure 6. will be dependent variables, while left hand side variables will be independent variables. All control variables will be included in the model.

Results

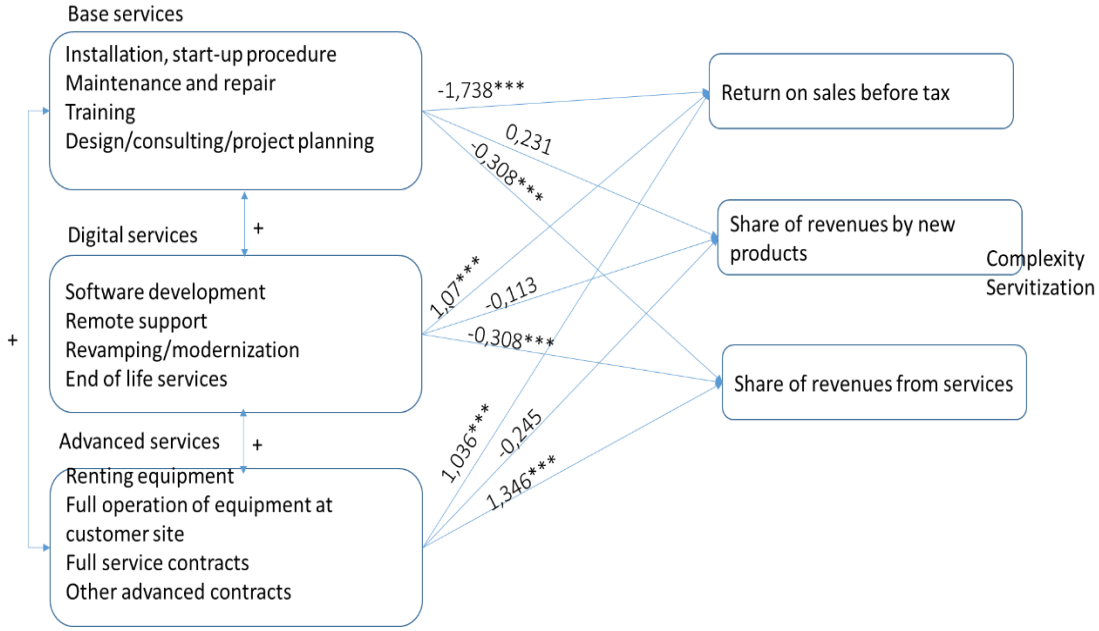
Results from the three regression models are displayed in Table 15 and Figure 13. In Table 15 standardized regression coefficients are displayed.

Table 15. Regression results

	Model 1 Return on sales before tax		Model 2 Share of revenues generated by services		Model 3 Share of revenues generated by new products	
	Beta	Sig.	Beta	Sig.	Beta	Sig.
ADVANCED services	1,036	0	1,346	0	-0,245	0,242
DIGITAL services	1,07	0	-0,304	0	-0,113	0,582
BASE services	-1,738	0	-0,308	0,018	0,231	0,477
Control variables						
Industry		n.s.		n.s.		0,574
Number of employees		n.s.		n.s.		0,362
Complexity		n.s.		n.s.		0,005
Servitized		n.s.		n.s.		0,042
Model results						
R		0,611		0,93		0,365
R^2		0,374		0,865		0,134
F		8,013		86,852		2,092
Sig		0		0		0,052

Source: EMS CRO 2015

Figure 13. Graphical representation of results



Source: EMS CRO 2015

Form Table 15 and Figure 13, it can be seen that indeed base services have negative Beta coefficients. That means that into those services has to be invested. It means that from those dependent variables (return on sales before tax and share of revenues by services) a portion is reinvested in those services. It can be argued that investment into base services can come from other sources, but those were the only variables we included in the model as dependent variables. These base services positively affect share of revenues generated by new products. This might be explained by the fact that the customer has to be trained on how to use the new product.

Digital services, contrary to our assumption, positively influence return on sales before tax. But negative Beta coefficients by relationship to share of revenues by new products and services, suggest that portion of those revenues are invested back into those digital services.

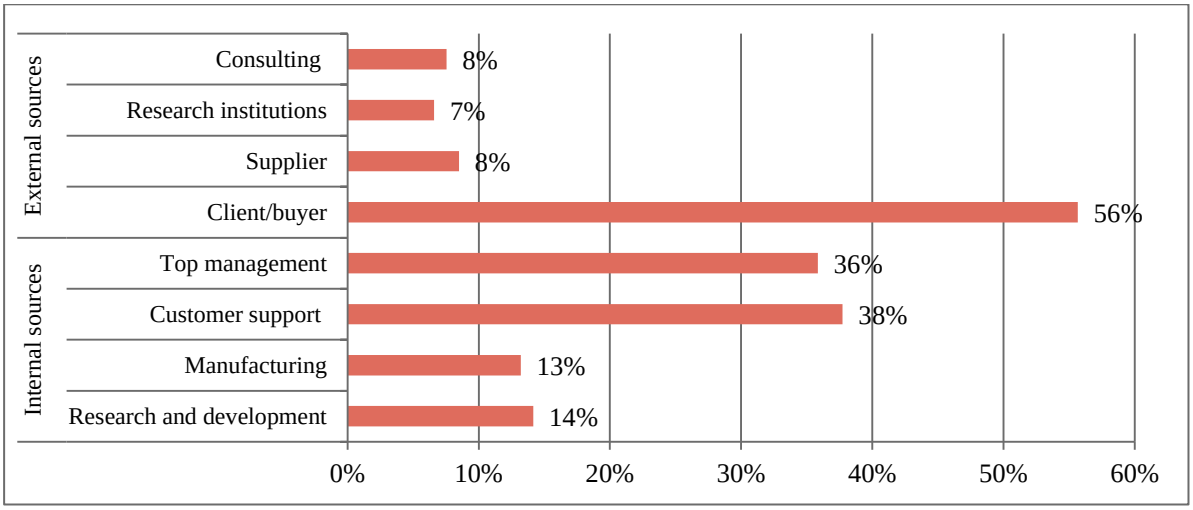
It is interesting to note that share of revenues by new products depend on control variables complexity and servitization. It means that more complex is the product and if the company offers additional services, the greater share of revenues by new products are obtained.

The hypothesized model depicted in Figure 6 is partially confirmed. It was assumed that digital services will need investment from return on sales, where in fact, those service even raise return on sales.

It is also confirmed that advanced services increase return on sales, and that those advanced services can be billed and thus, increase share of revenues by services. This can be seen by the positive Beta coefficient. It is also confirmed that base services necessities investment from return on sales and from share of revenues generated by services. It should be emphasized, as seen in Table 15, last column – Model 3 – where the dependent variable was share of revenues by new products, independent variables of services (base, digital and advanced) have nonsignificant relationships to the dependent variable. This means that for those relationships we cannot draw conclusions.

With this analysis, we wanted to research which services contribute to innovation and service revenues. It was seen from the model, that indeed base services are necessary, and that is in line with our GMRG findings. It was also seen that even advanced services are present in Croatian manufacturing, which is positive, not only for differentiating from competition but those services also generate a positive return on sales and share of revenues by those services. The following section will analyse further these services to see who initiated the provision of these services (Figure 14.).

Figure 14. Who initiated the service provision



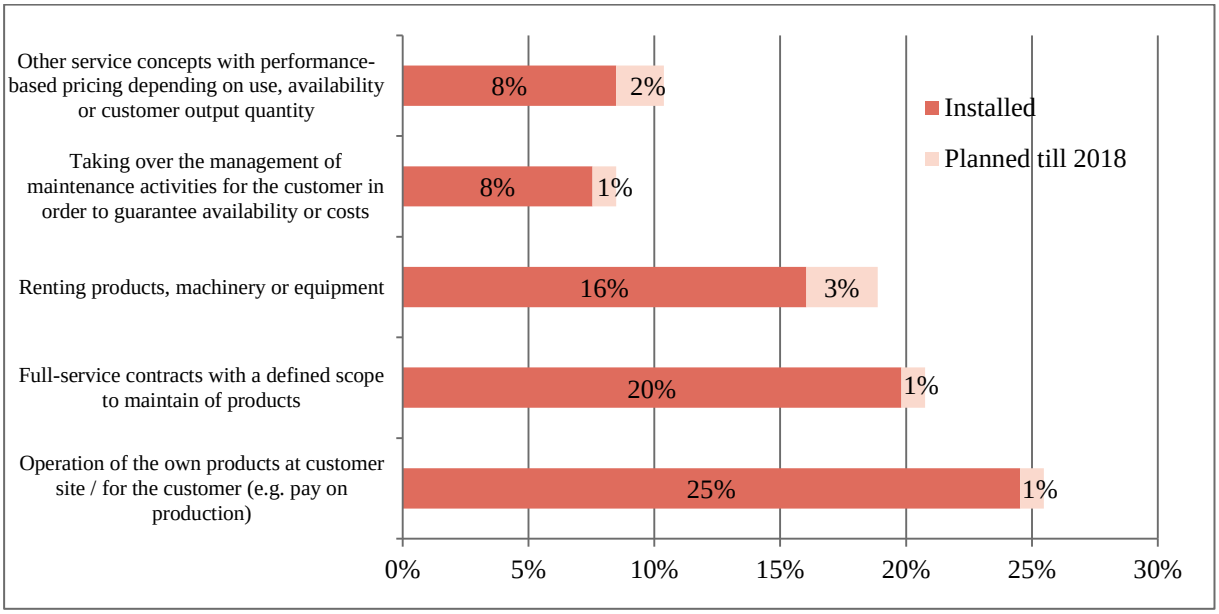
Source: EMS CRO 2015

In Figure 14, it can be seen that in the majority of cases, it is the customers that demand the service. That is a reactive response. The positive thing is that even inside the company there is an awareness of the necessity of service provision. In 36 % of cases it is by Top management initiative that the services are developed. Additional 38 % of ideas comes from Customer

support, where employees through conversation with customers see customer's issues that can be translated into provision of additional services. These two sources for new service development (Top management and Customer support) are proactive strategies, and such strategies are always better than *ad hoc* provision of services when their provision becomes imperative.

Further, it is analysed which advanced services are given by Croatian manufacturers and how many manufacturers will start providing these services in foreseeable future (until 2018).

Figure 15. Advanced services given today and forcasting until year 2018



Source: EMS CRO 2015

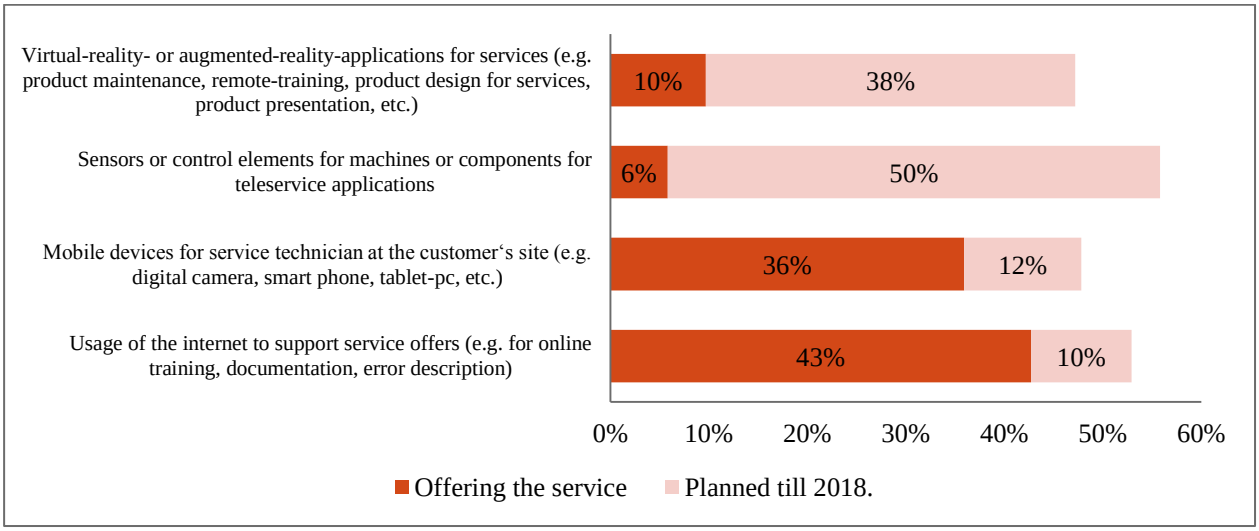
It was already mentioned that advanced services increase share of revenues generated by the products, and those revenues then consequently increase return on sales. Figure 15 displays advanced services provided by Croatian manufacturing companies. Manufacturing of products at customer site / for the customer (e.g. pay on production) is the dominant advanced service. But, only 1 % of companies intend to offer this kind of advanced service until 2018. Second advanced service is Full-service contracts with a defined scope to maintain of products (20 %). Here the company may or may not retain the ownership of products but they have to ensure its constant functionality. These two advanced services have the highest risk of provision. They can be provided only by manufacturers that are absolutely sure of quality and reliability of their

products, because of the risks associated with contracts. From the data we will see an increase of only 1 % of these services until 2018.

Third service according in Croatian manufacturing is Renting products, machinery or equipment. This contract is similar to the previously described two advanced services, but within this type of service the company rents its own or competitors equipment (this will be explained later). The repair and maintenance is contracted, as well. Since this is renting and not operating equipment this contract is a little less risky than the most advanced ones. This kind of contract seems more interesting to Croatian manufacturers because there is an increase tendency to adopt such contracts by 3 %. It may be that with such contracts manufacturers better use their spare capacity. The next services, in terms of their frequency, are maintenance and repair contracts and some other type of advanced contracts. Here the customer owns the equipment, and by this transfer of ownership the manufacturer bears less risk, but it is still not in their interest that the equipment fails because they are responsible for repair and if the equipment fails and the customer has additional costs because of malfunctioning of equipment or products. That would automatically be a decrease in manufacturer's reputation.

Advanced services depend on digital technology with which equipment can be surveilled remotely. This surveillance enables preventive maintenance and analysis might reveal how to improve or enhance products. Therefore, it is important to look at which digital technologies Croatian manufacturers have used. From Figure 10, it can be seen that 42 % of manufacturing companies in Croatia offered remote access in 2015. The actual offered digital services are displayed in Figure 16.

Figure 16. Offered digital service and forecasted implementation until 2018

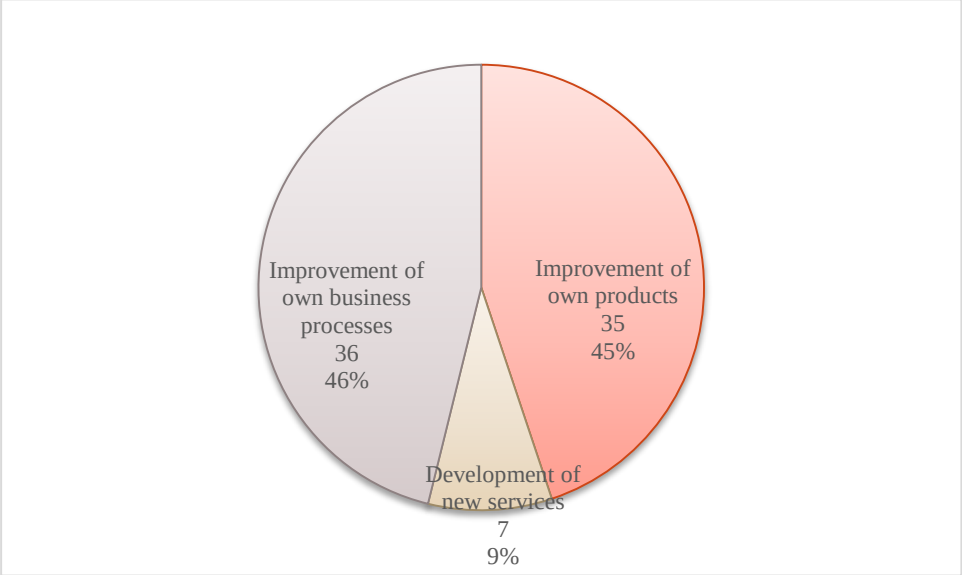


Source: EMS CRO 2015.

From Figure 16 it can be seen that Internet usage (43%) and mobile devices usage (36%) are most frequent in provision of services. These usages will increase until 2018. Increase of use of virtual reality for training and instalment of sensors will further increase until 2018 (38 %) for virtual reality, and (50 %) for remote access. Looking at the big picture, approximately 50 % of companies (every second company) will offer digital services until 2018. Those are: Usage of the internet to support service offers (e.g. for online training, documentation, error description), Mobile devices for service technician at the customer‘s site (e.g. digital camera, smart phone, tablet-pc, etc.), Sensors or control elements for machines or components for teleservice applications, Virtual-reality or augmented-reality-applications for services (e.g. product maintenance, remote-training, product design for services, product presentation, etc.). This is understandable because for digital technologies Moore’s law applies and that means that probably by 2018, these technology will be affordable for the manufacturing companies in Croatia.

Respondents were asked to ilicit the reasons why they use digital technologies and the responses are summarized in Figure 17.

Figure 17. Reasons for use of digital technologies



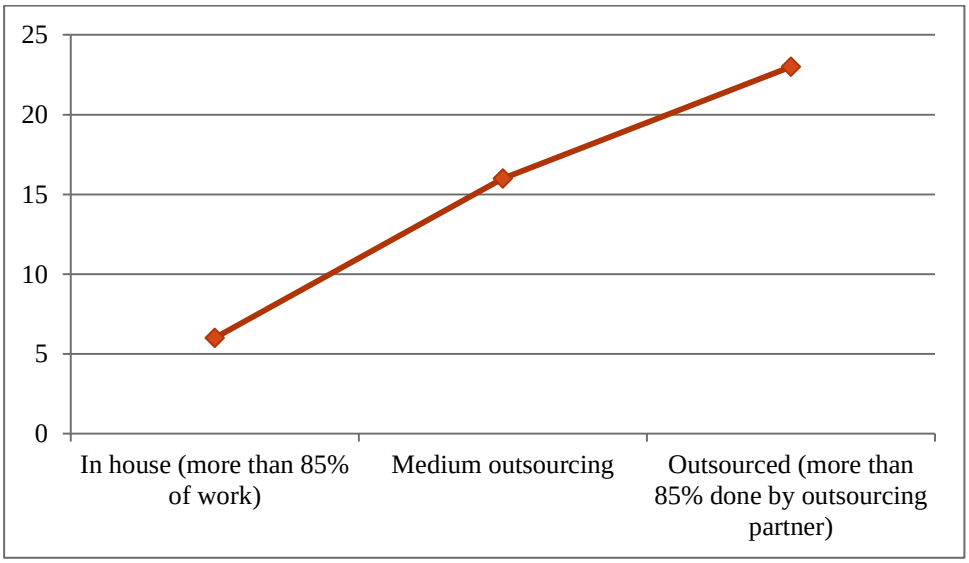
Source: EMS CRO 2015

Results from Figure 17 show that the dominant reason for using digital technologies is concurring with what the literature suggests in terms of advanced services. The manufacturer, offering an advanced service, has to bear risk of obsolescence of technology and try to mitigate these risk as much as possible. Digital technology offers him to monitor the functioning of his products and in 45 % of cases he uses this information to improve his products. In 46 % of cases, the manufacturer uses digital technology to enhance his production process, which includes the delivering and installing the products. It enables all other activities that are necessary after production of the product, thus, providing services as well. This is especially important if additional service is provided because the communication between departments is crucial in order to provide the service. Only 9 % of companies use digitally acquired information for generating new service offers. This small percentage is expected as it was seen in Figure 14 that in 56 % of cases, the customers are the ones asking for a service. Other internal sources for ideas for new products come from Top management and Customer service. But they obtain information and ideas from other sources rather than raw data acquired by sensors. For example, data acquired by sensors are in form of zero and one (the part is working or not, outside temperature or pressure ect.). Such data has to be analyzed to obtain an overview of parts functioning. It is hard to imagine that Top management would be mining such data. Top management get ideas from competition, benchmarking, or similar companies. Customer

support gets ideas from customer's problems. The 9 % of companies that use the data for new services shown in Figure 17, may have experienced employees that are able to perform the so called Big Data Analysis, that is analyzing patterns in a huge amount of data.

In this line of reasoning then comes the question, do companies have enough experienced employers in big data analysis? Such experts are not only expensive but they are also scarce. So the question that unfolds is: who helps manufacturing companies in providing services? Figure 18 presents the level of outsourcing of service provision by manufacturing companies. Three levels of outsourcing are presented: almost no outsourcing (less than 25 % of work), medium outsourcing, and high outsourcing (more than 85 % of work is done by the outsourcing partner).

Figure 18. The percentage of companies that provide service by themselves in comparison to those who externalized service offer



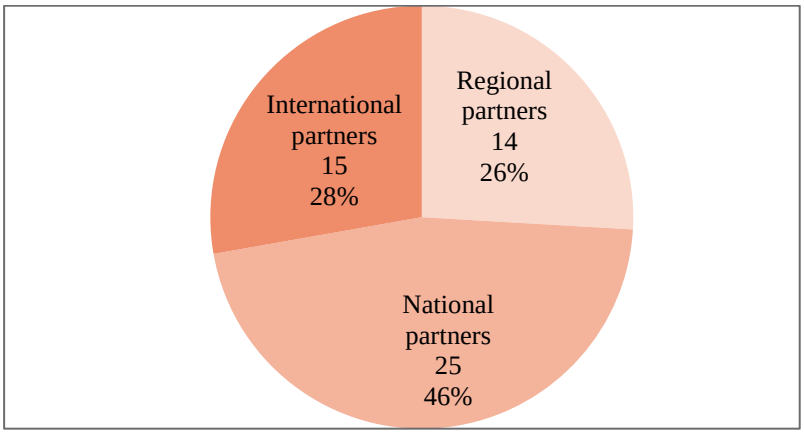
Source: EMS CRO 2015

Figure 18 shows a tendency of cooperation by manufacturing companies in provision of services. This might be the answer why share of revenues by services decreased since 2012. If a manufacturing company outsourced service provision, than naturally this stream of revenues goes to the outsourcing partner, and not to the manufacturer. This highlights what Porter (1998)

states: companies should outsource non-core activities, especially if they do not have adequate competences to perform the activity in-house.

Outsourcing of services is dominantly done by regional partners as can be seen on Figure 19.

Figure 19. Partners in service provision



Source: EMS CRO 2015

Figure 19 shows that only 28 % of service cooperation are with international partners, so the rest of cooperation is with regional and national partners.

There is one more issue needed to be explored. Literature suggests a trend of service offerings for competitor's products. For example Xerox tends to offer "Office document management" which means that they rely less on sales of photocopying machines, rather on the service of photocopying. As in offices there are usually several brands of photocopying machines, Xerox under their contract maintains also for example Cannon photocopying machine that is in their client's place (Baines et al. 2007.). Therefore we analyzed to what extent are Croatian manufacturers are able to offer services for competitors' products. According to Table 16, 32 % of Croatian manufacturers are able to repair and maintain competitor's products. This is followed by remote support (32 %), installation and set-up (29 %), and finally training and education for competitor's products (21 %).

Table 16. Ability to offer services for competitor's product

Service	%
Maintenance and repair	32 %
Remote support for clients (User Helpdesk, Service Hotline, web platform)	32 %
Installation, start-up procedure	29 %
Training	21 %
Design, consulting, project planning, (incl. R&D for customers)	21 %
Software development (e.g. software customization)	14 %
Redemption services (e.g. recycling, disposal, taking back)	11 %
Revamping or modernization (incl. enhancement of functions, software extensions)	4 %

Source: EMS CRO 2015.

These percentages are a good indicator for Croatian manufacturing, because the literature suggests that customers are willing to pay for such full services. Full services, as described by Xerox example, not only generate revenue but also indirectly create loyal clients that might pass a good word of mouth if they are satisfied. But here we have to go back to the question of human resources and employees. The manufacturing company has to have skilled employees and build strong intellectual capital. A customer will certainly be more satisfied with a technician that has also social skills and not merely technical skills (although the last is more important). Building intellectual capital is according to Teece (2014), the Top management's job. In the next section we will look into how well are Top managers in Croatian manufacturing investing into a positive climate and intellectual capital through investments into technology and organizational concepts. The following chapter presents organizational and technological concepts and their trends of implementation until 2018. The research is performed solely on the Croatian sample.

6. Trends until 2018

In Chapter 3 the importance of human resources and intellectual capital was emphasized. Employees form Human and Intellectual capital of a company. For this reason first we present all organizational concepts that were researched through the EMS survey. We additionally present predictions up to 2018, as assessed by responding managers. Every concept will be explained, as well as, where in the company a certain organizational concept gives highest benefit (all through the lens of servitization). After that, technological concepts will be presented. This is important, as it may be recalled from Chapter 4, that servitized companies in average invested more into new technology in last two years (5-10 % of revenues), in comparison to non-servitised firms. Therefore investment into technology is important, and same as with organizational concepts, technological concepts will be explained and their relationship with service offerings.

Organisational concepts

Organizational concepts presented are core questions in EMS questionnaire and were developed on grounds of thorough literature review. They are grouped in five categories: Human resource management, Energy and environmental controlling, Production management and controlling, Organization of production and Organization of work. All concepts will be explained in the following paragraphs except Energy and environmental controlling as they do not significantly impact service offerings. However these Energy and environmental issues do have a significant marketing value for the company (Thøgersen and Ölander, 2003).

From the principles of management it is known that Human resources management is one of the four managerial functions (Belak, 2014.). Human resource management deals with selecting employees that will match the job that has to be performed. But the word management in the human resources management means that employee behaviour can be influenced by a set of tools. One of these tools is compensation management that facilitates development of a desired organizational culture (Kuhn, 2009), where the management wants to foster innovation or put greater emphasis on quality or else. In Croatia, 54 % of manufacturing companies do have formal compensation plans and further 10 % of companies plan to implemeny them by 2018. That means that by 2018, 63 % of manufacturing companies will, by aid of compensation management tools, adapt their organizational culture.

The next issue is work-life balance. According to Michel et al. (2014) it was shown that employees that are not disturbed during their private time were more productive and showed better results of their work. This raises is a big issue in Germany, where even directors are enforced so as to not disturb employees during their private time (Sarva, 2015). From Figure 20 it can be seen that one fourth of Croatian manufacturing companies (25,5 %) have implemented regulations for work-life balance, and additional 11,3 % of companies will employ them by 2018, probably motivated by German example not to disturb employees during their free time.

If the company wants to enhance problem solving and creative thinking, employees should be able to meet and talk informally. This is enhanced by provision of places where employees meet unofficially, near cafeterias, coffee machines and similar other locations (Çokpekin and Knudsen, 2012). Almost 38 % of Croatian manufacturing companies do have such places for informal talk, they provide flexible working hours and help with child care. By 2018, additional 12,3 % of companies will install such places and help employees with child care which ultimately makes the employee more satisfied, loyal and more productive (Van De Voorde et al. 2014).

However, there is the question of retaining knowledge from elderly employees. Knowledge retention is emphasized through the component of structural capital in the Intellectual capital construct. This knowledge from elderly employees should be documented and made explicit as much as possible, and stored into knowledge databases. In this way the knowledge is not lost

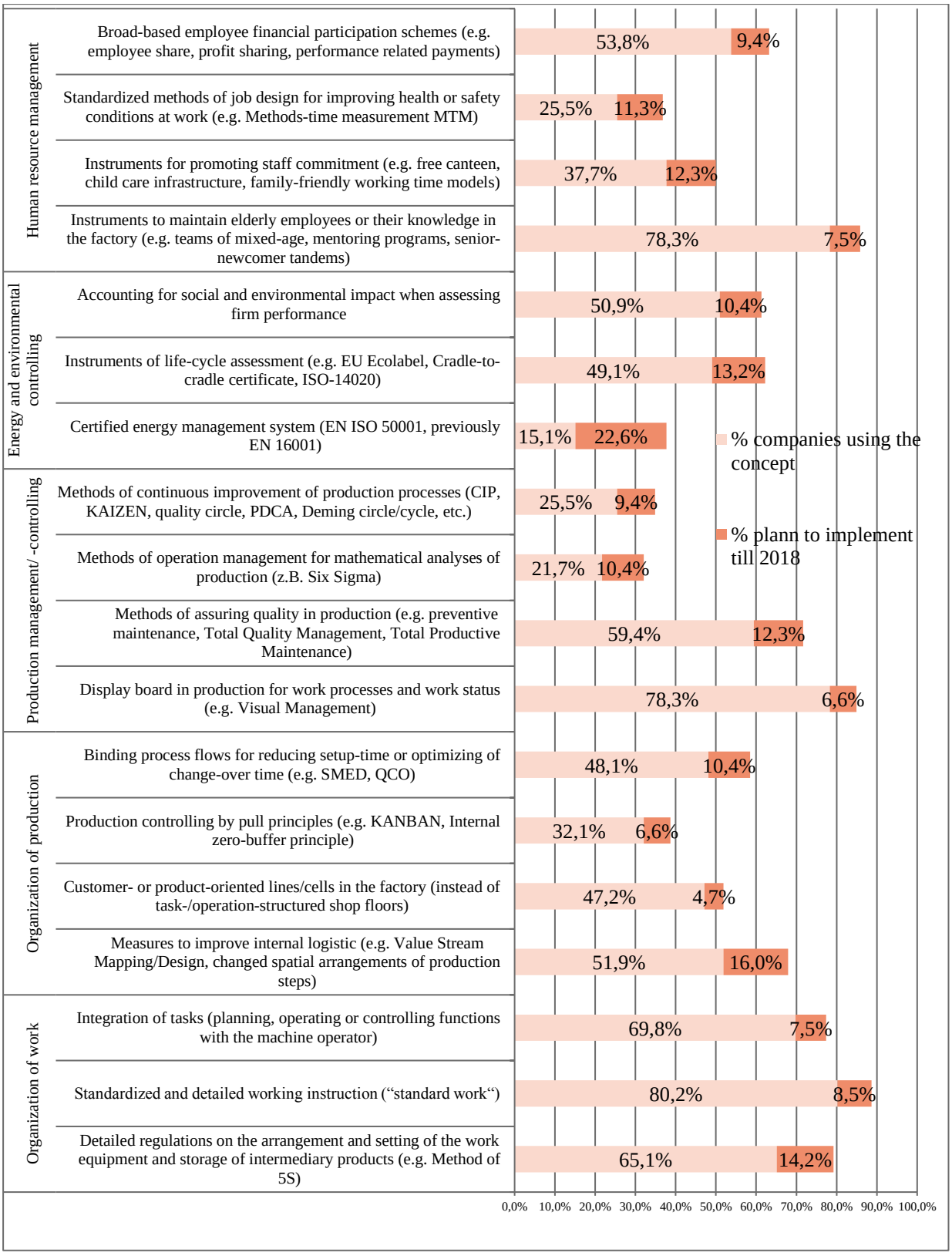
after the employee leaves the company. Having this knowledge stored, some reoccurring problems are solved faster and this whole structural knowledge builds the total intellectual capital of the company (Brown and Eisenhardt, 1997).

What has human resource management to do with providing services? First of all, if a company servitizes than it has to ensure that the customer's problem is solved. Also, development of new products and enhancing existing products is full of problem solving situations. There is a need for employees to freely talk and that means that apart from technical skills they have to have high social skills. Further, a solution to customer's problem usually spans across several departments, so these informal meeting places form an ideal place to solve problems (but are not limited only to informal talks). Simply put, not all problems can be solved by e-mails. And there is a question of timely solution to customer's problems. If the customer has to wait too long for a solution they might simply refer to a competitor who offers a solution faster, regardless how customer was satisfied with the company.

Production management and controlling

This group of tools are: display board in production for work processes and work status (for example Visual Management); methods of assuring quality in production (for example preventive maintenance, Total Quality Management, Total Productive Maintenance); methods of operation management for mathematical analyses of production (for example Six Sigma); methods of continuous improvement of production processes (CIP, KAIZEN, quality circles, PDCA, Deming circle etc.). The objective for all these tools are to improve the production process. If the production process runs flawlessly than there is a greater probability of obtaining a product without defects. But, all these methods require education and training of employees in use of the tools. If employees are trained and educated and continuous improvement instilled in the company's culture, then the company may be sure in its products and than the company can offer advanced services that can generate additional revenues. But, those services can only be offered by companies that trust their products and can take over the risk of eventual failure of their product.

Figure 20. Usage of organizational concepts and their planned introduction by 2018.



Source: EMS CRO 2015.

From Figure 20, it can be seen that almost 60 % of companies use Total Quality Management (TQM) and that additional 12,3 % will install the concept in their manufacturing by 2018. The percentage in reality is even higher because ISO certificates are based on TQM principles. Visual management is also part of Total Quality Management concept, as it visually shows the problems or potential problems. Visual control has been implemented by 78,3 % of companies and additionally 7 % plan to implement them by 2018. Before, this visual management was done using Control charts, but today's modern equipment have displays that display Control charts in real time. KAIZEN, Quality circles form TQM, Deming's PDCA (Plan-DO-Control-Act) circle and Six Sigma, are also grounded in TQM philosophy, therefore we believe that the real percentages are even higher than displayed in Figure 20. (approximately 30 % by 2018.). The terms such as KAIZEN are not frequent in practice. KAIZEN is only the japan word for continuous improvement. On the other hand, continuous improvement is a requisite for obtaining ISO standards. Most Croatian manufacturing companies have implemented ISO standards as it is a prerequisite for exporting to the European Union.

Organization of work

Organisation of work and other researched questions are: detailed regulations on the arrangement and setting of the work equipment and storage of intermediary products (method 5S), standardized and detailed working instruction, integration of tasks (planning, operating or controlling functions with the machine operator) came from the Lean Management philosophy, that puts emphasis on eliminating any waste (so called 7 deadly wastes). Through 5S method a greater emphasis is put on the tidiness and cleanness of the work space. These techniques not only show strong positive effect on quality and business results (Negrão et al., 2016.), but also on innovation (Leavengood et al., 2014.).

Concepts of efficient organisation of work and Lean Management principles are at high levels in Croatian manufacturing. Clear organization and placement of working tools (5S method) implemented already 65,1 % of companies, while 14,2 % more will install them by 2018. It means that by 2018. almost 80 % of Croatian manufacturers will use these principles of organizing workspace. Standardized procedures and detailed work instructions are already in use by 80,2 % of companies, and additional 8,5 % will implement them by 2018. This is understandable since those written procedures are the basic requirement for obtaining ISO

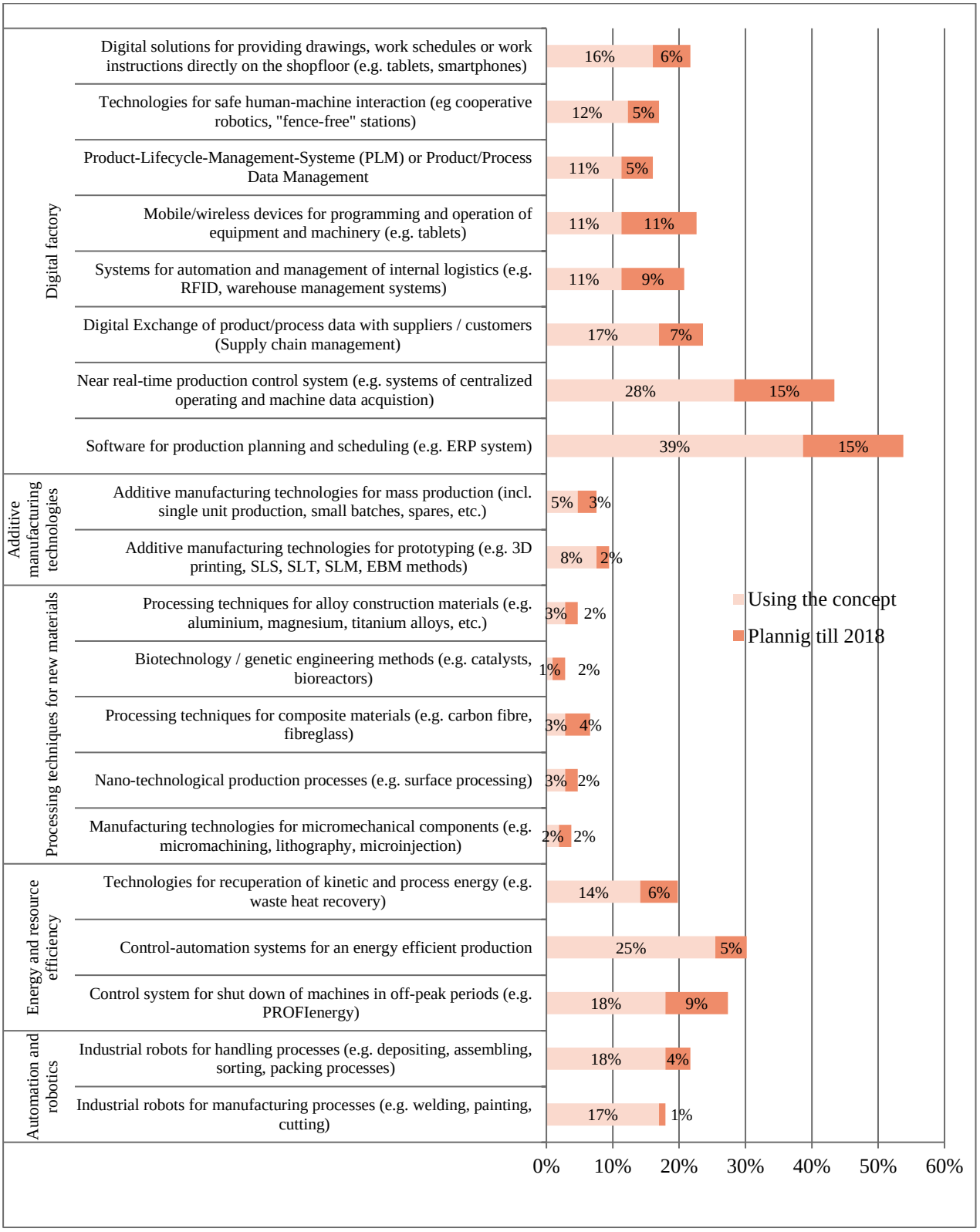
certificate. Integration of tasks (planning, operating or controlling functions with the machine operator) use already 70 % of companies, with 8 % of companies planning to integrate tasks by 2018.

What is the connection with services? Simple, Lean production is a philosophy that states that if properly designed and all waste eliminated, the service could be provided with less resources (human and material). Consequently that means that the service is provided faster, more cost-effectively and thus generating additional revenues with less input. Lean Management is a philosophy of continuous improvement (much like Total Quality Management) of the whole manufacturing company. Since continuous improvement evolves in time and brings positive benefits alongside it can be rightfully be called a dynamic capability.

Technological concepts

Technological concepts are grouped into: Automation and robotics, Energy and resource efficiency, Processing techniques for new materials, Additive manufacturing technologies and Digital factory. Each technology is displayed in Figure 21, but they will not be explained in detail since those explanations could be found in research results EMS HR (2016) published on the web site of the project. In this part, a focus is put on the group of technologies under Digital factory, because they have a significant impact on providing services.

Figure 21. Percentage of companies (using the technology and will implement) by 2018.



Source: EMS CRO 2015.

In Digital factory, the researched concepts were: Software for production planning and scheduling (for example ERP system), Near real-time production control system (for example systems of centralized operating and machine data acquisition), Digital Exchange of product/process data with suppliers / customers (Supply chain management), Systems for automation and management of internal logistics (for example RFID, warehouse management systems), Mobile/wireless devices for programming and operation of equipment and machinery (for example tablets), Product-Lifecycle-Management-Systems (PLM) or Product/Process Data Management, Technologies for safe human-machine interaction (for example cooperative robotics, "fence-free" stations), Digital solutions for providing drawings, work schedules or work instructions directly on the shop floor (for example tablets, smartphones).

Digital solutions for forwarding work instructions to the shop floor will be implemented additionally 6 % of manufacturing companies by 2018, which means that more than 20 % of companies will use this technology. In terms of servitization this means that manufacturing and accompanying services can be performed quickly. Technology for safe human-machine interaction is not that widespread (22 % of companies use it and only 5 % more will implement it by 2018). But this technology has more to do with safety of employees than servitization. Product-Lifecycle-Management-Systems are systems that track the product (digitally) from manufacturing until it is returned for recycling or disposal. This was already described in Chapter 5, under advanced services that manufacturers offer. The aim of such systems is to gather information about the functioning of the product and from that information to find ways how to improve products. The system tracks information about possible exchanges, repairs, disposal and the like. Such technology is used by only 11 % of companies, with only 5 % increase by 2018. The usage of mobile technologies and automatization of logistics increases the speed of delivery. These technologies are possessed by 11 % of companies but with a significant increase (20 %) by 2018. Digital supply chain management have only 17 % of companies and additional 7 % of companies plan to install such solutions by 2018. This is a slow progress, but it has to be emphasized that Supply Chain Management Solutions cannot be implemented without the information technology solid infrastructure. Example of infrastructure is solid Enterprise Resource Planning software (ERP), which presents a digital picture of the enterprise, and real time production control systems.

These two infrastructure technologies have highest implementation rates (28 % for real time production control and 39 % for ERP systems). Implementation of both technologies will rise by 15 % by 2018. That means that by 2018, 40 % of companies will have real time control of

production, and enterprise wide ERP systems 50 % of companies. This will form a good base for improvement of production, improving quality, cost reductions and finally increased reliability of production, thus making the companies more certain in its products to start giving advanced services.

This section showed that Croatian manufacturers do have a solid base for offering services, even advanced services. The fact is, that base services will have to be provided free of charge, but will have benefits from other factors, for example positive word-of mouth (positive inexpensive but valuable marketing) that then leads to increased sales of regular products.

7. Conclusion

This book deals with only one aspect of manufacturing and that is, providing additional services or servitization. There are still disagreements whether an increase share of revenues manufacturers can be obtained by provision of services. The presented GMRG study showed that servitization actually helps competitiveness, that is, differentiating from competition, retaining the current market position and not for generating additional services. So services are actually a way to differentiate from competition. The ability to provide services is a dynamic capability (it evolves in time and it takes time to develop services), but dynamic capabilities bring benefit only if they are applied on so called ordinary capabilities.

Ordinary capabilities are necessary for day to day activities and are generally: administrative capabilities, operations capabilities and governance capabilities and are rooted in (1) skills of personnel, (2) facilities and equipment, (3) processes and routines including technical manuals, and (4) administrative coordination needed to get the job done. These ordinary capabilities are considered high if a company has a skilled workforce and advanced equipment (Teece, 2014). A company that has strong ordinary capabilities and high intellectual capital (a dynamic capability which resides in employees competences) will have a better market position, although not necessarily better financial results in terms of increasing revenues, profits and market share. Therefore, servitization is a survival strategy and not a strategy to acquire additional shares of revenues. Examples of Rolls-Royce, ABB, Alstom, Nobel, MAN show that these companies managed to generate 50 % of sales by service, while the other 50 % comes from revenues from products sold. But, such extreme shares of revenues are rare and there are still too few companies that offer such advanced services. Actually it was shown that such advanced services can be offered for complex products/systems that are sold directly to the customer or to the government. The majority of manufacturing will unfortunately have to provide services without a direct financial benefit.

But there is a way out of this vicious circle, and that is through the use of digital technology. In the Croatian manufacturing sample it was shown that by 2018, approximately 50 % of companies will be able to provide remote support and installation, training and other services and in such way decrease the costs of providing services. It was also shown that base and digital services require investments, but they can be rewarded by providing advanced services (but they require base and digital services), such as, complete contracts, renting of equipment, full

service contracts. Additional benefit of services and especially advanced services is the creation of loyal customers that recommend the company thus performing free marketing. That, then, lowers marketing expenses, attract new customers and in this indirect way, raises revenues and ultimately business results.

The studies presented in this book highlighted that it is important to invest into employees and their social skills to provide services at high professional level and in cost-efficient way. Some researchers recommend forming a Servitization department, but other authors warn that the creation of an additional department will not guarantee a better provision of services. Instead, it is necessary to ensure that employees from different departments freely talk about issues and problems. Also communication throughout the company should flow freely (also with external partners such as buyers and suppliers). For communication, digital technology really helps, but for some issues or problems there is no replacement to face-to-face communication.

As a final conclusion, it might be said that Croatian manufacturers face new challenges, but if they invest in their employees and technology, their global competitiveness will increase. Maybe they would not be able to profit from base and digital services, but those services are the base for providing advanced services, which on the other hand, can bring benefits.

Bibliographies

Jasna Prester, Phd

Jasna Prester was born in Zagreb in 1969. She lived in Paris and Algiers, where she attended the American and French School. After returning completed high school of economics, and then in 1989 entered Faculty of Science, University of Zagreb, which she graduates as engineer of theoretical physics, elementary particles. She defended her thesis titled "Neutrino background radiation, and possible detections". Immediately after completion her studies she was employed at Viadukt d.d. where he began working in the IT department as an information technology assistant. During her nine years' experience she progressed to Head of systemic support. In 2000 she enrolled in postgraduate studies at the Faculty of Economics, University of Zagreb, department Organization and Management that was led by professor Pere Sikavica. In 2003 she defended her thesis on the topic "The impact of risk aversion in the business decision-making." That year she moved to work at the Faculty of Economics in Zagreb as a research assistant, taking charge of teaching Production management. In 2006 she defended her doctoral dissertation titled "Agency theory and of supply chains management," under guidance of mentor professor Darko Tipurić. Since 2003 participates in the project "European Manufacturing Survey" under the leadership of the Fraunhofer ISI Institute in Karlsruhe, Germany, and since 2008 she is included in the "Global Manufacturing Research Group". From this collaboration emerged numerous scientific papers. In 2014 she became head of the project 3535 "Building the competitiveness of Croatian manufacturing" financed by the Croatian Science Foundation.

At the Faculty of Economics she teaches: Operations Management in the third academic year, Strategic Management in the fourth year, Supply chain management and Service operations management at graduate studies of department of Management. She is author of a scientific book Management innovation, as well as two university textbooks: Supply chain management and Service operations management.

Iztok Palčič, PhD

Associate Professor Dr. Iztok Palcic has been employed at University of Maribor, Faculty of Mechanical Engineering, Laboratory for Production and Operations Management since 1999. He is Vice-Dean for Studies since July 2015. His areas of expertise are production management, project management, value management, technology management and network organisations. From 2005-2006 he was also employed at GEA College of Entrepreneurship as a director of GEA College Research and Development Institute. He received his Ph.D. in 2004 when he defended his doctoral dissertation thesis "A model of industrial clusters development, organisation, knowledge and technology transfer". Since 2004 he is a member of executive board of Slovenian Project Management Association and a member of European Operations Management Association (EUROMA). He is also certified IPMA project manager (Level C) and editor-in-chief of Project Management Review.

Assoc. Prof. dr. Iztok Palčič has wide practical experiences through consultancy in manufacturing companies and other organisations, where he works aa a consultant and trainer in companies and public organisations from the field of project management and operations management. He is also evaluator of projects for Eurostars, Cost, Innovation Fund Denmark, Slovenian Ministry of Economic Development and Technology etc. He has many experiences in different national and international R&D projects as a project leader or project team member: 6. FP, Leonardo, PHARE, Tempus, Erasmus projects etc. Since 2002 he has been working on his R&D and teaching activities abroad: TU Wien – 2 months, TU Graz – 11 months, Leeds University Business School – 1 month, Faculty of Technical Sciences Novi Sad (Serbia) – 3 months, where he is also visiting professor.

Božidar Matijević, PhD

Božidar Matijević, Ph.D. is a Full Professor at the Faculty of Mechanical Engineering and Naval Architecture (FAMENA), University of Zagreb.

Having completed his master's thesis titled "The Heat Diffusion Boriding Process of Steels", he received his MSc degree from FAMENA in 1992. On October 7, 1997 he received his PhD degree from FAMENA after completing his thesis titled "Kinetics of Diffusion Forming of Carbide Layers". In the period between 1991 and 1995 he worked on the project "Optimization of Integrated Production of Parts", 2-08-182, grant holder Professor Igor Čatić, funded by the

Croatian Ministry of Science and Technology. He also participated in the following scientific projects: “Thermal Modifications of Metal Surface Layers”, 120-044, grant holder Professor Mladen Stupnišek, 1997-2001, funded by the Croatian Ministry of Science and Technology, and "Surface Engineering in the Manufacture of Structural Parts and Tools", 120-1201833-1791, grant holder Professor Franjo Cajner, 2007-2014, funded by the Croatian Ministry of Science, Education and Sports, as well as in the technology project “Diffusion Coating of Tools”, grant holder Professor Mladen Stupnišek, 2004-2006, funded by the Croatian Ministry of Science and Technology. Currently, he is participating in the research project “Building Competitiveness of Croatian Manufacturing, EMS_GMRG, IP-2013-11-3535, grant holder Professor Jasna Prester, 2014-2017, funded by the Croatian Science Foundation. Further, he collaborated on the project “Development of Multi-Layers on Tool Steels” within the Croatian-Slovenian program of cooperation on a wider international project EU1565-SUBLATO “Surfacing of Blanking Tools” within the PHARE program, and on the international project ARISE: Advanced Research, Innovation and Technology Transfer in Surface Engineering, EU: IPA IIIC - Science and Innovation Investment Fund – SIIF, 2013-2015.

As a member of the academic staff of the Chair of Heat Treatment and Surface Engineering he has taught exercise classes in the following courses: Materials I, Materials II, Materials III, Heat Treatment, Heat Treatment II, Materials and Heat Treatment, Surface Engineering, Diffusion Processes and Tool Materials at the undergraduate level, and Materials 1 and Materials 2 at the level of Polytechnics. At the Polytechnics of Karlovac, study of mechanical engineering, he was giving lectures in the course Materials II – Fundamentals of Heat Treatment. He was thesis advisor at the undergraduate level and the Polytechnics, specialization: Materials and Heat Treatment. For several years he was responsible for the organization of the student training, organizing also international field trips for students specializing in the field of Materials.

Professor Matijević is a visiting professor at São Carlos School of Engineering, University of São Paulo, Brazil, where he held a lecture for doctoral students within the Science and Materials Program in 2016. His professional activities are directed to innovations and cooperation with industry, and he is an international and Croatian patent holder.

Supported by the EURO LASER ACADEMY from Vienna, he spent two months in Germany and England to perfect his knowledge and skills in the application of lasers in the metal forming processes. He also completed a training for a teacher of entrepreneurship, organized by the Croatian Ministry of Economy, the GEA COLLEGE, Ljubljana, Slovenia, and Tvente

University, Netherlands. In addition, he passed the state license exam held by the Croatian Ministry of Physical Planning, Construction and Housing qualifying him to perform professional monitoring in the field of construction. He was head of the Laboratory for Heat Treatment from 2001 to 2007, in which period the Laboratory established successful cooperation with over 150 Croatian companies. He prepared several dozens expert reports in the field of examination of thermally and thermal-chemically treated components as well as analyses of fractures in and damage to machine elements.

Between 2012 and 2014 Professor Matijević was head of the Department of Materials Science at FAMENA. Currently, he is head of the Chair of Heat Treatment and Surface Engineering and head of the center of excellence in the field of quenching, QRC – Quenching Research Center at FEMENA. From 2002 to 2006 he was secretary of the Croatian Society for Heat Treatment and Surface Engineering (HDTOIP), and currently, he is president of the Society and since 2013 a member of the "Faust Vrančić" Award Committee. He is also member of the Croatian Society for Materials and Tribology (HDMT), the Austrian Society for Metallurgy and Materials (ASMET) and the Slovenian Society for Heat Treatment (SHT).

He speaks English and German and is a father of six children.

Ivan Kumić, PhD

Ivan Kumić was born in Split in 1983. He finished elementary school in Zagreb, and Aeronautical technical high school Rudolf Perešin in Velika Gorica, which he completed as an Aircraft Technician. He graduated from the Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, in 2009 with a master's degree in materials engineering. In February of 2010 he started working as a research and teaching assistant at the Department of Materials, Chair for Heat Treatment and Surface Engineering where he enrolled in postgraduate doctoral program of Material Science. In 2016. he defended his doctoral thesis (titled: New surface diffusion modification process for endoprosthetic bone implants titanium alloy) and earned a PhD degree. Since September 2016. he has been employed as a postdoctoral researcher at the abovementioned Chair, and in December of the same year has been granted a Research Associate title.

His activities at the Department of Materials include teaching in various courses. For a course of Heat Treatment and Surface Protection he was (with a team of authors) acknowledged in 2013 with a reward for best pedagogical and didactic design of e-course.

Alongside his scientific and teaching engagements, he is/was included in several projects. In 2010 he enrolled in establishing activities of the Quenching Research Centre (QRC) – Centre of excellence. He was a research assistant on a Ministry of Science, Education and Sport funded project Surface Engineering in the production of structural components and tools (2010.-2014.), and Business and Innovation Agency of the Republic of Croatia – BICRO funded project CoatPro – Coating with advanced Properties (2013.-2014.). He also was engaged as a researcher (2013.-2015.) in the EU funded project ARISE (Advanced Research, Innovation and technology transfer in Surface Engineering), within which he helped in PACVD (Plasma Assisted Chemical Vapour Deposition) technology transfer to this Region. He was a member of the Faculty Council, E-learning Committee, Strategy Committee, and Elected President of the Students Council. He is a member of Croatian Materials and Tribology Society and Croatian Society for Heat Treatment and Surface Engineering. He is fluent in English and has a comprehensive knowledge of German.

Ivana Rašić Bakarić, PhD

Ivana Rašić Bakarić, Ph.D. works as Research Associate at the Institute of Economics, Zagreb in the Department for Regional Development. She received her MSc title in 2005 after finishing postgraduate study ("Operational Research") at Faculty of Economics and Business University of Zagreb. Title of her master thesis was "The Use of Factor and Cluster Analysis – Grouping Local Government Units of the selected Croatian Counties". In 2010 she received her Ph.D. Title of her doctoral thesis was "Statistical and methodological basis for definition of spatial-economic entities of the Republic Croatia".

Ivana Rašić Bakarić, Ph.D. participated in three scientific projects ("Sustainable Development, Innovation and Regional Policy in Croatia", "Economic Development of the Republic of Croatia and the Accession to the EU: Macroeconomics, Microeconomics and Spatial Economics", and "Globalisation Mechanisms and Economic Development Criteria") financed by the Croatian Ministry of Science, Education and Sports.

She has been involved in the research activities related to scientific articles publication and has collaborated with the public and business sector since 2001. She has been engaged as an expert on several projects for international organisations (European Commission, UNDP, GIZ). She has had an experience in industrial sector analysis (Croatian manufacturing industry - analysis of technological intensity of production and its influence on the competitiveness of Croatian manufacturing; the analysis of chemical industry - production, employment, wages; the analysis of food and beverage industry). Her current research interests focus on cultural and creative industries and regional/urban economics topics. Her most recent contribution to the public policy area has been cooperation with Croatian Cluster of Competitiveness of Cultural and Creative Industries, participating as a principal investigator in Mapping Cultural and Creative Industries in Croatia study. During 2015 she has collaborated on a project entitled Comparison of public utilities' services pricing in larger cities in Central and South-East Europe, commissioned by the City of Zagreb. In 2014 she has been awarded a grant from Global Development Network – Regional Research Competition 15 along with two colleagues for a research of City specialisation and factor productivity in South-East Europe.

From 2008 to 2012 she had been teaching Statistics at graduate level at Faculty of Economics and Business University of Zagreb. Ivana Rašić Bakarić, Ph.D. wrote one book in 2010 in Croatian language. "Strategic Programs for Local Development: Croatian Experiences" The book was written with Irena Đokić, Ph.D and Jelena Šišinački, Ph.D. She wrote 28 publications and participated on several international congresses and conferences. She is reviewer for many domestic scientific journals and international conferences.

Figures

Tables

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Index