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TECHNOLOGY STATUS AND COMPETITIVENESS OF SERBIAN MANUFACTURING INDUSTRY

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Abstract: *Manufacturing industry is regarded as a main engine of economic growth. This paper aims to reveal characteristics of manufacturing industry in Serbia in terms of its technology structure, competitiveness and relative position in a group of countries. Technology structure is presented on the basis of OECD classification of industry based on R&D intensity and competitiveness is introduced using Competitive Industrial Performance (CIP) index as an indicator of relative competitive ability. Conducted analysis has shown that Serbian manufacturing industry is lagging behind selected EU countries which has negative impact on economic growth and development.*

Keywords*: industry, manufacturing industry, technology structure, competitiveness, Competitive Industrial Performance (CIP) index.*

1. INTRODUCTION

Since the first industrial revolution, over the second and third, until the emerging fourth industrial revolution, industry is the main driving force of economic growth and development. This driving force is an integral part of the process of diversification and development of human creativity and its needs, and it depended on technological progress and the dynamics of the development of knowledge, science and technology. The development features and characteristics are based on the development and structural changes of the industry, which includes relative participation of new and technology intensive industries. There are theoretical and empirical arguments proving that the industry, especially the manufacturing sector, is the initiator and driving force of economic development and structural changes of the national economy. Compared to other sectors, manufacturing industry provides special opportunities for capital accumulation, economies of scale and technological progress (Szirmai, 2009).

The main drivers of intensive industry development and its structural changes are: knowledge, skills, innovation, technology, demand, resource efficiency, investments, company size, activities of the value chain, agglomeration and industrial policy (Mićić, 2015). In other words, technology is a factor that largely determines the characteristics of structural changes in the economy and industry.

The process in which the economic structure evolves under technological development can be explained in the following way: investment in R&D drives the development of new technologies, installation of capital stock brings new technical processes into sector production, new and old technical processes within a sector exchange their relative weights in production as they are phased in or out, and sectors evolve or transform over time (Pan, 2006).

Authors exploring economic and industrial development of Serbia consider that the most important problems of Serbian economy are structural discrepancies, obsolete technology, a low level of investments, high production costs, the social function still dependent on companies, inefficiency, ecological requirements, but also low exports, incompatibility with the EU standards, and a lack of comprehension of industrial processes in the EU (Jakopin & Bajec, 2009).

The main feature of structural changes in the economy of Serbia in the last two decades is deindustrialization accompanied by inadequate implementation of transition and privatization. Hence, there is the necessity of formulating new industrial policy that will be based on: export-oriented reindustrialization (Mićić & Zeremski, 2011), identifying and supporting propulsive sectors and industries (Aranđelović, Petrović-Ranđelović, & Marjanović, 2013), and creating incentives for specific companies and sectors by public authorities (Kočović & Radovanovic, 2013).

Analysis of Serbian industry is enriched including topics such as R&D, technology, innovation. New industrial policy in Serbia should be based on research and development (R&D), new technologies, education, effective investments and integrative networking of all key partners in all phases of reproduction (Leković & Mićić, 2013). It also recognized the necessity of introducing innovations in order to increase the technological level of the industry and improve competitiveness in the international market (Savić, Bošković & Mićić, 2012). Starting from the view that the development of science and technology essentially defines the intensity and speed of economic growth, domestic authors are also researching the capabilities of the Serbian economy to create and commercialize knowledge and technology. One of the approaches is the concept of national innovation system, which is based on the assumption that the research system is part of a larger system that includes economy, institutions, academic community and environment (Kutlača & Semenčenko, 2005).

The main objective of this paper is to point out the importance of manufacturing industry structure, technology profile and competitiveness as general conditions of sustainable economic development. In order to reveal relative position of Serbian manufacturing industry, its characteristics are compared to selected industrialized and industrializing EU countries.

2. METHODOLOGY

In empirical studies and literature there are various indicators of industry structure, technology profile and competitiveness. In this paper, base index of industrial production was used with a goal to determine general trend and dynamics of the development of the Serbian economy in the last two decades. As the base period was used 1990 in order to perceive the relative decline in the level of industrial production in the period 1991-2013. Structural changes in the manufacturing industry of Serbia were analyzed on the basis of gross value added (GVA).

Comparative research method was applied for evaluation of growth rate of manufacturing industry. Growth in industrial production in Serbia was compared to the growth rates of manufacturing industry of selected industrialized and industrializing economies. Countries were classified in two groups according to the classification presented by United Nations Industrial Development Organization (UNIDO, 2013). Selected countries from group of industrialized economies are: Czech Republic, Hungary, Slovenia, Slovakia and from industrializing - Bulgaria, Croatia, Poland, Romania, Serbia.

Technology structure of Serbian industry was analysed using OECD classification of industries by technological intensity. Starting from the premise that technological advances are a key determinant of productivity growth and international competitiveness, OECD has made a classification of industries based on technological intensity. An analysis of investments in research and development and the results of this activity, the OECD has ranked all manufacturing industries in 4 categories: high technology, medium-high technology, medium-low technology and low technology (OECD, 2005).

Competitiveness of manufacturing industry was analyzed using data on CIP index which is based on understanding industrial competitiveness as the capacity of countries to increase their presence in international and domestic markets whilst developing industrial sectors and activities with higher value added and technological content. The CIP index consists of eight sub-indicators grouped along three dimensions of industrial competitiveness: 1) countries' capacity to produce and export manufactures, 2) technological deepening and upgrading, 3) world impact (UNIDO, 2013).

3. INDUSTRY STRUCTURE AND INDUSTRIAL GROWTH IN SERBIA

After the Second World War, Serbian economy was characterized by rapid industrialization that affected the overall socio-economic revival of the country. After 1990, breakup of the federal state, civil war and economic sanctions led to the disintegration of industrial system of Yugoslavia. Transition process after 2000 brought intense structural transformation and creation of a market economy. Although in this period was planned an industry recovery, the process of deindustrialization is continued. Hence, many authors point out that it is necessary to carry out the process of re-industrialization in Serbia. Performance of Serbian industry after 1990 can be perceived using base index of industrial production (Figure 1). Base indexes of industrial production show that the period after 1990 was characterized by a drastic decline in industry production, and even after 2000 industrialization has not been stopped. In 2013 industrial production amounted only 47.43% of the industrial production in 1990.

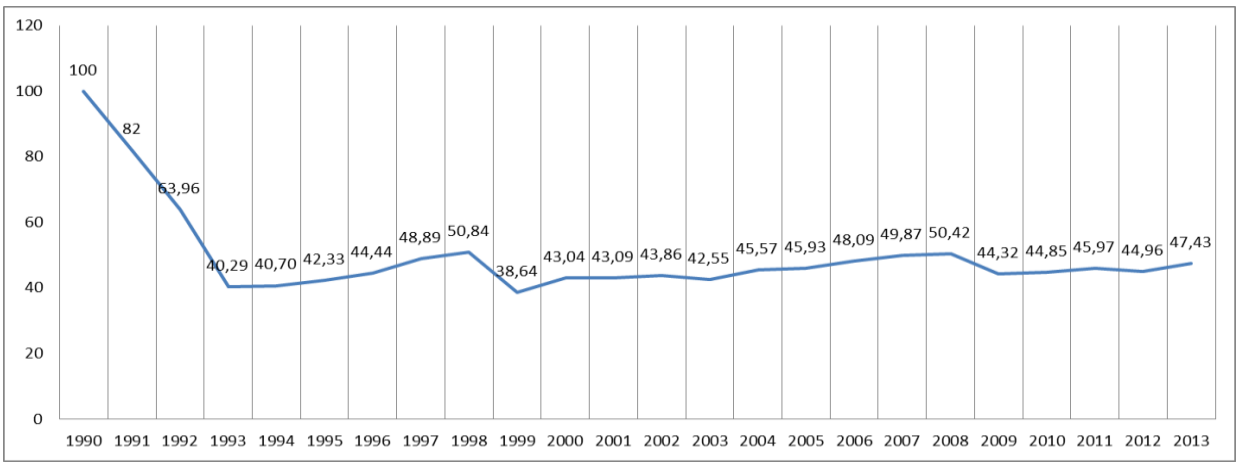

Figure 1: Indexes of industrial production in Serbia from 1990-2013.
Source: Statistical Office of the Republic of Serbia.

The decline in industrial production in Serbia after 2000 is followed with structural transformations visible in the structure of production and employment. In addition to a global trend that is reflected in the growth of the service sector and a reduction in the share of industry and agriculture, it is important to analyze the changes in the structure of industry gross value added (Table 1). The structure of industrial production in Serbia shows that the manufacturing industry had the largest share in the structure of gross value added. However, in the period 2000 to 2014 there was a reduction in the share of manufacturing industry and increase in the share of the other three industry sectors (mining and quarrying; electricity gas, steam and air conditioning supply; water supply, sewerage, waste management and remediation activities). According to the presented data, decline of manufacturing industry share in the reporting period was 7.9%.

Table 1: Gross value added by activities (current prices, structure, %)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Mining and quarrying	1,1	0,9	1,3	1,4	1,3	1,3	1,4	1,2	1,2	1,1	1,3	1,5	1,6	1,5	1,1
Manufacturing	**23,6**	**22,6**	**18,4**	**16,9**	**15,0**	**14,4**	**13,8**	**13,9**	**14,0**	**14,0**	**13,6**	**14,1**	**15,1**	**16,1**	**15,7**
Electricity, gas, steam and air conditioning supply	0,6	0,7	2,4	2,6	2,8	2,8	2,8	2,7	2,6	3,0	2,8	2,9	2,9	3,6	2,9
Water supply, sewerage, waste management and remediation activities	0,8	0,9	1,0	1,2	1,2	1,2	1,2	1,1	1,0	1,0	1,1	1,2	1,2	1,2	1,2

Source: Statistical Office of the Republic of Serbia.

Average growth rate of Serbian manufacturing industry in the last 15 years was 0.75% which is considerably lower than in selected countries in both country groups (Table 2). For example, average growth rates in Slovakia, Poland and Czech Republic were 8.58%, 6.05% and 4.54% respectively. Since growth rates of manufacturing industry represent and indicator of total economic results in certain period, general conclusion is that manufacturing industry of Serbia has insufficient impact on GDP and productivity growth.

It is interesting to note that almost all observed countries have high volatility of growth rates of manufacturing industry (which shows their standard deviation) and very low minimal values. This is mainly due to the impact of Global economic crisis which resulted in extremely negative growth rates of manufacturing industry in 2009.

Table 2: Growth rates of manufacturing sectors from 2001-2015, in %.

Country group/ country		Average	Min	Max	Standard deviation
Industrialized economies	Czech Republic	4,54	-14,70	12,40	6,92
	Hungary	4,43	-18,20	11,70	7,41
	Slovenia	1,83	-19,10	8,50	6,55
	Slovakia	8,58	-18,70	21,60	10,24
Industrializing economies	Bulgaria	4,40	-22,40	17,60	9,12
	Croatia	1,23	-10,40	6,20	4,79
	Poland	6,05	-3,50	14,50	5,45
	Romania	4,06	-6,60	13,30	5,44
	Serbia	0,75	-15,90	7,70	5,63

Source: Eurostat

The reason for very modest results of Serbia in terms of growth rates of industrial production lies in the development model applied in the observed period. It was a development strategy based on the significant role of the service sector, import and foreign direct investment. This model of development has not contributed to the increase in production and employment in those industries that could realize high productivity and rapid economic growth. Bearing in mind the developments in the last two decades it can be concluded that economic and industrial policy should be based on increase of production and productivity in the sectors of tradable goods an a reduction in costs in the non-tradable goods sectors, which will in turn affect the growth of competitiveness and creating an attractive investment environment.

4.TECHNOLOGY STRUCTURE AND COMPETITIVENESS OF SERBIAN MANUFACTURING INDUSTRY

In addition to the low growth rates, Serbian industry is characterized by unfavourable technological structure. As presented in Figure 1, in the structure of Serbian manufacturing industry dominate industries of low and medium-low technology intensity, while the lowest share have high and medium-high technological intensity industries. Average share of low-technology manufacturing in the period 2000-2013 is 46.51% and average share of high-technology manufacturing is 6.57%. In the observed period, only medium-low technology industries tend to increase, while other technology groups tend to decrease.

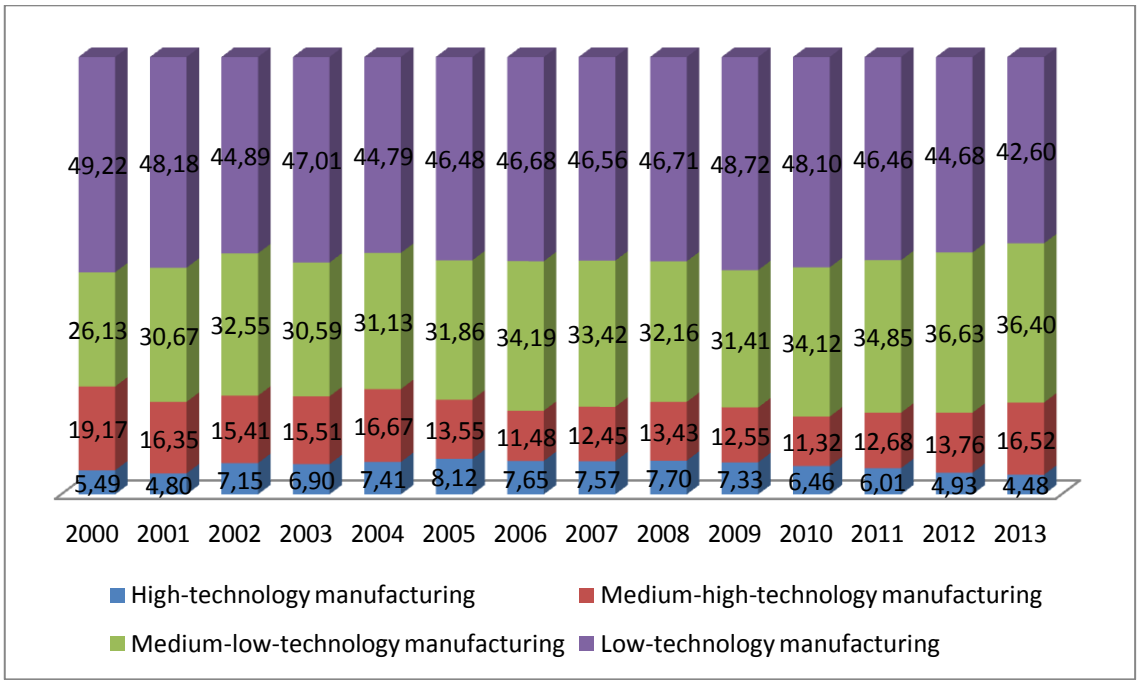

Figure 2: Technology structure of Serbian manufacturing industry.
Source: Calculated by the author on the basis of data from Statistical Office of the Republic of Serbia.

Unfavourable technology structure of Serbian industry proves that its production has low level of technology intensity, low level of finalization and a low added value. Such products are generally intensive with labour and natural resources, which has low impact on economic growth and development. Also, these results imply extremely small investments in improving the technical level of the industry, but also a lack of implementation of the results of scientific research in industrial production.

Presented data on the structure of GVA, growth rates and technological intensity of manufacturing industry of Serbia show inefficient structural reforms implemented after 2000. Structural changes have not been based on increasing the technological intensity of production which resulted in the inability of Serbian manufacturing industry to achieve a satisfactory rate of growth and competitiveness in the world market.

Manufacturing industry is not just an ingredient of development - it is the essential ingredient. Namely, manufacturing industry is: applying technological progress to production, driving innovation, diffusing innovation, developing new skills and attitudes, leading institutional development, producing beneficial externalities, stimulating modern services, generating dynamic comparative advantage, internationalizing economies, modernizing enterprises (UNIDO, 2002).

The competitiveness of a country arises from the manufacturing industry performances. Therefore, it is important to see relative positions of countries in terms of manufacturing industry competitiveness. In order to understand relative competitive position of Serbian manufacturing industry it is used Competitive Industrial Performance (CIP) index.

Competitiveness of the manufacturing industry in Serbia is at a very low level, which reveals 74th place in 2012 out of 140 analyzed countries (Table 3). All selected countries in both country groups have higher ranks which are result of more successful performances of their manufacturing industries. If the competitiveness of Serbian industry is observed in the last two decades, it can be seen that after the sharp decline during the 1990s, there was no significant improvement after 2000. Unlike Serbia, Poland, Hungary and Slovakia have significantly improved their relative competitiveness in the last twenty years.

Table 3: Ranks of competitiveness of manufacturing industries for selected countries

Country group/ country		CIP index rankings			
		1990	2000	2010	2012
Industrialized economies	Czech Republic	25	24	19	18
	Hungary	36	27	26	27
	Slovakia	37	41	27	25
	Slovenia	28	31	32	33
Industrializing economies	Bulgaria	43	63	59	59
	Croatia	33	50	54	57
	Poland	51	33	24	23
	Romania	34	44	35	34
	Serbia	54	79	75	74

Source: UNIDO, 2015.

If the CIP index value in 2012 is observed (Figure 3), industry of Serbia has the CIP index of 0.03 which is several times lower than in other countries surveyed. These data show extremely low performances of manufacturing industry in Serbia.

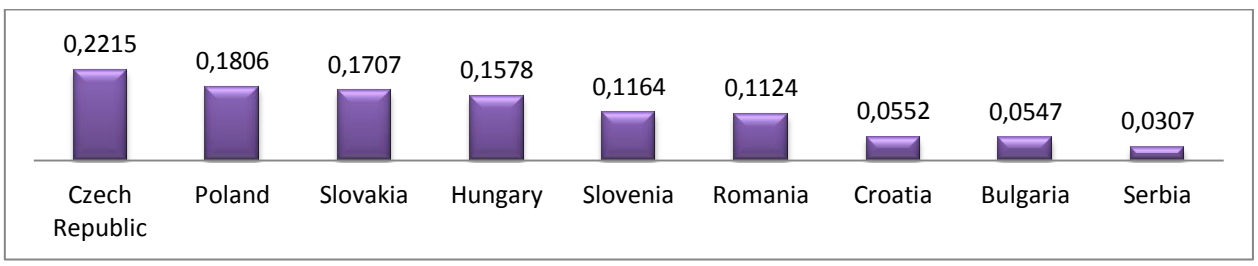

Figure 3: CIP index values in 2012
Source: UNIDO, 2015.

Although CIP index has important functions in monitoring and benchmarking industrial competitive performances, it is necessary to take it into account as a preliminary indicator of countries' industrial competitiveness. This means that using CIP index for creating industry should be complemented with other analyses on different levels (sector, industry, production task, institution, company, etc.) and topics (infrastructure, technology, labor and capital costs, innovation types).

5. CONCLUSION

Empirical analyses and economic reality have shown that successful industry and especially manufacturing industry is one of the basic determinants of long run sustainable growth. Manufacturing industry is the prime creator of value added and jobs in the economy; it is a field for application of technological development in production generates positive externalities for the rest of the economy and therefore it is a source of a country competitive ability. Manufacturing industries with higher technological intensity will create greater value added in the economy and higher growth rates.

Structural transformations in Serbian economy after 2000 were visible in the decrease of manufacturing industry share in the structure of gross value added. This was followed with variable growth rates and low average growth rate of manufacturing industry (0.75% in the period 2001-2015). The reason for this is a development strategy in this period which was based on significant role of import, foreign direct investment and service sector. Manufacturing industry was also characterized with unfavourable technology structure which means that those industries that require most R&D investments had the lowest share in Serbian GVA. According to relative industrial competitiveness indicator, CIP index, Serbian manufacturing industry competitiveness is one of the lowest in the group of industrializing countries.

Low performances of Serbian manufacturing industry indicate that there is a need to change industrial and development policy in order to re-industrialize the economy and increase production in industries that can create high productivity. To achieve this, it is critical to address constraints on technology development as important part of strategy for improving competitiveness of manufacturing industry.

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GLOBAL ELECTRONIC MARKET IN THE FUNCTION OF RETAILERS INTERNATIONALIZATION

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Abstract: *New incentives to strengthen the domination of international retailers are the development of products with the trademark and management of product categories. The globalization of markets and a steady increase in the internationalization of retailers, thanks to scientific and technological progress through interactive resources, leads to the development of electronic marketing channels. The internationalization of the business of large retailers contributes to the growth of concentration of the European and world market retail. Large retailers using modern technological innovation and business internationalization become agents of development in the electronic market.*

Keywords*: private label, globalization, internationalization of retailers, concentration, electronic market.*

1. INTRODUCTION

The structure of retailing is transformed in the European Union and other developed economies markets from a large number of small and independent retailers to the emergence of strong national and multinational retailers. Retailers develop new strength by applying technological innovation and internationalization of business. Large retailers are taking a leading role in relations with consumers and dominant position in the marketing channels. Strengthening retail power in marketing channels in the global electronic market opens numerous intensive theoretical and practical issues:

- What are the essential components of differentiation and market positioning of large retail companies in regard to competition?
- What is the achieved level of the electronic retailers' market concentration?
- What is the strengthening of the position of global electronic retailers in marketing channels like?
- Is the concentration of retailers in favour of consumers?

Based on the issues mentioned above there is a need to analyze the concentration of retailers in the global electronic market. In this sense, it is necessary to consider the largest electronic retailers regarding consumers in marketing channel system of consumer goods. Strengthening the power of retailers in relation to other participants in the global market intensifies the process of horizontal and vertical integration in the electronic marketing channels.

2. PRIVATE LABEL AND MANAGEMENT OF PRODUCT CATEGORIES AS NEW INCENTIVES FOR INTERNATIONALIZATION

Successful market positioning in relation to competition provides retailers with differentiation and strengthening of their own private label. By the development of private label large retailers achieve higher profitability and create loyal customers. Private labels allow concentrated, powerful and large retailers to strengthen their market position in marketing channels. The following figure indicates the market share of products with private label by individual countries in Europe.

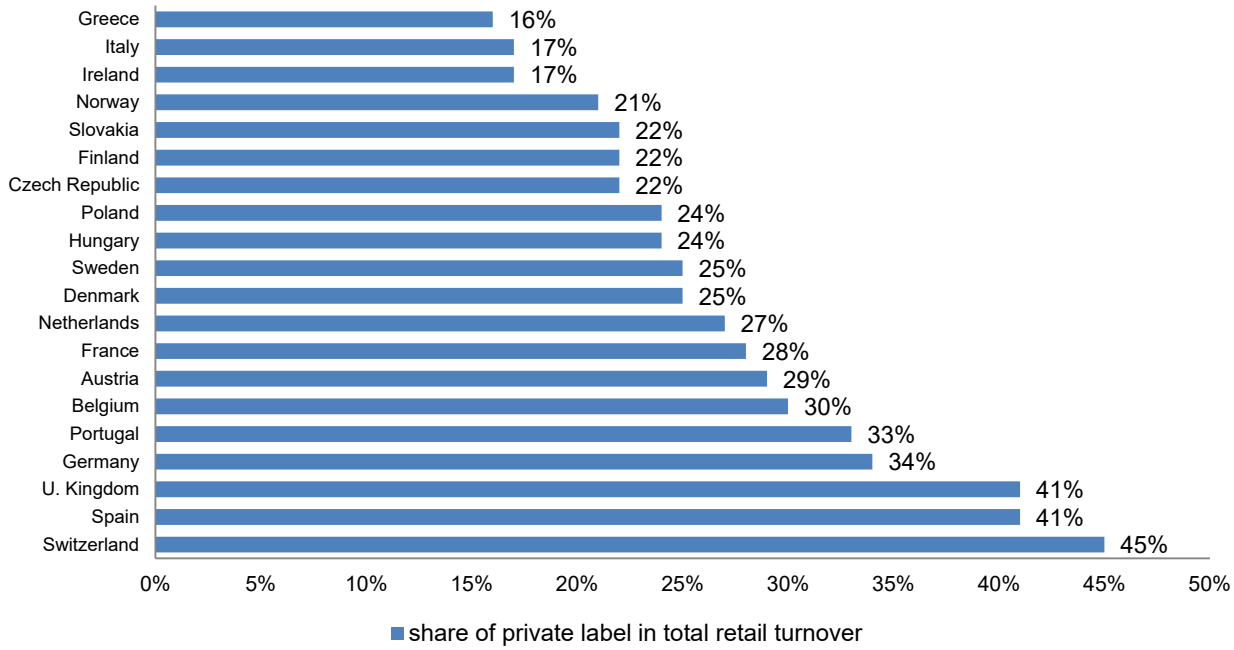

Figure 1: Market share of products with private label by individual countries in Europe in 2014 (Nielsen, 2014, p. 6)

The largest market share of products with the private label was recorded in Switzerland 45% Spain 41% and the UK 41% in 2014, but also with significant participation in other European countries. The average value of the global market share of products with the private label amounted to 16.5%in 2014. The long-term trend of development in all markets in Europe indicates continuous increase in share percentage of products with private label.

Highly noticeable processes of retail market concentration have marked the end of the last and the beginning of this century (Lovreta, Končar and Stanković, 2015, p. 213). High level of competition in Europe confirms that its intensity is an essential factor in the development of private labels. Higher concentration of retail market of food and other products of everyday consumption leads to greater share of private labels in retail. Retailers with internationalization of their business create international corporate brands.

With the development of products with the private label, retailers are creating new market-oriented brands based on a comprehensive behavior of consumer needs. Along with the development of private label there is also a parallel process of building management product categories in the internationalization of retailers. Product categories managers have the task of creating the structure of assortment, selection of producers, the arrangement of space in the retail store, all in order to achieve the set targets and product profitability. Strong suppliers who dominate in one or more categories of products, which bears greatest responsibility for achieved retailers' business results, certainly have the preference. Suppliers undoubtedly need to meet the standards in order to enter the discussion with product category managers of large retailers. Product categories managers are focused on consumer demand for producer brands, and reliability of quantity and availability of the product, in order to meet the demand of the whole chain of retail stores.

Product category managers are increasingly counting on products with private label in achieving profits nowadays. Consumers are increasingly looking for a distinctive offer from modern international retailers which is provided through a range of products with the private label. All retailers in Europe have developed a range of products with private label. The achieved level of concentration of the retail market and the participation of the trade mark in the retail market is highly positively correlated. It must be emphasized that strengthening the power of retailers would not be happening without modern technological advances that are increasingly focused on meeting the needs of consumers in the global electronic market of consumer goods. The unique technology of electronic retailing opens up new opportunities for marketing and sales on the global electronic market. The unique characteristics of e-commerce technologies are: ubiquity (Internet/Web technology is available at any location), global reach (technology across national boundaries throughout the world), the universal standard (Internet standards, as well as a collection of new technological standards), social technology (content generation technology users and social networks), personalization and customization (this technology allows the transfer of personalized messages, both individuals and groups), information density (information technology reduces costs and raises their quality), interactivity (technology

that works through the interaction with the user) and wealth (technology allows different types of messages, such as video, audio and text messages) (Končar, 2015, p. 281). Information technology has changed the structure of marketing channels where international retailers dominate in contemporary conditions with specific strategies of global performance and development.

3. ACTUAL LEVEL OF CONCENTRATION OF ELECTRONIC RETAILER MARKET

The globalization of markets and supranational regional integration contribute to the internationalization of the retail trade, which develops specific marketing and management strategies (Končar, 2015, p. 276.). The effects of the internationalization of retailing are visible on the example of the European Union single market. Intensified internationalization processes strengthen the position of retailer in relation to producers. It is difficult to imagine success in modern business environment on the international market without creating networked and long-term relationship between a larger numbers of participants in the chain of creating value for consumers (Lovreta, Končar and Petković, 2013, p. 572). Internationalization opens up new areas of growth and development in the modernization processes of markets and retailers. Higher level of market concentration of electronic retailers certainly is an important factor in the development of modern global markets and trade. Electronic retailers are getting bigger at the national and supranational level, with a growing market share that belongs to a smaller number of retailers. An important role is played by electronic retailers who take up internationalization activities and expand operations to foreign markets contributing to significantly lower level of concentration.

Internationalization and globalization lead to a higher degree of concentration and expansion of multichannel approach in trade (Končar and Lekovic, 2015, p. 361). The growth of level of concentration and strengthening the power of big electronic retailers such as Amazon.com, Apple Inc.com, J.D.com, and others, lead to changes in balance of power in marketing channels affecting the management and operation of electronic markets. Strengthening the power of retailers is conditioned by increasing the achieved level of concentration of retailing, technological development of the retail sector as well as modern management and marketing strategies. One of the most significant trends occurring in retailing is that of technological innovation (Dunne, Lusch and Carver, 2014, p. 165.). The formation and development of electronic retailing and more intense globalization of the retail activity leads to new positions in contemporary market conditions. Large retail chains are increasingly developed and become dominant in the global electronic market. Strengthening the market position of retailers intensifies changes in the development of electronic retail formats.

Table 1: Status of electronic retailing at major retailers by revenue in 2014 (Deloitte, 2015, G12, G36)

No.	Rank among largest electronic retailers	Company	Country of origin	Share of electronic retailing in total retail revenue	Growth of electronic retail revenue in 2014	Growth of electronic retail revenue from 2011-2014	Growth of retail revenue from 2009-2014
1	4	Wal-Mart Stores Inc	USA	2.5%	22.0%	24.0%	3.5%
2	6	Tesco PLC	United Kingdom	6.5%	20.0%	14.6%	1.8%
3	9	Casino Guichard-Perrachon S.A.	France	7.1%	20.1%	15.8%	13.1%
4	11	The Home Depot Inc.	USA	4.5%	36.9%	42.9%	4.7%
5	16	Costco Wholesale Corporation	USA	2.7%	18.0%	15.9%	9.5%
6	31	Metro Ag	Germany	2.4%	20.2%	56.9%	-0.8%
7	33	Target Corp.	USA	2.5%	30.0%	19.3%	2.7%
8	36	Carrefour S.A.	France	1.8%	-	-	-2.8%
9	41	GroupeAuchan SA	France	2.2%	1.7%	11.3%	6.2%
			Average	3.5%	21.11%	25.1%	4.21%
			Average of 250 largest retailers	13.2%	19.7%	22.0%	4.9%

The largest "click and brick" retailers by revenue, with the specified rank in the group of largest electronic retailers are listed in Table 1.The share of electronic retailing in the total retail turnover is from 1.8% to 7.1%.It can be concluded that retailers successfully implement electronic retailing, as indicated by the high rate of revenue growth in case of these electronic retail retailers. If we compare the growth rate of sales in

the retail and electronic retail revenue growth in general, at the level of each individual retailer, rate is several times higher. The same indicator is for all major retailers.

Growth of the global "pure play" electronic retailers has a positive influence on the growth of levels of productivity and profitability in retail phase of electronic marketing channels. Strengthening the power of electronic retailers and raising the level of concentration contributes to creating new value for customers. All this generally leads to a higher level of concentration of retail and changes relations between competitors on the global electronic market.

4. STRENGTHENING THE POSITION OF GLOBAL ELECTRONIC RETAILERS IN MARKETING CHANNELS

Strong market concentration and the dominance of a small number of major retailers change the structure of marketing channels. Modern retailers create superiority in horizontal and vertical relationships of competition in the global market. The increase in the concentration of power and strengthening the global "pure play" electronic retailers in marketing channels contributes to the internationalization and expansion of electronic markets. A higher level of concentration in the sector of electronic retailing focuses on the issues of horizontal and vertical competition within the marketing channels in the global electronic market.

Table 2: The largest global "pure play" electronic retailers by sales revenue in 2014 (Deloitte, 2015, G36-37)

No.	Rank among largest electronic retailers	Company	Country of origin	Electronic retail revenue u mil USA $	Growth of electronic retail revenue in 2014	Growth of electronic retail revenue from 2011-2014
1	1	Amazon.com	USA	70.080	15.1%	18.6%
2	2	JD.com	China	17.672	62.0%	73.2%
3	12	Vipshop Holdings Limited	China	3.701	120.2%	153.8%
4	17	Zalango AG	Germany	2.943	25.7%	63.1%
5	20	Newegg Inc.	USA	2.800	3.7%	1.6%
6	28	Vente.privee.com	France	2.311	8.0%	17.5%
7	39	ASOS Plc	United Kingdom	1.579	26.7%	25.6%
8	40	Ocado Group plc	United Kingdom	1.570	19.8%	16.6%
9	42	Overstock.com Inc.	USA	1.497	14.8%	12.4%
10	45	Ulmart, CJSC	Russia	1.300	50.0%	63.2%
				Average	34.6%	44.56%
				Average of largest electronic retailers	19.7%	22.0%

The largest global "pure play" electronic retailers according to their origin are from the countries with developed market that have developed an electronic market. Indicators of revenue growth of electronic retailers indicate higher growth rates for "pure play" electronic retailers. Revenue growth of these electronic retailers is also higher than the growth of the "click and brick" electronic retailers. Customers are becoming more and more able to make contact in physical and digital way with retailers thanks to multichannel approach. Developing strategies in-store and online technology enables the creation of links with customers through all marketing channels. Consumers are increasingly comfortable with buying through multiple channels and types of outlets, such that their purchase behavior varies not just by segment but also by purchase occasion (Palmatier, Stern and El-Ansary, 2015, p. 215). Multichannel access combines the physical and digital modes sales. By recognizing the needs of consumers, competition and market trends allow modern retailers to create long-term sustainable competitive advantage. This particular range of product categories and services provide global retailers improvement in business performance. The level of retail globalization by product category in 2014 can be seen in Table 3.

Table 3: Level of globalization by retail product categories in 2014 (Deloitte, 2015, G28)

	% Retail revenue from operations outside of the country of origin	Average number of countries in which retailers operate	% of retailers that operate in only one country
Clothing and footwear	31.6%	25.9	14.6%
The products of daily consumption	22.2%	5.3	41.3%
Technique	24.5%	8.1	33.3%
Different product categories	22.2%	11.4	36.4%
Average of largest retailers	23.4%	10.4	34.0%

Strengthening the position of large retailers by product category is the result of the development of product line selection. Retailers carry out a careful different selection of products in case of business outside the country of origin and, or if they are operating in only one country, as can be seen in Figure 2. The growth of market concentration by product category, clothing and footwear, products of daily consumption, techniques and different product categories, based the growth and strengthening of major retail chains, contributes to a growing level of efficiency in the global electronic market.

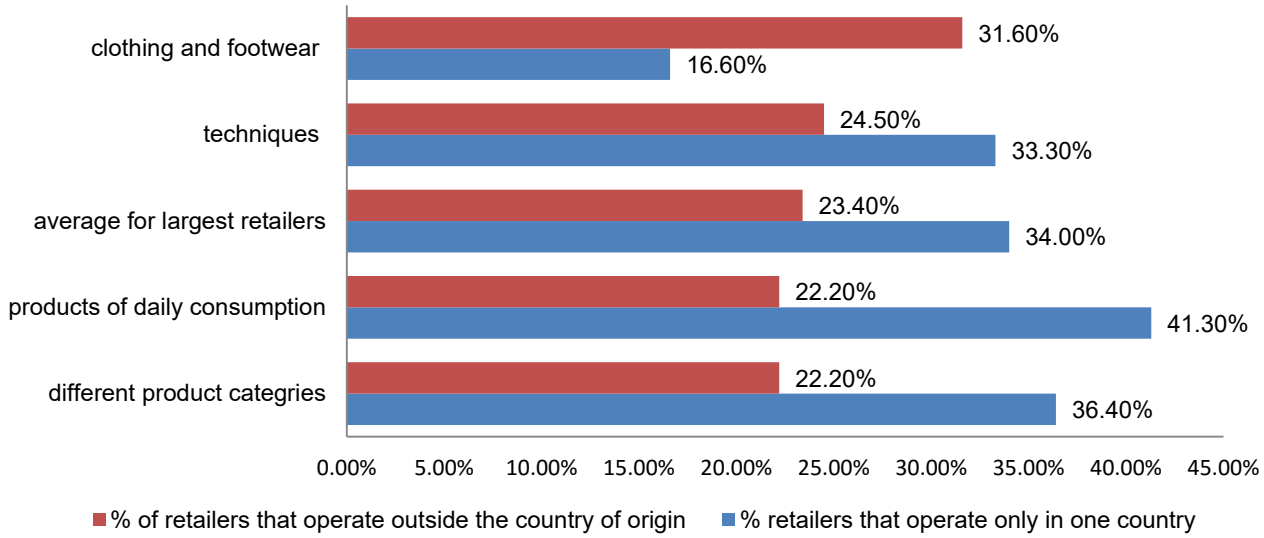

Figure 2: Retail sales by product category outside the country of origin and retailers operating in only one country (Deloitte, 2015, G28)

Online commerce is much more flexible, and what offers customers is saving time and the possibility of buying products that are not available on the local market. With the globalization of retailing customers can order online products of different brands outside the country of origin. It is anticipated that world will have 4 billion Internet users in 2019 and by 2020. Further growth of electronic retailing is linked to the growth of Internet use and the availability of infrastructure, which will facilitate the use for the consumers. Number of Internet users in the past has grown exponentially, with slower growth in recent years, but the adoption of this technology by younger users is noticeable. Its mass use and innovative potential of the Internet will certainly have an impact on the further globalization of markets, and special offers have developing countries in integration into global flows. Balanced growth of the total population in the world is expected in the preceding period, while growth in the number of Internet users has a decreasing pace of growth and stagnation in the previous period, reaching 40% of the total world population.

Effective marketing channel strategies of international retailers create a new structure of the multichannel strategy. Online catalogs are becoming leaders in the structure of the multi-channel mix. In the United States, about 74% of Internet users, age 14 and older, are “buyers”. Another 16% research products on-line (“browsers”), but purchase them off-line (Laudon and Traver, 2015, p. 378). Good multichannel strategy becomes the primary mean of achieving sustainable competitive advantages (Končar, 2015, p. 302).

5. CONCLUSION

The growing internationalization of retail activity causes changes in competitive structure of global electronic market. Product development strategy with the private label and management of product categories become the new incentives in the internationalization and the dominance of retailers. Electronic retailers internationalize their activities and contribute to the growth of the degree of concentration and change the balance of power in marketing channels. The market position of major retail chains intensifies changes in the global electronic market. Thanks to multi-channeling, retailers achieve long-term competitive advantage. Levels of retail globalization at individual product categories contribute to increasing the efficiency of electronic markets. International retailers through a multichannel strategy contribute to long-term sustainable competitive advantages in the global market.

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THE CONCEPT OF HYBRID METHOD FOR RISK ASSESSMENT IN NEW PRODUCT DEVELOPMENT

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Abstract: *Contemporary companies are forced to assume significant risk if they want to quickly and successfully launch a new product to the market. Therefore, the ability of effective risk management is considered as very important factor in the implementation of high-risk projects of product innovation. This paper presents a new hybrid method for risk assessment suitable for new product development (NPD) projects, created by connecting two well-known methods, Risk Breakdown Structure - RBS and Failure Mode and Effects Analysis - FMEA. The RBS is employed as a foundation for this hybrid method. The method includes formulating of the RBM matrix, which is based upon two dimensions (1) Work Breakdown Structure (WBS) - presented through phases of Stage-Gate model and (2) Risk Breakdown Structure (RBS) - presented through categories of risk that can significantly impact the innovation project. FMEA method is used due to its way of overall importance of risk calculation i.e. the way risk priority number is calculated.*

Keywords*: hybrid model, risk assessment, risk categories, NPD, RBS, FMEA, Stage-Gate*

1. INTRODUCTION

In today's unpredictable business surrounding companies have to be prepared to adapt and develop if they want to survive. Therefore, most of nowadays companies with great concern refer to improvement of their innovation performance in order to achieve sustainable growth and significant competitive differentiation (Milutinovic & Stosic, 2013). Considerable number of authors and leaders from different branches identified innovation as a key driver in long-term success and profitability (Stosic, Milutinovic, Zakic & Zivkovic, 2016).

Innovation has been regarded as risky and hazardous which can be confirmed by the fact that only one of sixty product ideas brought into the innovation process reached commercial success, and about 80% of man-hours are used on unsuccessful products in innovation ventures (Epstein, 2002). Also, it is estimated that about 46% of the funds, invested by company in the development and launch of new products/services is related to unsuccessful projects (http://www.prod-dev.com/stage-gate.php).

Having in mind that innovation ventures carry considerable risk that cause more than one half of the individual innovation undertakings to fail, companies have to find the way to succeed in commercial success. In order to minimize the risk in innovation projects companies use the risk management as one of the most influential factors for innovation project success. By itself, risk can appear in any aspect of innovation project and consequently can result in cost overruns, schedule delays and even poor quality (Murray, Grantham, & Damle, 2011). Therefore, risk management in innovation projects is an important topic for practitioners and academic scholars and therefore today it is being increasingly incorporated into business models. Implementation of effective risk management strategy leads to increased performance in NPD (new product development) firm (Mua, Peng, & MacLachlan, 2009). According to survey conducted by Murray, Grantham, & Damle, (2011) the majority of participants - managers with extensive project management experience, confirmed that have used some kind of risk management techniques.

This paper presents new hybrid method for risk assessment, as a part of the overall risk management process in the NPD projects. The main goal is to provide a structured process that identifies how objectives, in this case phases of model Stage-Gate, may be affected. Additionally to analyze the risk in term of consequences and their probabilities before deciding on whether further treatment is required. Risk assessment indicates risk identification, description of the risks, and estimating their respective probabilities and impacts (IEC/FDIS, 2009). While the tools and techniques used for risk identification are designed to assist a project manager in gathering information which influence a project's objectives, scope, and budget; risk assessment provides an insight concerning how likely something is to go wrong and what the associated impact will be (Murray, Grantham, & Damle, 2011).

Starting from this point, the paper is organized in two main sections, first related to theory on risk management, especially in NPD projects, as well as explanation of concepts of RBS and FMEA method. The second one is related to description of the new hybrid method, its structure and the way the overall risk relevance is calculated combining aforementioned methods.

2. PROJECT RISK MANAGEMENT BASIC CONCEPTS

The essential purpose of risk management is to improve project performance via systematic identification, appraisal and management of project related risk (Chapman, & Ward, 1996). The risk management process can be considered as a very useful aid to decision making regarding uncertainty and the possibility of future events and their impact on established objectives. It includes the application of logical and systematic methods for (IEC/FDIS, 2009):

- communicating and consulting throughout this process;
- establishing the context for identifying, analyzing, evaluating, treating risk associated with any activity, process, function or product;
- monitoring and reviewing risks;
- reporting and recording the results appropriately.

Different approaches to the process of risk management are used in the literature and practice, according to the number of stages, location, nature and manner of the risk events occurrence (Table 1).

Table 1: Risk Management Process – selected approaches

References	Risk Management Process
Bruckner, List, & Schiefer, 2001	Goal definition review, Risk Identification, Risk Analyses, Risk Planning, Risk Tracking, Risk Control
Smith & Merritt, 2002	Identify Risks, Analyze Risks, Prioritize and map risk, Resolve Risks, Monitor Risks
PMI, 2004	Risk Management Planning ,Risk Identification, Qualitative Risk Analysis, Quantitative Risk Analysis, Risk Response Planning, Risk Monitoring & Control
Rafele, Hillson & Grimaldi, 2005	Risk identification aid, Risk assessment, Comparison of alternatives, Risk reporting
IEC/FDIS, 2009	Risk identification, Risk analysis, Risk evaluation, Risk treatment, Monitoring & Review
PMI, 2009	Identification, Assessment, Treatment, Planning, Treatment, Monitoring, Documentation

Risk management is one of the functional areas of project management. Speaking of innovation projects, a high degree of risk intensifies the importance of this functional area. Innovation and innovation projects, as a rule, assume the impact of various risk factors, which importance rises with the increase of investments, but also of other factors that affect the expected innovation project success (Stosic, 2013).

Risk management in innovation projects implies analysis of all factors that could affect the innovation process. Therefore, it is desirable that the project managers – managers for risk management, as well as some of operational managers, are involved in the process of risk assessment (Stosic, 2013). Due to a large number of risk events that can be identified in an innovation project, it is often very difficult to perform their proper systematization.

Accordingly, the paper proposes a new hybrid model for risk assessment, which is constructed by combining two well-known methods, RBS and FMEA methods, and that can offer better structure of risk sources and their impact.

Based on extent literature review, this paper presents different risk categories that can affect project objectives and that can be observed for various projects (Table 2).

Table 2: Project risk categories – selected authors

Author	Risk Categories
Godfrey, 1996	Political, Environmental, Planning, Market, Economic, Financial, Natural, Project, Technical, Human, Criminal, Safety,
Akintoye & MacLeod, 1997	Environmental, Political, Social and Economic, Contractual arrangement, Financial, Construction, Market/industry, Company, Development in IT, Project
Tummala & Burchett, 1999	financial and economic, political and environmental elements, design, site construction, physical elements, and “acts of God”

Doering & Parayre, 2000	Technological risks, marketing risks and organizational risks
Miller & Lessard, 2001	Market-related risk, Completion risk and Institutional risk
Keizer, Halman & Song, 2002; Keizer, & Halman, 2007	Technological risk, Organizational risks and Business risks
Hall, Hulett & Graves, 2002	Management Risk, External Risk, Technology Risk
Ghosh & Jintanapakanont, 2004	Financial and Economic Risk, Contractual and Legal Risk, Subcontractors related Risk, Operational Risk, Safety and Social Risk, Design Risk, Force Majeure Risk, Physical Risk, Delay Risk
Nielsen, 2006	Delivery/Operational Risk, Technology Risk, Financial Risk, Procurement Risk, Political Risk, Environmental Risk, Social Risk, Economic Risk
Murray, Grantham, & Damle, 2011	Technological and Operational Risk, Financial and Economic Risk, Procurement and Contractual Risk, Political Risk, Environmental Risk, Social Risk, Regulatory and Legal Risk, Safety Risk, Delay Risk

For the purpose of this paper, i.e. generation of RBM matrix for NPD projects, categorization proposed by Keizer, Halman & Song (2002) will be used. These categories of risk are applied since they are recognized as critical success factors in product innovation projects. Three main risk categories Technology risks, Organizational risks and Business, and twelve subcategories are identified (Table 3). These categories are chosen considering their application for risk identification and assessment for new product development projects, representing one of innovation project category. *Technology risks* refer to product design, manufacturing technology and intellectual property. *Organizational risks* refer to internal project management and external organizational influences. *Business risks* refer to issues such as the impact of a new product on the company's brand positioning, consumer and trade acceptance, commercial viability, and the potential actions of competitors (Keizer, Halman, & Song, 2002).

Table 3: NPD risk categories (adapted from Keizer, Halman, & Song, 2002; Keizer, & Halman, 2007)

	Level 1	Level 2
NEW PRODUCT DEVELOPMENT PROJECT RISKS CATEGORIES	Technology risks	Product technology risks
		Manufacturing Technology Risks
		Intellectual property Risks
	Organizational risks	Supply chain & Sourcing risks
		Screening & Appraisal
		Organizational & Project Management Risks
	Business risks	Product Family & Brand Positioning risks
		Consumer Acceptance Risks
		Trade Customer Risks
		Competitor Risks
		Commercial Viability Risks
		Public Acceptance Risks

This categorization of new product development risk can be found further decomposed on 142 more project issues which are, also, recognized as critical factors for successful NPD (Keizer, Halman, & Song, 2002).

2.1. Basic concept of the RBS method

According to Hillson, Grimaldi & Rafele (2006) RBS is a tool that groups the sources of risk that may affect the project and organize them in a way that allows a detailed analysis of the overall risk exposure of the project. RBS method is based on two dimensions: work breakdown structure – WBS and risk breakdown structure - RBS. This dimensions of WBS and RBS enable generation of a matrix structure known as *Risk Breakdown Matrix* (RBM) (Figure 1), which allows members of the project team to manage risk at all levels of the specific project (Rafele, Hillson, & Grimaldi, 2005). First step is related to definition of WBS structure of project, in this case NPD project, with all major and minor tasks. Second step is related to risk identification and classification through RBS. Third step can be defined as a process of fulfilling the RBM matrix (Figure 1)

with probability of occurrence risk ($P_{i,j}$) and impact of risk ($I_{i,j}$) for every activity and phase i.e. work package (WP).

The value of each cell in the RBM is calculated considering two components: the probability of risk event occurrence (P) and the degree of potential impact (I) that risk event can have. Probability is related to the presence of a risk in the RBS, and impact refers to the consequence of that risk in the WBS. This can be expressed by the formula:

$$R_{WP,i} = \sum_{j=1}^{n} P_{i,j} * I_{i,j} \quad (1)$$

$P_{i,j}$ is the probability of occurrence of risk- j in WP- i;
$I_{i,j}$ is the impact of risk- j in WP- i;
$R_{WP,i}$ is the global incidence of risks in WP- i.

			RBS						
			Risk sources						
WBS Work Packages			$P_{i,1}$	$P_{i,2}$	$P_{i,3}$	...	$P_{i,n}$	ΣR	WPs order
	WP_1	$I_{1,j}$						**$\Sigma R_{1,j}$**	
	WP_2	$I_{2,j}$							
	WP_3	$I_{3,j}$		**$P_{2,3}$*$I_{3,2}$**					
	WP_4	$I_{4,j}$							
	...	…							
	WP_m	$I_{m,j}$							
	ΣR		**$\Sigma R_{i,1}$**						
	Risk sources order								

Figure 1: RBM matrix (adapted from Rafele, Hillson, & Grimaldi, 2005)

In this paper, identification of risk events in innovation project i.e. new product development, realization was done using the two dimensional framework emphasizing that organization can identify, analyze, respond to and monitor the major risks over the process by using RBS. Risk events are structured in three major categories on the first level, and twelve subcategories on the second level of hierarchical system (Table 3).

2.2. Basic concept of the FMEA method

Failure Mode and Effect Analysis – FMEA, is a systematic method for identifying and preventing product and process problems before they occur. The main application of this method is to prevent defect occurrence, enhance safety, and increase customer satisfaction. Therefore, FMEA identifies and prioritize possible imperfections in products design or process development stages (McDermott, Mikulak & Beauregard, 2009).

One of the most cited definitions for FMEA method was given by US MILITARY STANDARD 1629A (1980) describing method as “the set of procedures by which each potential failure mode in a system is analyzed to determine the results or effects thereof on the system and to classify each potential failure mode according to its severity”.

A several types of FMEA’s have been used whenever failures would mean potential harm or injury to the user of the end item being designed (Table 4).

Table 4: FMEA types (http://www.npd-solutions.com/fmea.html; IEC/FDIS, 2009)

Types	Usage
System	focuses on global system functions
Design or Construction	focuses on components and subsystems
Process	focuses on manufacturing and assembly processes
Service	focuses on service functions
Software	focuses on software functions

The main idea of FMEA is to generate a risk priority number (RPN) for each failure mode. Risk priority number is determined by following three factors:

- *Severity* - the consequence of the failure should it occur (McDermott, Mikulak & Beauregard, 2009)
- *Occurrence* - the probability or frequency of the failure occurring (McDermott, Mikulak & Beauregard, 2009)
- *Detection* - the ability of detection technique or method(s) to detect the risk event with enough time to plan for a contingency and act upon the risk (Carbone & Tippett, 2004).

RPN can be described as a weighted assessment number used for prioritizing the highest risk items. The Risk Priority Number is a mathematical product of the numerical Occurrence (O), Detection (D) and Severity (S) ratings (Equation 2). All of these factors are rated on a scale ranging from 1 to 10 (Table 5, 6, 7). Ratings that affect the RPN value are taken based on the universal scale or they may be formulated for a particular system that is analyzed (Ericson, 2015).

$$RPN = O * S * D \tag{2}$$

Table 5: Occurrence Rating Criteria

Occurrence	Rating	Description
Minor	1-2	An unlikely probability of occurrence during the observed period.
Low	3-4	A remote probability of occurrence during the observed period.
Moderate	5-6	A moderate probability of occurrence during the observed period.
High	7-8	A high probability of occurrence during the observed period.
Extreme	9-10	Risk is almost inevitable during the observed period.

Table 6: Severity Rating Evaluation Criteria

Severity	Rating	Description
Minor	1-2	Risk is of such minor nature that the strategic partner will probably not detect the risk.
Low	3-4	Risk will result in slight strategic partner annoyance and/or slight consideration of negative decision.
Moderate	5–6	Risk will result in strategic partner dissatisfaction and annoyance and/or consideration of negative decision.
High	7–8	Risk will result in high degree of strategic partner dissatisfaction and cause serious consideration of a negative decision.
Extreme	9–10	Risk will result in major strategic partner dissatisfaction and cause negative decision.

Table 7: Detection Rating Criteria

Detection	Rating	Description
Very High	1–2	Detection method is highly effective and it is almost certain that the risk will be detected with adequate time.
High	3–4	Detection method has moderately high effectiveness.
Moderate	5–6	Detection method has medium effectiveness.
Low	7–8	Detection method is unproven or unreliable; or effectiveness of detection method is unknown to detect in time.
Very Low	9-10	There is no detection method available or known that will provide an alert with enough time to plan for a contingency.

Identification and prioritization of critical components are followed by an effort on reducing the criticality of the components in the system that have the highest priority. Those efforts should first be addressed to the highest ranking critical items. The main idea is to reduce the RPN by eliminating or controlling the cause of the failure; or reducing the ratings of severity, occurrence and detection (Puente, Pino, Priore & Fuente, 2002).

3. GENERATION OF THE HYBRID METHOD

The aim of this paper is said to be construction of a new tool for risk assessment in projects of product innovation. This new method is developed based on two previously defined methods - RBS and FMEA. The main reason for using RBS method is its structure, which is suitable for risk identification, primarily in the sense of possible connection of risk sources with phases of the innovation project. As it was pointed out, this is reflected through RBM matrix and its two dimensions - WBS and RBS.

Regarding WBS structure, stages of the well-known Cooper's Stage-Gate model for managing innovation projects have been used. Those are: *preliminary investigation*, *build a business case*, *development*, *testing and validation* and *full production and launching to the market* (Cooper, 2011). On the other hand, the main reason for using FMEA method is detection rating which does not exist in RBS method, and that can have a major impact on the overall relevance of the risk.

The basic idea of a hybrid method is a new way for calculations of overall risk relevance, which is adapted to identify and assess the risk of innovation projects. Therefore, the calculation is based on the following assumptions:

- P→O => the probability rating (P) - occurrence of risk events from the RBS method, is mapping into occurrence rating (O) - frequency with which a given risk occurs from the FMEA method;
- I→S => the impact rating (I) – the impact of risk events from the RBS method, is mapped into severity rating (S) - seriousness of the effect if a given failure occur from the FMEA method.

Considering these assumptions and individual formulas for both methods (RBS and FMEA), new way for calculating RPN has been proposed:

$$\begin{aligned} R &= P * I(RBS) = O * S(FMEA) \\ RPN &= O * S * D(FMEA) \\ RPN &= R * D \end{aligned} \tag{3}$$

This formula has been adapted for use in the field of innovation projects since it involves risk categories (risk sources) that are related to new product development (Table 3) and to impact that these categories have on the phases of the Stage-Gate model.

First step in the analysis is to define dimensions of WBS and RBS. Second step is to determine the probability of the occurrence of risk categories that are related to innovation project. This is followed by the determination of impact that this categories can have on certain phases of innovation project. Then the probability that a certain category of risk will be detected in time is determined, that is, before realization of its negative impact and eventually, calculation of RPN is performed.

Table 8: Hybrid RBM matrix

			Work Breakdown Structure						
			Preliminary Investigation	Build the business case	Development	Test and validation	Production and full launch	∑R	Risk sources order
Risk Breakdown Structure	Technology risks	Product technology risks							
		Manufacturing Technology Risks							
		Intellectual property Risks			**$R_{3,3}$*$D_{3,3}$**				
	Organizational risks	Supply chain & Sourcing risks							
		Screening & Appraisal							
		Organizational & Project Management Risks							
	Business risks	Product Family & Brand Positioning risks							
		Consumer Acceptance Risks							
		Trade Customer Risks							
		Competitor Risks							
		Commercial Viability Risks							
		Public Acceptance Risks							
		∑R						The overall risk of the project	
		Risk sources order							

As can be seen in Table 8, the overall risk relevance for risk category *Intellectual property* that can influence the *Development* phase is calculated by multiplying the risk relevance $R_{3,3}$ ($P_{2,2}$*$I_{2,2}$ or $O_{2,2}$*$S_{2,2}$), and detection rating for this risk category ($D_{3,3}$).

4. CONCLUSION

Bearing in mind that one of the most important characteristics of innovation projects is high risk taking, it is essential that companies incorporate risk management into their processes of innovation if they want to avoid exceeded costs, disposal of planned activities and poor quality of new products. Furthermore, of great importance for the companies is to use different tools for risk assessment, or to be able to adjust them to different types of projects, regarding that the various projects are being affected by different risk categories.

For this reason, the paper presents an outline of hybrid method for risk assessment that is suitable for NPD projects. Featured hybrid method can be very important in terms of identifying the impact of risk categories on the stages of model for new product development. Moreover, this method is very useful and has a lot of benefits. Some of these benefits facilitate the risk management process on a particular project, while others are relevant across set of projects. Once the RBS of NPD project is defined, it can be used in a variety of ways. Categorization of risk using RBS and consequently proposed hybrid method, provides a numerous additional insights of risk exposure on the project: understanding the type of risk exposure on the project, exposing the most significant sources of risk to the project, revealing the roots causes of risk, allowing risk responses to be developed for root causes or depended groups of risks, etc. (Hillson, 2003). Also, this tool is helpful when it comes to risk identification, assessment, comparison of projects, risk reporting, lessons learned for future projects.

Having in mind that project phases consist of various activities it should be recommended to apply this method also on the level of each specific phase. In that way the principle of decomposition can be consistently engaged on every level of the project, which enables better identification of risk parameters. This is also in line with the agile approach, thus representing one of the key features and advantages of the proposed method.

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INDEX OF POTENTIAL FOR TECHNOLOGY ENTREPRENEURSHIP DEVELOPMENT: PRACTICE FROM SERBIA

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Abstract: *This paper explores the potential for technology entrepreneurship development, considered as the main force for the prosperity of countries. An index of Technology Entrepreneurship Development Potential (TED-pot) is created, in order to enable the cross-countries comparison. The index includes four indicators grouped into two pillars – ICT potential and Entrepreneurial potential. The index is applied on six ex-Yugoslav countries and the EU for the period 2009-2014. The study is aimed at determining whether the potential of Serbia lies in the entrepreneurial IT sector, which is proven to be the case.*

Keywords*: technology, entrepreneurship, development, potential, index, Serbia*

1. INTRODUCTION

In the modern turbulent and fast-changing business environment, technological progress, innovation, and sustainability are recognized as the most important forces influencing business success. Entrepreneurs are change agents seen as those who could change the overall living standards and work conditions. Apart from creating wealth from their entrepreneurial ventures, they also create jobs and represent the main 'force' acting against unemployment. Simply put, they create conditions for a prosperous society. Combining these views on the modern business world, sustainable technology entrepreneurship stands out as the modern concept contributing to actual practice and development.

As elaborated in the publication *"Entrepreneurship in Serbia – A Necessity or an Opportunity?"* (CEVES, 2014), Serbia is a country where foreign direct investments cannot replace the creativity and energy of thousands of people driven by entrepreneurial ventures and ideas. In Serbia, entrepreneurship should not be 'second-rate' because our country is an economy of small and medium-sized enterprises (SMEs), which actually are entrepreneurial ventures. We need to be aware that most of the big companies have the roots in entrepreneurial ventures, and started as small companies. If we pay attention to small businesses, with a little patience, we will have the opportunity to create a great economy.

Additionally, if we assume that technology is the basis for development, and ICT is the backbone of technology today, the potential for countries' development lies in the ICT sector. SIEPA (2015) published a brochure on Serbian ICT sector, pointing out that computer software is one of Serbia's main export products. Serbia is globally acclaimed for being the biggest exporter of raspberries, but the value of exported software and services is almost twice as big as the export of raspberries. In 2013, Serbian ICT industry was ranked 40th globally when it comes to value of exported software. This made ICT one of the most successful and export-oriented industries in Serbia. Sector's export is on the constant rise especially when it comes to export of computer and information services i.e. software development. In 2008 the value of exported services was €96 million and by 2013 it reached as much as €265 million, which is amazing 165% increase. Serbian IT market was worth around €410 million in 2013, which is still far less than before the global financial crisis outbreak in 2008, when it was worth €550 million. The potential for reaching and exceeding that result is evident (SIEPA, 2015).

Starting from such an entrepreneurial, technology-oriented way of thinking, and in order to test the potential for the development of technology entrepreneurship in Serbia, we created an index of potential for technology entrepreneurship development (TED-pot), and afterwards performed a comparative analysis which encompasses six ex-Yugoslav countries and the EU. The main idea is to compare Serbia with the average for the EU, and with the other regional countries hypothesizing that fostering technology entrepreneurship is the strategic development orientation for Serbia. The aim of the paper is to determine whether the Serbian development potential lies in the entrepreneurial IT sector, i.e. to prove that Serbian development potential lies in technology entrepreneurship. The analysis covers the period 2009-2014.

The rest of the paper is organized as follows. In Section 2 we briefly define the technology entrepreneurship concept and highlight the importance of technology start-ups in modern business. In Section 3 we present the created index of Technology Entrepreneurship Development Potential (TED-pot). Section 4 presents the comparative analysis, results and discussion. Section 5 shows the limitations of this study, future work directions, and concludes the paper.

2. TECHNOLOGY ENTREPRENEURSHIP AND IMPORTANCE OF TECHNOLOGY START-UPS

The importance of entrepreneurship, especially technology (technological, hi-tech or techno-) entrepreneurship is evident in today's business. As Harms and Walsh (2015) highlight, most of today's entrepreneurial heroes such as Bill Gates, Steve Jobs, Mark Zuckerberg and Craig Venter have one thing in common – they are technology entrepreneurs "who base their success on the recognition, creation and exploitation of an opportunity for value creation that a technology has offered". Therefore, we could notice that technology entrepreneurship drives the prosperity in individuals, firms, regions, and nations. It lies in the heart of many important debates that bring together all the participants of the famous Triple Helix model – academia, industry and government. However, according to Bailetti (2012), unless a generally accepted definition of technology entrepreneurship is established, these debates lose their focus.

In his work, Bailetti (2012) defines technology entrepreneurship as "an investment in a project that assembles and deploys specialized individuals and heterogeneous assets that are intricately related to advances in scientific and technological knowledge for the purpose of creating and capturing value for a firm". Technology entrepreneurs have a task to bring together the technical world and the business world in a profitable way (Byers et al., 2011). Therefore, we could observe technology entrepreneurship as the link between science and technology and the practical new value created for the customers, upgrading their living conditions and standards, contributing to the overall welfare of the economy and society (Etlie, 2000). Levi Jaksic et al. (2010) suggest a technology entrepreneurship cycle model focusing on new technology as an opportunity. They emphasize that it differs from the technology push model which is based on new technological innovation being "pushed" through the business operations with a "hope" that sustainable business strategies will be found and enable the success of the venture. The technology entrepreneurship model they present is initialized by opportunity – recognized or created as technology innovation; it has organization-wide context and entrepreneurial perspective.

Fostering technology entrepreneurship is understood as a means to release currently unexploited opportunities hidden in individuals, shelved technologies and resource combinations (Gilsing et al., 2010). Innovation is a precondition for success, but being innovative does not automatically mean new value for the customer and competitiveness. This is where technology entrepreneurship has a vital role, pushing the innovations to the market. In the future, technology entrepreneurs are asked to contribute to solutions to world problems (Groen & Walsh, 2013).

3. INDEX OF TECHNOLOGY ENTREPRENEURSHIP DEVELOPMENT POTENTIAL (TED-pot)

Understanding the importance of technology entrepreneurship today, we decided to create a measure of potential for technology entrepreneurship development. OECD & EC-JRC (2008) published the *Handbook on Constructing Composite Indicators – Methodology and User Guide*, which provides help in creating indices. The Handbook aims to contribute to a better understanding of the complexity of composite indicators and to an improvement in the techniques currently used to build them.

The following general steps were followed in creating TED-pot:

1. Selecting the indicators that will be included in the final index,
2. Finding the right sources for collecting the data,
3. Normalizing the data, and
4. Finding the method for weighting and aggregating the selected indicators.

Steps 1 and 2: Selection of indicators and finding the right source for data collection

When deciding which indicators TED-pot should include, it was obvious that two variables must be included: one which indicates the level of ICT potential of countries, and the other which refers to the entrepreneurial potential. Analyzing the indicators measured by the *WorldBank*, we found seven potential indicators to include: ICT service exports (% of service exports, BoP), ICT goods exports (% of total goods exports, BoP), High-technology exports (% of manufactured exports), Time required to start a business (days), Start-up procedures to register a business (number), Number of new businesses registered (number), and Ease of doing business (1=most business-friendly regulations).

After collecting the data from the *WorldBank* database, indicator on high-technology exports was excluded because of a large amount of the missing values. Number of new businesses registered turned out to show

the result and not the entrepreneurial potential, so was excluded and observed as a control indicator. Ease of doing business is measured only for the two-year period (2014 and 2015), so we stayed with four indicators grouped into two pillars (variables):

1. ICT potential (ICT-pot), and
2. Entrepreneurial potential (E-pot).

In the Figure 1 we present the structure of TED-pot index, which consists of two pillars, and four indicators – two for each pillar. The links for collecting the data on these four indicators is given in the Appendix 1.

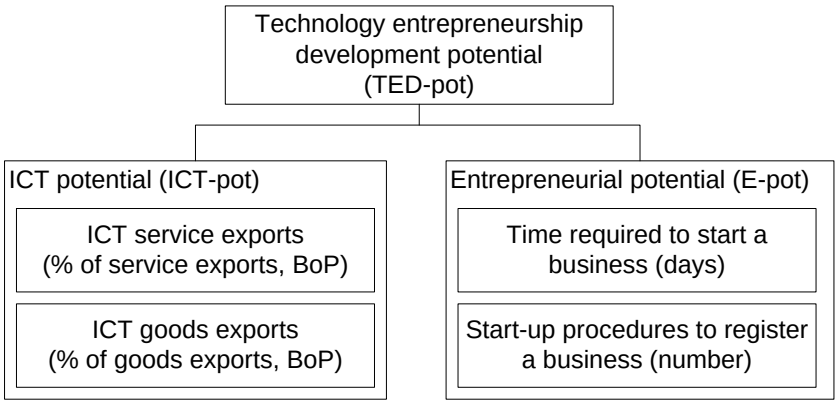

Figure 1: Structure of the TED-pot index (source: authors)

Step 3: Normalization (rescaling) of data

After deciding which indicators to include, and collecting the data, we need to re-scale the values of indicators to be suitable for aggregation. In the case of TED-pot, we observe the variables (pillars) with different natures. This means that the higher value for ICT service/goods exports, the better, but not in the case of the variables of Entrepreneurial potential where lower values show better results (it is better to have less procedures and less time needed for starting a business). This is why we needed to perform different re-scaling procedures for the two observed indicators, to make the values of indicators and the final index value positively correlated (when the values of indicators grow, also does the final index value). In the Table 1 we present the method for preparing the data for aggregation.

Table 1: Transformation of original data (normalization and preparation of data)

Pillar	Indicator	Correlation with the final index value	Normalization and preparation of the data	Correlation with the final index value after transformation
ICT potential	ICT service exports	positive	$\frac{x}{\max(x)}$	positive
	ICT goods exports	positive		positive
Entrepreneurial potential	Time to register a property	negative	$1-\frac{x}{\max(x)}$	positive
	Start-up procedures	negative		positive

As we can see from the Table, for normalization we used the max-normalization, which means that we divided the values of an indicator with the highest value for the observed year. Additionally, for the indicators of E-pot, we needed to perform one more action – subtracting the obtained value from 1 in order to make the positive correlation with the final index value. To clarify, all indicators values are now scaled from 0 to 1, where 1 is the highest value.

Step 4: Weighting and aggregation

For obtaining the final index value we used the simple weighted function with equal weights. The overall TED-pot has been built upon the equal weighting of the two mentioned pillars (ICT-pot, and E-pot), by using the following formula:

$$TEDpot = \sum_{i=1}^{2} \alpha_i P_i \quad (1)$$

where P_i represents the two pillars for each country and α_i is the constant of ½.

The value for each pillar is calculated by the same procedure used for the overall index, that is, through the simple mean of certain indicators. In total, we considered four basic indicators: two for the first pillar, and two for the second. The final TED-pot values, as well as the values for each pillar are bounded from 0 to 1.

4. STUDY ON THE POTENTIAL FOR THE DEVELOPMENT OF TECHNOLOGY ENTREPRENEURSHIP: RESULTS AND DISCUSSION

With the aim to determine whether Serbian development potential lies in the entrepreneurial IT sector, a comparative analysis was performed, which encompasses six ex-Yugoslav countries and the EU. TED-pot index, as well as ICT-pot and E-pot partially, are calculated for each country for the period 2009-2014. In the Figures 2 and 3 the results for the two pillars – ICT-pot and E-pot, are presented, respectively. The blue line shows the Serbian best value in the observed period.

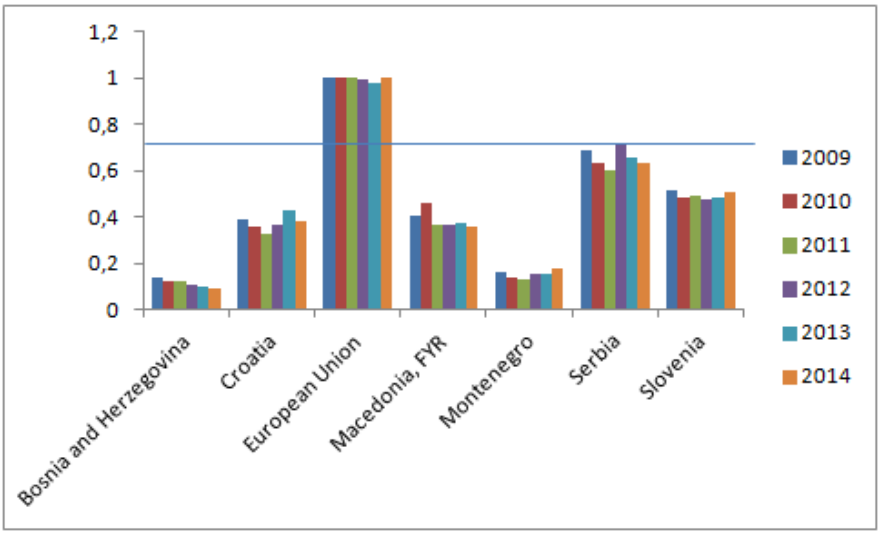

Figure 2: ICT potential (ICT-pot) - comparisons among ex-Yu countries and the EU, period 2009-2014

From the Figure 2 we can clearly see that Serbian ICT sector takes the second place with the values around 0.7 (scale 0 to 1), just behind the EU average. The EU value equals almost 1 throughout the whole time period, except for 2012 and 2013 when Serbia was above the EU average regarding ICT service exports (EU average was 35.5 and 34.59, while Serbia exported 35.87 and 35.94% of total service export). It is very interesting that regarding ICT service exports, Serbia was near the EU or above for the whole period 2009-2014. All other ex-Yugoslav countries are far behind, among which the best is Macedonia with the values around 20%. Bosnia and Herzegovina is the worst, with the values around 6%. Regarding ICT goods exports, the situation is different. The best is the EU (values around 5-6%), followed by Croatia, Slovenia and Serbia, which are intertwined throughout the observed time period (all around 1.5-2.5%). However, aggregating these values into one – the ICT-pot pillar, we can see that the EU is the best, but closely followed by Serbia, and far from the other countries which values do not exceed 0.5 (scale 0 to 1).

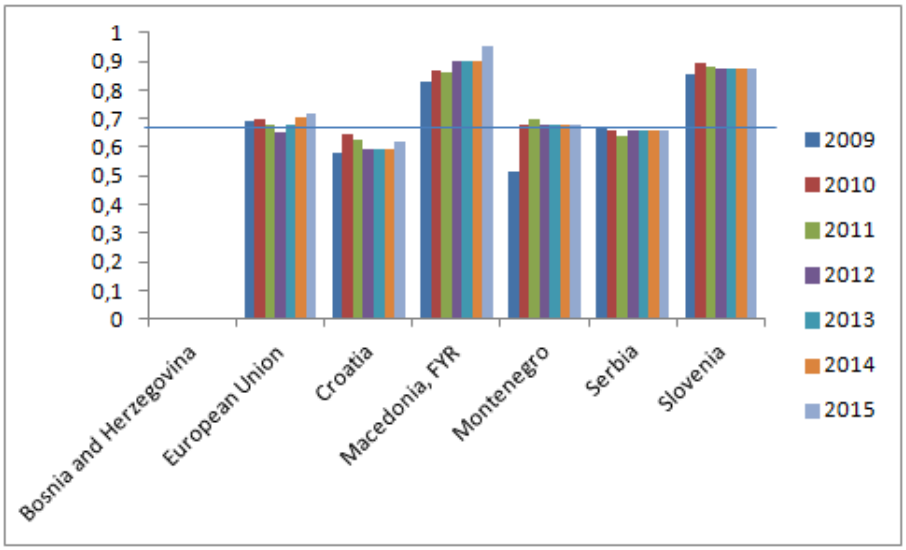

Figure 3: Entrepreneurial potential (E-pot) - comparisons among ex-Yu countries and the EU,

period 2009-2014

Figure 3 shows different results for the E-pot pillar. The EU does not have the best results. Macedonia and Slovenia, with the best (fastest) procedures for starting a business, are ranked at the top. Both the number of procedures and the time required to start a business are the lowest in Slovenia and Macedonia. Bosnia and Herzegovina are placed very low, with the values 0 for the whole time period, e.g. throughout the observed time, Bosnia and Herzegovina had the following values: 99 to 67 days for starting a business, and around 13 start-up procedures. Comparing to Macedonia, where time required to start a business is around 2-3 days, with 2-3 procedures, it is clear why Bosnia and Herzegovina has scored 0 for this pillar. Serbia, Montenegro, and Croatia have scored similar results regarding the E-pot.

Finally, the aggregated TED-pot values which indicate the potential for technology entrepreneurship development of the observed countries are presented in Figure 4. The values which are closer to 1 are better. Figure 4 clearly shows that Serbia is very near the EU average, with the highest potential for technology entrepreneurship development, far ahead of other ex-Yugoslav countries. Serbia is followed by Macedonia, Montenegro, Slovenia and Croatia which have close final values. Bosnia and Herzegovina are at the back of the list, with the final value of around 0.35 (value for Serbia in 2012 is around 0.8 on the scale 0 to 1). The values for the EU are slightly above 0.8 for the whole period (except 2009).

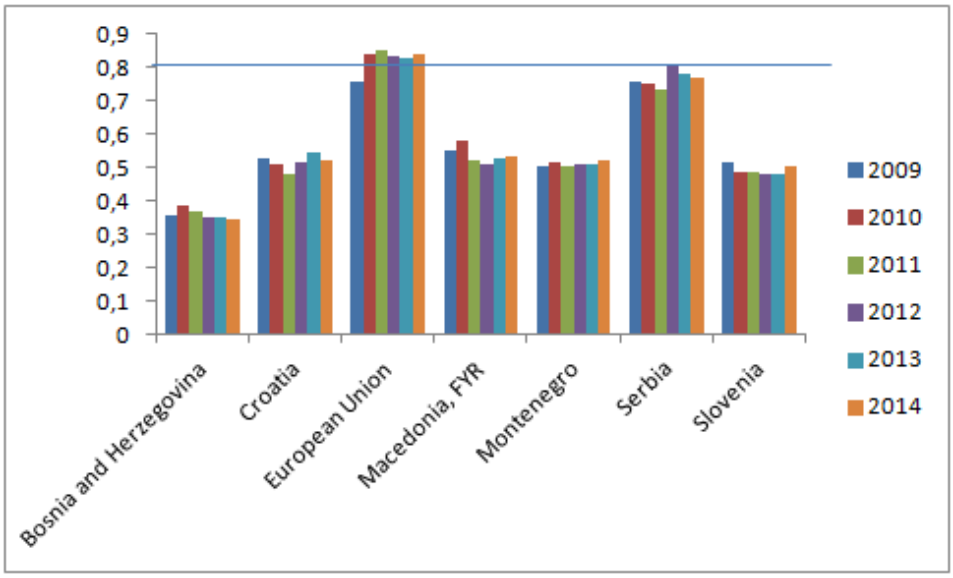

Figure 4: Technology Entrepreneurship Development Potential (TED-pot) - comparisons between ex-Yu countries and the EU, period 2009-2014

These results indicate that the potential of Serbian development lies in its entrepreneurial ICT sector. In order to really further step up this result, the state has to increase investment into research and development and science which nowadays stand at 0.3% of GDP (the EU average is around 2%). Serbia, which shows remarkable results in ICT exports, is currently investing only €60 per capita into the development of the ICT industry, far less than e.g. Croatia (€200). The EU average is €800 (SIEPA, 2015). Since ICT is considered as priority sector for the Government (MESTD, 2016), they should increase the support for this sector over the years, especially since the sector gives strong results in attracting investors and employment. One thing that proves that Serbia is on the right track is opening of the ICT hub for technology entrepreneurship in the science park Zvezdara (in 2014), as well as the Startit centres in Belgrade (in 2015) and Indjija (in 2016).These are incubators which are intended for fostering technology start-ups. Besides these, the well-known Business Technology Incubator of Technical Sciences (BITF) already fosters 53 start-ups, which developed 45 innovations, among which 10 are patented (data available on the official web-site of BITF).

5. CONCLUSION

The objective of this paper was to examine whether the Serbian development potential lies in technology entrepreneurship. In other words, we wanted to confirm the hypothesis that technology entrepreneurship is the focal development strategy for Serbia. For that purpose, we developed an index of Technology Entrepreneurship Development Potential (TED-pot) which has two pillars: ICT-potential (ICT-pot) and Entrepreneurial potential (E-pot). These pillars include two indicators each: ICT goods and ICT service exports (for the first pillar), and Time required to start a business and Start-up procedures (for the second). All the data is collected from the *WorldBank* database. The methodology for construction of TED-pot is explained in Section 3. The index was applied on a set of six ex-Yugoslav countries and the EU, for the period 2009-2014. The detailed results and discussion are presented in Section 4. To summarize, the

calculated values show that Serbia has the best potential for technology entrepreneurship development in the region, being closely behind the EU (e.g. value of TED-pot for Serbia in 2012 is 0.808, while for the EU this value equals 0.835; scale 0 to 1). Although Serbia does not have the best E-pot value in the region, based on the fact that the procedures and time required to start a business are not the lowest, it still has a fertile ICT sector which compensates the slightly lower E-pot value. It should be noted that it is in the best tradition of the history of technology in Serbia since the first digital computer in Central Europe was manufactured in Serbia back in 1960. At the time, Serbia was also one of the six countries in the world with the capability and know-how needed to do that (SIEPA, 2015). Summing up the results of TED-pot index, it could be concluded that Serbian potential is in the development of technology start-ups which could further grow and become the back-bone of Serbian economy.

Since, to the best of our knowledge, this is the first attempt of measuring potential for the development of technology entrepreneurship at country level, there are at least three obvious limitations of this paper which could be discussed. The first is the selection of indicators which are included in the TED-pot index. The second is the methodology used for constructing TED-pot (normalization of data, weighting and aggregation scheme). The third limitation is the narrow analysis, since it included only six ex-Yugoslav countries and the EU average, and should be broadened to a larger set of countries in order to validate the index results, which could be performed by comparing and connecting TED-pot values with the established values such as Ease of doing business, ICT development index, Technology readiness etc. The results could be validated only on a larger sample of countries. The future research directions are found to be: 1. revising of included indicators (considering including a larger set of indicators), 2. revising of the methodology used for obtaining the final value (considering different normalization techniques, as well as weighting and aggregation schemes), 3. broadening the analysis worldwide and enabling the global cross-country comparison, and 4. adding the third pillar - sustainability, with the aim to create a measure of the potential for sustainable technology entrepreneurship development.

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APPENDIX 1

Table: Links used for collecting the data:

Indicator	Link
ICT service exports (% of service exports, BoP)	http://data.worldbank.org/indicator/BX.GSR.CCIS.ZS
ICT goods exports (% of total goods exports)	http://data.worldbank.org/indicator/TX.VAL.ICTG.ZS.UN
Time required to start a business (days)	http://data.worldbank.org/indicator/IC.REG.DURS
Start-up procedures to register a business (number)	http://data.worldbank.org/indicator/IC.REG.PROC

USE OF MODERN TECHNOLOGY IN HOTEL ORGANISATION: THE INFLUENCE OF INFORMATION TECHNOLOGY ON HUMAN FACTOR

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Abstract: *Technological innovation is one of the most important factors in business in today's market. The most important factor in hotel business is human factor, since it is service-oriented industry but it must include use of technology to survive and have success at today's competitive market.*
The subject of this research is literature review and analysis of the concept of technology use in hotel business, and its effect on human factor.
The aim of this research is to analyze use of modern technology in hotel business, guests' and employees' satisfaction with them, their motivation and willingness to use them.
It is assumed, that the use of technology has positive influence on hotel service, but only as a way of making better service provided by employees (assuming that they are trained and motivated to use it) and that technology cannot and should not replace human factor in hotel industry.

Keywords*: hotel industry, modern technology, human factor, guest satisfaction and employee motivation*

1. INTRODUCTION

Hotel industry, like other business-oriented organizations exists on market that represents a place of demand and offer, where sellers and buyers meet and where an object of exchange must exist (a product or service) (Popesku, 2013). Hotel industry is service-oriented and operates on the market of services; therefore, the most important factor is to provide the best service. The value of services or products depends on many factors such are social, economic, hedonistic, etc. (Popesku, 2013).
Services are valued by specific characteristics that differ from products. Intangibility, creation and use of services in the same time - simultaneously, are two characteristics where human factor is very important, because human is providing services and using it. There must be an understanding between provider and user of service, because the buyer or user of services is at the same time responsible for the creation of services (Popesku, 2013).
Another important factor is specifics of touristic need that represents added value and not the basic need. The way in which the service is provided to consumer is important, in order to be satisfied. Human factor is important for the creation of service because one of the service characteristics is that consumers must meet people who provide them service in order to consume the service. Human resources and potential are the most important factor of the organization because using their knowledge, skills, abilities and competencies can contribute to the success of the organization (Dessler, 2013). However, technological changes have brought innovations in the way of providing services in all sectors, and are an important competitive factor.
Organization of hotel business is very specific. Since the consumer segment is constantly changing as trends change, hotel managers need to change and upgrade services they offer to potential guests in order to survive on the market, since without profitable customers it is not possible (Jaško et al., 2013). Hotel managers are also trying to design a business model that will adapt to new needs of consumers of service. It includes use of modern technology. According to research conducted in the USA in 2015, based on a random sample of 3.103 respondents, 60% of potential clients would prefer to stay in a hotel that has technology that allows hotel check in and entering the room by using a smart phone (Softveradvice, 2015).

2. HOTEL BUSINESS ORGANISATION

Very important factor in the hotel industry is the relationship with the customer and guest experience. Since the decision-making process in the tourism industry is led by hedonistic and emotional factors, most users choose travel destination and hotels based on emotions, fantasy and personal preferences (Štiklica, 2015). Modern hotels are organized, and divided by functions and departments. According to the European hotel standards, they can be classified into five categories. Based on Štiklicas research (2015), guests are

impressed mostly, by the hotel design and decoration, and that is the first thing that attracts them when they enter the hotel. Technical possibilities of the hotel are at the lowest level. According to research by Rauch, Collins, Nale and Barr (2015), environment where services are provided is more important in the medium category hotels (3 *), than a way service is provided or if there technological capabilities exist that would improve service. However, if the technology is used to increase the diversity of products, and basic hotel services (for example, self-service kiosks for check-in), guests think that it improves the quality of overall service.

Since the last economic crisis that affected hotel industry, as well, managers are constantly trying new ways to attract new guests and retain old ones. Use of technology in hotels may represent a successful strategy for creating a competitive advantage. Increased use of social networks and the Internet made more information available for hotel managers' research, especially in the design of strategies for the hotel business (Koutroumanis, 2011). Online booking systems such are Booking.com, Venere.com, Airbnb and many others are unavoidable strategic methods of modern hotels. Most hotels have variety of programs that allow them access to databases of the guests. Employees, though, must be taught and interested in using such technology and understand it, so they can use it to improve services. Since there are new trends and changes in hotel organization and use of technology, a strategy for organization change of human factor must be created also, since human factor is the most important in hotel industry (Ko, Pei, and Tsai, 2016). Hotel managers' focus is on guest satisfaction with use of technology innovations. Since employees are the ones using technology in every day work, it should become the focus as well, because if the employees are not motivated, educated and interested to use it there will be no successful implementation (Ko, Pei, and Tsai, 2016).

3. TECHNOLOGICAL INNOVATIONS IN HOTELS

Since the 80s, information technology is included and used in changing tourism and hotel business and as part of its strategy (Buhalis and Law, 2008), as it influence strategic management orientations (Čudanov and Jaško, 2012). Nowadays, tourist and guests are mostly well technologically educated, work in multicultural environments, have wider choice of services, and thus a wider range of demands. Technology progress has brought the chance for tourists to choose by themselves set of services and destinations through internet, and to choose package tours, less. Tourists are less tolerable for waiting, queues, and cancellations. They demand from service providers to be quick in recognizing, and satisfying their needs (Buhalis and Law, 2008).

According to Softver advice (2015), on average 13% of smart phone owners would prefer to make a reservation in a hotel through some application, 37% would prefer to choose a hotel with lobby that offers some kind of modern technology, like touch screen, or self-service kiosk to check in, 41% would prefer face recognition hotel that recognizes guest and personalizes the service. It is shown that use of modern technology in that way would cut costs for 50%. This research should be taken with caution because it is done on small sample of American population and it is biased because it is conducted by Softver Company. Touch screen, face recognition, and smart phones used to check in and entering the room instead of key, are some of technological innovations that are used mostly in USA, so far, but are planned to apply in hotel chains around the world. Making a reservation through mobile application is new channel of sale in hotel business. In some hotels, there is even option to use smart watches for check in and room entering instead of key card. Use of interactive mobile technology have made providing of some services in hotels easier. For the guests it is easier to order food, find needed information about destination they are at, and in that way they make it easier also for the employees, they do not have to ask lot of questions receptionist for example.

Guests as well as employees, who are more open, curious, and interested in games, are more likely to use mobile technology in hotel (Zhu and Morosan, 2014). Off course, in order to use these applications in hotel, employees are first who must be completely familiar with the concept and how to use it. If employees are interested and use technology often, their smart phones, and applications, they will be more motivated to use it as a tool for work and they would be satisfied because it makes their work easier (Zhu and Morosan, 2014). Big hotel chains have their human resource departments research motivation and satisfaction of employees with using technology in work, and create strategies accordingly.

However, the question is whether technology can replace human factor and to what extent it would be necessary to achieve success in hotel business."Savioke" company that specializes in robotics, invented a butler robot in 2014. that is designed to take small object (toothpaste and razor) to guests. According to their research, 56% of guests were interested in this service before the use, and after using it higher percent of guests were indifferent. According to research of Softver advice (2015), "millennia's" generation is a consumer segment that should be in focus of hotel managers, when introducing new technologies, while if they want to attract the older generation, it is not necessary to introduce many technological innovations.

Improtant factor when planning the use of modern technology, and to what extent as a tool for work, is setting goals that hotel wants to achieve. Indentifying the position of hotel in the moment of planning, setting clear objectives, and appropriate strategy, as well as the mission and vision of the hotel, will increase success (Dessler, 2013). Use of modern technology depends on guests that hotel wants to attract, but on

the structure of employees as well. It is more likely that guests, who share same values on the terms of culture, tradition, and use of technology as employees, will be attracted to come to the hotel.
Information technology in hotel business that is used appropriately has contributed to improving service quality, communication and cost reduction. In some hotels where employees and guests are not ready to use it, it may represent a problem or even cause dissatisfaction (Lam, Cho and Qu, 2007).

3.1. Information systems in hotel industry

There are three phases of the implementation of information systems in hotel, such as: accounting phase (accounting, marketing and billing), administrative phase (reservations, reception, reports) and tactical phase (technology, security, security systems) (Radaš, 2015).
Technology development created database that can be a base for carrying out a lot of research and analysis, with the aim of improving and enhancing services and relationship with guests (Kuzmanovic, 2013). Databases are important because of the data organization, consistency, and longer period of storage, multidimensionality and web-design. They are used to collect data about guests, and enable measuring the results achieved, more accurately. Big data, as modern concept, represent enormous database that is important for hotel managers to analyze and use data easier and satisfy guests. It can be used through on line reservation system, but it should be carefully used to get correct and precise data.
There are information systems for operational support (systems for transaction processing - Transaction Processing Systems) intellectual work support (systems for professional support - Professional Supporting Systems, Office System - Office Information Systems and Knowledge Management Systems) and for management support (score cards, balance card) (Kuzmanovic, 2013). In hotel industry usually CRS (Computer Reservation Systems), PMS (Property Management System) and CRM (Customer Relationship Management) systems are used, and every hotel uses some customized software for work. All hotel information systems (HIS) are designed to facilitate the work of employees and reduce their time of collecting, processing and analyzing data, provided that employees know to use them (He, Kyung, Kim and Moon, 2015). The work is made easier for all employees in the marketing, reservations and reception department. Their work is made easier because they can store all the information in computer and can find information easier by typing certain parameter in the search program. There are programs and applications that can help receptionist remember some reservations and remarks, helping to avoid possible errors (Hotelier - reservation softver, for example).

3.2. Intelligent room

Modern technology in hotels is also used through system of intelligent rooms. Significant services are: improving surveillance and warning - SOS alarm, control the temperature in the room, monitoring the status of the guest, which serves to provide the information that guest is in the room, whether he wants or does not want to be disturbed, access control and payment - payment by credit card, the card to unlock the room instead of a key, which also serve to turn the electricity in the room – electricity savings (Kuzmanovic, 2013).
Some systems are designed to facilitate services to guests while some are designed to facilitate the work of employees. Time and space solutions for time and attendance evidence, and access control systems are simple systems for employees, enabling hotel manager to control work easier (Spica, 2016). The systems do not require special training and are easy to use. Managers can easily review the working hours of employees, and receptionists use it to know the position of everyone. For example, if an error occurred while marking the availability of rooms for cleaning, to prevent entry into the room if a guest is in the room and thus avoid unpleasant situations and error employees. The system provides a pleasant environment, a better insight into the business organization, better coordination of activities and faster adjustment to modern requirements (Spica, 2016). Electronic locks provide more security and control, and maintenance and thus facilitate the work of employees (house cleaners, technical maintenance, reception, managers) and requires no special training other than in the implementation of these solutions.

3.3. Self-service technology

At first people were skeptical and reluctant to use self-service technology but eventually got used to this type of service. If a guest or an employee had a satisfying experience when using self-service technology, or heard of one's experience, he is more likely to use it again (Meutera, Ostromb, Bitnerb and Roundtreec, 2003). When guests plan a trip and want to spend less money, they are more likely to use Internet and technology, but when they want reliable and safe service, they opt for the human factor (Cheyne, Downes and Legg, 2006). Customers should have a choice to use the service in a way that will best meet their needs. Self-service technology is used increasingly in hotels and is subject of various research. It is mainly used as a substitute of human factor or as an addition to existing services. The opinions of managers on the introduction of this type of technology diverge - on the one hand, fear that by replacing human they will lose guests who prefer interaction, on the other hand is an opportunity for cost reduction and improvement of

services (Haemoon, Miyoung and Seyhmus, 2013). The advantage of self-service technology use is time saving. How the habits of people are changing, in some areas they do not have the need for personal contact, so the human factor can be replaced by technology and thus reduce the cost of the hotel. Waiting lines in the lobby or restaurant makes negative overall impression of hotel, especially when it is first encounter in the hotel. The use of self-service technology brings guests a choice how they want to use the service. They can get service the traditional way where the human factor is involved or with the help of technology (Kokkinou and Cranage, 2013). According to Kokkinou and Cranage (2013) if there is no crowd or queue for check-in at the reception with employees and at the same time self-service kiosk is available, 25.08% of guests would choose kiosk. 90% of guests consider the expected waiting time of 120 seconds, after which the queue provokes discontent. Employees can help to encourage travelers and guests to use the machines to save time.

3.4. Shortcomings and problems using information systems

The advantage of information systems and modern technology are great, but there are also disadvantages and threats that affect the quality of services. About 55% of attacks on credit card took place in the hotel business. There are threats in terms of data theft, security breaches of data and information. The hotel industry is the most interesting to hackers because of the low level of system security. In order to protect information systems, ISO standards for safety are introduced, and many programs for risk assessment (Njeguš, Grubor and Vejnović, 2013).

As an important factor in preventing fraud and theft in the hotel industry, the use of biometric measures is recommended, such as using a fingerprint or voice, instead of cards or phone identification (Jungsun and Bo, 2014). To avoid a problem during work and use of modern technology as much as possible, the appropriate training of employees is required, that would include the IT team that implements new technology in the hotel, as well.

If it is made easier and faster for employees to learn how to apply the technology, and improving the visibility of some of the services in the application of technology, the greater the motivation and interest in using the same would be (Lam, Cho and Qu, 2007). Hotels that are using technology largely, have to educate also those who are dealing with the information technology, as well as employees that are going to use it, in order to improve the service. The IT team is specialized to understand computers, not people, and guests. If they would have a better understanding of end services, maybe would be able to improve their service. It would be good if they were also engaged in training programs for other employees that are directly related to guests (Nedry, 2015).

4. HUMAN FACTOR IN HOTELS

4.1. The importance of the human factor

The human factor cannot be replaced completely because human resources are the ones who create and influence economic efficiency of the organization, create products or services, control quality, place them and determine the overall strategy of the organization (Kuzmanovic, 2013). Corporate culture in organizations including hotels, affects the success and competitiveness of the organization. If employees are satisfied, motivated to work and are success-oriented it is more likely that the hotel will be more successful (Sawalha, Zaitouni and Elsharif., 2012).

According to Kokkinou and Cranage (2013), if self-service kiosk is used in the hotel, check-in waiting lines would reduce and the quality of services would improve, but only when there are employees at the reception. If the self-service kiosk is used to replace an employee completely, the business would remain at the same level. It would not reduce the cost of doing business as assumed. Of course, employees must be adequately trained to use self-service kiosk, otherwise waiting lines could be bigger. According to Haemoon, Miyoung and Seyhmus (2013), it is desirable to add a self-service kiosks and modern technology in hotels in tourist resorts, to help employees to provide services, but guests still want to interact with employees.

The technology, on one hand provides privacy, autonomy and effective service, but on the other side does not meet the emotional need of guests. The essential role of the human factor is empathy and understanding. When guests are dissatisfied with the service, they can complain to the employee, not to the machine. Employees can have better understanding of their need, understand how they feel, whether they are angry, nervous, happy, and what kind of services can be provided, accordingly. If guests have built trust and relationship with employees, they are more likely to come back to the hotel.

4.2. The influence of information systems on human factor

How successful implementation of technology in the hotel will be, depends on the willingness of employees to use it. Since its use is very important competitive factor (He, Kyung, Kim and Moon, 2015), employees and management of the hotel are aware that it is necessary to use it, but there are often problems when it is applied. The willingness and interest of employees for the use of modern technology in the hotel depends on

the willingness and beliefs about the usefulness of the use of information technology in general (Ko, Pei and Tsai, 2016). Ko, Pei and Tsai (2016) showed in their research that if there is a positive attitude about the use of information technology, there would be greater intention and readiness for its use in the service process. According to He, Kyung, Kim and Moon, hotel information systems facilitate employees work in different ways and they are satisfied with this way of work (2015). "The technology increases the quality of service, reduce operational costs, reduce routine and repetitive tasks for employees and creates the possibility that employees focus on creating ideas and innovation, and to provide quality customer service" (Andjelkovic, 2008, p. 166).

However, despite the readiness and motivation to use information technology in the work, there must be knowledge and expertise to use it, adequately. It is believed that it is best that managers or people in the hotel that are considered the most important people in the hotel, assist and encourage employees to use modern technology in the hotel (Ko, Pei and Tsai, 2016). In addition to the IT team that carried out the implementation of new technologies in the hotel, managers have operative knowledge and support employees. The employees will then transfer the knowledge and assist guests.

Hotel organizations have to change if technological changes are introduced, as ICT gives strategic influence on organization (Čudanov, 2011). Hotel managers must choose and employ personnel who is technologically competent and is able to understand the training program that involves the use of technology. Besides current knowledge and skills required for employment, receptionists, managers and heads of some departments in the hotel (language skills, teamwork, communication skills, education background, analytical skills, ability to evaluate ...) (Kosar, 2002) new skills has to be sought as well as the knowledge of technology basics.

It is necessary that most employees know how to use all devices and technologies that the hotel has implemented. If potential employees do not have experience in use of systems and programs of the hotel, it is necessary to have basics, so to be able to adapt quickly to new conditions and technologies, as openness presents important factor in company's growth (Jeraj, Marič, Todorović, Čudanov and Komazec, 2015). Various studies on the employees willingness and self-efficacy to use technology in work have shown that the majority of employees are willing and interested to use it, and feel that it makes it easier to work (Ko, He, Law).

Very important factor in the service industry is educated and professional staff. Many hotels create their training programs that will meet the needs for certain positions they need. Particularly significant is investment in staff that have the knowledge, not only professional, but also about the behavior of customers. The continuous process of education, gaining experience, and development of interpersonal relationships is desirable in learning organizations. It enables employee to prepare for future jobs. Training is for the employee to train for the current job, and development is for the future (Noe, Hollenbeck, Gerhart and Wright, 2012).

5. CONCLUSION

The use of modern technology in addition to the human factor is emerging strategy that can improve the quality of services. Fifteen years ago, and more attention was paid to the price of computers and technology, that was used in the hotel. Today when almost every hotel has available technology at affordable prices, focus is shifting to human resources who are using it. Focus is shifted to finding the most efficient way to achieve the best combination of cost of purchase and use of the technology, and the training and motivation of employees to use it. When applying technology, first consumer segment should be determined and in line with that, use modern technology to a greater or lesser extent.

Since guests are driven by emotions when choosing the hotel, very important factor is relationship that they established with employees. As long as the role of information systems and modern technology is to improve service, increase business productivity, quality and way of communication to a higher quality level (not at any price and to reduce costs), it can bring a competitive advantage (Kuzmanovic, 2013). There is a consumer segment, which would be interested in fully automated hotel, but so far, there are no relevant data to show.

Hotel can achieve success if it is able to combine modern technology as an aid and in accordance with the human factor, and not to replace human entirely. Hotel can achieve success if combines modern technology with the human factor that is motivated and qualified to use it. If some of these factors lack in hotel business strategy, it is more likely that the strategy will not achieve expected success.

Tradition, and its preservation together with technology in modern tourism are some of the most intensely debated issues in many researches dedicated to tourism management and marketing policies in general (Goeldner, Ritchie and Mcintosh, 2000). Traditionalism, as a tourist aspect that has acquired some distinctive components, recognized in the specificity of human factor, and especially in hotels services and in the specific cuisine, once coming on a collision course with the technology risks generates a real deterioration of the potential in any kind of the tourism activity. Thus, the general equilibrium defined by the balance between the human resources tradition and modern technology could be sought and found even in the contemporary hotel organization.

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POTENTIAL IMPACT OF 3D PRINTING IN REDESIGNING SUPPLY CHAIN – EXAMPLE OF MEDICAL INDUSTRY

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Abstract: *This paper covers the globally recognized topic of additive manufacturing. The document examines in particular its impact on supply chain and how medical industry benefits from it. In addition, research of the development of this field in Serbia has been conducted with recent findings. Interviews with the people in this industry in Serbia have been the backbone of the research. Paper combines theoretical knowledge and practical views presented from world's leading business thinking centers. The aim of this paper is to give a contribution in revealing the possibilities 3D printing provides and to highlight its impact in medical industry in Serbia and worldwide.*

Keywords*: 3D printing, additive manufacturing, medicine, supply chain, supply chain management*

1. INTRODUCTION

Supply chain management is of great importance for everyday functioning of organizations. A large amount of resources is invested into managing it effectively and efficiently. Numerous hours of labor and significant investments in equipment, machines, software and personnel training is what accompanies today's supply chain management. An example of traditional model of manufacturing supply chain is showed below:

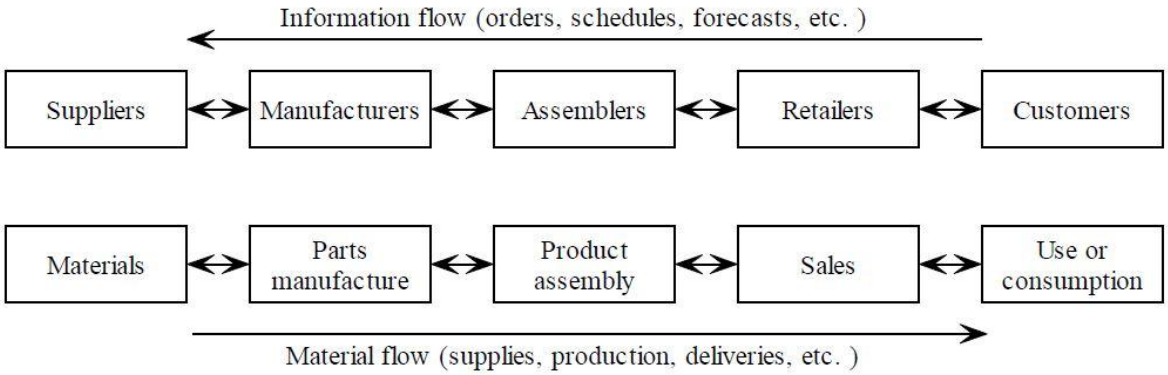

Figure 1: Generic configuration of a supply chain in manufacturing (Vrijhoef & Koskela, 2000)

This configuration shows the checkpoints in the process of serving customers. All those checkpoints are interconnected with a number of support functions and processes. Some of the biggest cost drivers are transport, IT support, quality control, etc. It is the purpose of supply chain management to conduct all of those in a proper ways, with reasonable cost on one side, and satisfied market demands and customer needs on the other. The scope of roles supply chain management varies in size, but either way, its functioning is essential for the success of an organization.(Mentzer et al., 2001)

2. EVALUATION OF SUPPLY CHAIN

Companies continually monitor the performance of their supply chain. Some industries have their own peculiarities and require very specific measures, but the core idea behind the supply chain management metrics is the same. Some of the key metrics are presented by (Gunasekaran, 2004) and could be divided in several areas:

Metrics for order planning;

- Order lead time (time elapsed between the receipt of the order until the delivery of the finished goods to the customer)

- The customer lead path (a path that an order traverses and the time spent in different channels)

Evaluation of supply link:
- Evaluation of suppliers (efficiency, flow, integration, responsiveness)
- Strategic level measures (lead time against industry norm, supplier pricing against the market)
- Tactical level measures (efficiency of purchase order cycle time, cash flow, quality assurance, capacity flexibility)
- Operational level measures (adherence to developed schedule, avoiding defects)

Metrics at production level:
- Range of products and services
- Capacity utilization

Evaluation of delivery link:
- Average cost per delivery
- Flexibility of delivery systems to meet particular customer needs
- Total distribution cost

Customer service and satisfaction:
- Customization level
- Customer query time
- Post transaction services

Logistics cost:
- Cost of assets and return on investment
- Information processing cost

3. 3D PRINTING TECHNOLOGY

Technology of 3D printing belongs to a class of techniques known as additive manufacturing. The key characteristic of additive processes is that they build objects layer-by-layer rather than through molding or subtractive techniques (e.g. machining and carving).(Murphy & Atala, 2014) At this point, 3D printers are able to produce objects from a variety of materials, such as plastic, metal, ceramics, glass, paper and even living cells. These materials can come in form of powders, liquids, filaments or sheets. There are now home 3D printers available, which cost less than $1000, but their possibilities are no match for industrial ones and have limitations.

A variety of 3D printing techniques are in use today, each having its own advantages and drawbacks. Most used additive manufacturing technologies are, according to (Manyika et al., 2013):
- **Selective laser sintering (SLS)**. In this technique, a layer of powder is deposited on the build platform, and then a laser forms a single layer of the object into the powder, fusing the powder together in the right shape. Afterwards the build platform moves down and more powder is deposited to draw the next layer. SLS does not require any supporting structure, which makes it capable of producing very complex parts. General Electric, for example, bought an SLS engineering company to build parts for its new short-haul commercial jet engine;
- **Direct metal laser sintering (DMLS)**. This technique is similar to selective laser sintering but deposits completely melted metal powder free of binder or fluxing agent, building as a result a part with all of the desirable properties of the original metal material. DMLS is used for rapid tooling development, medical implants and aerospace parts for high-heat applications;
- **Fused deposition modeling (FDM)**. A filament of plastic resin, wax, or another material is extruded through a heated nozzle in a process in which each layer of the part is traced on top of the previous layer. If a supporting structure is needed, the system uses the second nozzle to build that structure from a material that is later discarded (such as polyvinyl alcohol);
- **Stereolithography (SLA)**. A laser or other UV light source is aimed onto the surface of a pool of photopolymer (light-sensitive resin). The laser draws a single layer on the liquid surface; the build platform then moves down, and more fluid is released to draw the next layer;
- **Laminated Object Manufacturing (LOM)**. A sheet of material (paper, plastic, or metal) is fed over the building platform, adhered to the layer below by a heated roller, and a laser cuts the outline of the part in the current layer;
- **Inkjet-bioprinting**. Bioprinting uses a technique similar to that of inkjet printers, in which a precisely positioned nozzle deposits one tiny dot of ink at a time to form shapes. In cases of bioprinting, the material used is human cells rather than ink. The object is built by spraying a combination of scaffolding material (such as sugar-based hydrogel) and living cells grown from a patient's own tissues. After

printing, the tissue is placed in a chamber with the right temperature and oxygen conditions to facilitate cell growth. When the cells have combined, the scaffolding material is removed and the tissue is ready to be transplanted.

3D printing has several advantages over conventional construction methods. With 3D printing, an idea can go directly from a file on a designer's computer to a finished part product, potentially skipping many traditional manufacturing steps, including procurement of individual parts, creation of parts using molds, machining to carve parts from blocks of material, welding metal parts together, and assembly. 3D printing can also reduce the amount of material that is wasted during the process of manufacturing and create objects that are difficult or impossible to produce with traditional techniques, e.g. objects with complex internal structures that add strength, reduce weight, or increase functionality. In metal manufacturing, for example, 3D printing can create objects with an internal honeycomb structure, while bioprinting can create organs containing internal network of blood vessels.

3D printing is also gaining traction for direct production of tools, molds, and even final products. These newer uses of 3D printing could enable unprecedented levels of mass customization, shrinking and making supply chains less costly, and even the "democratization" of manufacturing as consumers and entrepreneurs begin to print their own products. Looking longer term, perhaps beyond 2025, one category of 3D printing – bioprinting of living organs – has long-term potential to save or extend many lives. (Lee & Stewart, 2014)

4. EFFECT OF 3D PRINTING ON THE SUPPLY CHAIN

As implications of the technology expand and prices drop, the first big implication is that more goods will be manufactured at or close to their point of purchase or consumption. As a result, many goods that have relied on the scale efficiencies of large, centralized plants will be produced locally. Even if the per-unit production cost is higher, it will be more than offset by the elimination of shipping and of buffer inventories. Parts could be made at dealerships and repair shops, and assembly plants could eliminate the need for supply chain management by making components as needed. (D'Aveni, 2013)

Another implication is that goods will be customized at an unprecedented level because altering them won't require retooling, only slight modifications of instructions in software. For some industries and some products, the concept of "on-demand" manufacturing could radically change business models and supply chains. Consider, for example, a homeowner needing a spare part for a dishwasher. He orders the part online from the manufacturer, receives a bar code for the part and gets it printed at a local 3D printing center, perhaps at a library, post office or a big box retailer. Such a scenario shrinks the supply chain to almost one link – eliminating those connecting development, prototyping, production, delivery, and warehousing of parts. A survey conducted by PricewaterhouseCoopers presents what are the most likely implications of 3D printing on modern businesses. The chart below shows the results.

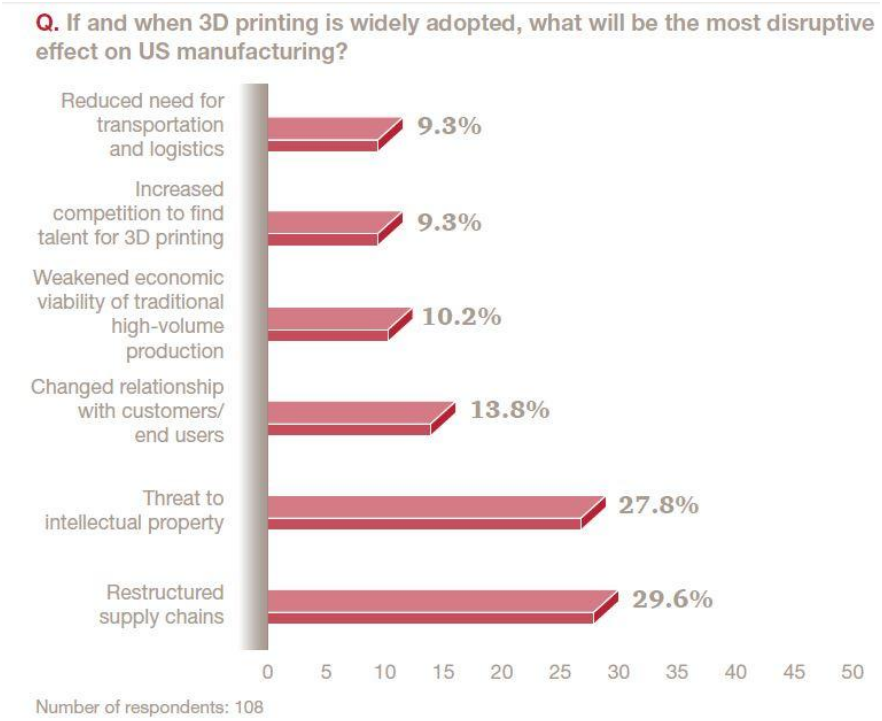

Figure 2: How could 3D printing disrupt? Supply chain restructuring and intellectual property threat tops the list (McCutcheon, Pethikc, Bono, & Thut, 2014)

Whether its impact is evolutionary or revolutionary, 3D printing technology is recognized as a striking trend that will significantly impact supply chains. Those that do nothing will be left wanting, because the influence of 3D printing technology on supply chains is expected to grow. (Sebastian & Omera, 2015)

Based on assessments stated, the 3D printing could cause a supply chain to look a lot simpler, as shown in the Figure 3.

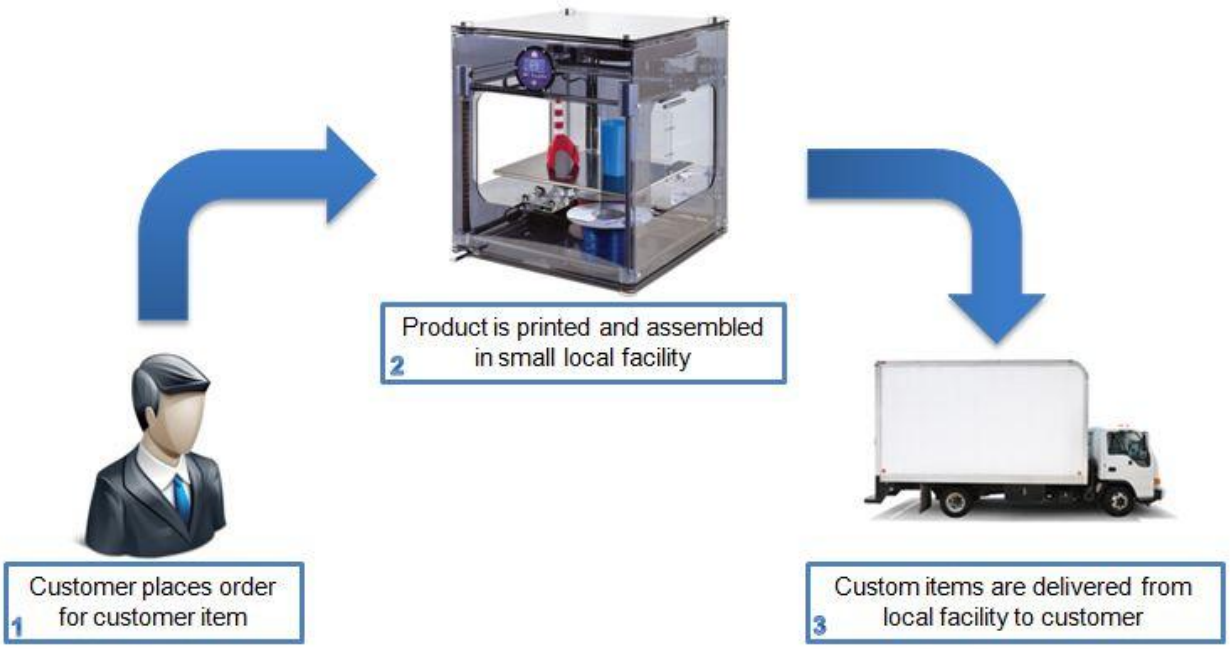

Figure 3: New supply chain model using 3D printing technology

A supply chain having these characteristics would show superior performance in almost all, or the vast majority of supply chain metrics, compared to traditional supply chain. The impact of supply chain on the business of the future is inevitable. The precise form and scope of it are still to be shown. The interest and hype it is creating is impressive. A fact that shows that it is not only a hype is that professional services firms, such as Deloitte, are offering courses in additive manufacturing (Nanney & Cotteleer, 2015). Process is fairly simple, starting with an Auto CAD file, which is afterwards loaded into the 3D printer, which assembles the object based on that. It is clear that new forms of employee training are required for that and already now can we see the steps made towards it, especially in the defense, automotive and aerospace industries, which possess the biggest traction for adopting this technology.

5. CURRENT DRAWBACKS OF 3D PRINTING AND ROOM FOR ADVANCEMENT

The technology of 3D printing has been developing since 1980s, but it still has drawbacks that need to be addressed in order for it to become truly widespread. There are now home printers available, at reasonable prices, even below $1000. But these do not provide perfect performance. Mostly used for prototyping, home printers are producing objects of low-strength capabilities. The 3D printers are about at the same stage as the PCs were in the initial stage of their development. (Lee & Stewart, 2014) Current limitations of 3D printing, which vary by printing technique, include relatively slow build speed, limited object size, limited object detail or resolution, high material cost and, in some cases, limited object strength. However, in recent years rapid progress has been made in reducing these limitations.

Additive manufacturing is still far away from producing massively final products. There will be some highly complex parts that are better made through 3D methods (such as certain aerospace components, like turbine blades), or unique situations where there is no room for a machine shop and the nearest parts depot is far away (such as the International Space Station). Special potential of 3D printing is for spare parts industry. Currently, 3D printing is mostly used by automotive industry (about 40% of all devices used), and medical with about 15%, where the biggest user are dental markets and audiology.(Lee & Stewart, 2014)

Drawbacks of 3D printing do not come down only to current technical limitations, which are likely to be significantly improved. There are some cons that are directly related to the nature of additive manufacturing. Namely, 3D printers may pose a health risk when used at home. The emissions from desktop 3D printers are

similar to burning a cigarette. While heating the plastic and printing small figures, the machines using PLA filament emitted 20 billion ultrafine particles per minute, and the ABS emitted up to 200 billion particles per minute. (Stephens, Azimi, El Orch, & Ramos, 2013) These particles can settle in the lungs or the bloodstream and pose health risk, especially for those with asthma.

Next, 3D printers consume a lot more of electrical energy than e.g. injection molding to make an item of the same weight. Because of this, 3D printers are better for small batch runs. Industrial-sized 3D printers may not be the answer to lessening our use of coal power any time soon. Furthermore, additive manufacturing vastly relies on plastic in its process. One of the biggest efforts recently have been efforts to reduce reliance on plastics, from grocery bags to water bottles to household appliances that can be made from recycled materials instead. Though using raw materials reduces the amount of waste in general, the machines still leave unused or excess plastic in the print beds. The plastic byproduct ends up in landfills, which overall produces additional environmental concern.

Overall, intellectual property is an issue that needs to be taken into consideration seriously in order to create a sustainable model for using 3D printers. 3D printing will change the business market, but also provide possibility for black market for these items. That means that the legislation will have to be created accordingly to catch up with the progress. This potential digital piracy is similar to the way the internet challenged the movie and music industries for copyright, trademarks and illegal downloads.

Finally, there is also a vast room for abuse of 3D printers, which could be used to make weapons, drugs and similar illegal and/or so far narrowly controlled items.

6. 3-D PRINTING IN PRODUCTION OF ORTHOPEDIC INSOLES

Orthopedic insoles are typical products that can be produced using traditional methods, but for which 3-D printing provides broad advantages. Here are highlighted some changes to the supply chain design if 3-D printing is used for producing orthopedic insoles.

The traditional supply chain of orthopedic insoles - Many consumers regularly purchase orthopedic insoles for health reasons to help deal with defects in the natural shape of the foot or positioning of the foot during standing or walking. The insoles are usually partly machined and partly handcrafted. The insole manufacturer holds inventories of cork, plastic and leather, which are the main components for the insole. Cork and plastics are used for the basis of the insole, while a leather top-layer is often assembled at the end of the production process. The cork and plastics cannot be used right away, but need pre-production before they can serve as input materials for the final assembly of the insole. Traditionally, purchase of an orthopedic insole requires frequent contact between the client and an orthopedist, and resultantly the insole manufacturer.

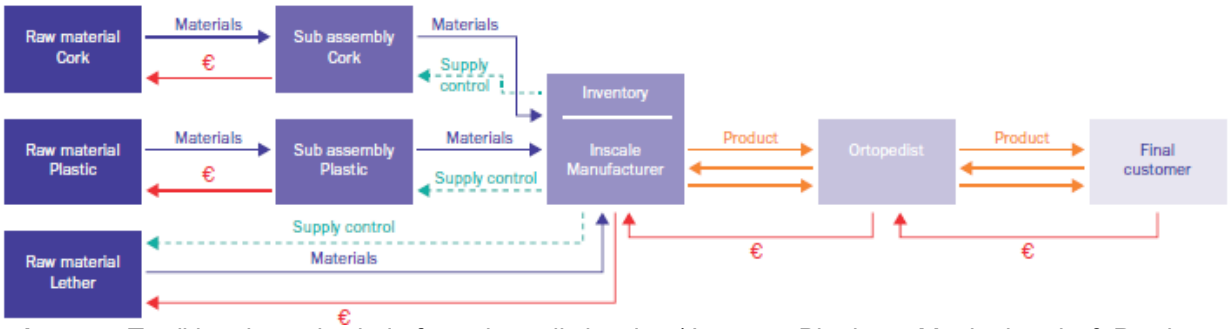

Figure 4: Traditional supply chain for orthopedic insoles (Janssen, Blankers, Moolenburgh, & Posthumus, 2014)

The orthopedist takes a foam print or plaster cast from the client's foot and determines which physical adjustment the client needs. Then he sends the scan, along with his notes, to the insole manufacturer. The insole manufacturer receives the customer's foam scan from the orthopedist, interprets the orthopedist's notes and it fabricates the sole using CNC manufacturing technology. After the sole is finished, it is sent to the orthopedist who will perform the final fitting with the customer. Most clients, however, are not satisfied with the product the first time around and usually adjustments to the insole are needed. The insole is send back and forth from manufacturer to orthopedist to optimize the fitting, and the customer has to visit the orthopedist every time for fitting. The total process easily takes up four to six weeks and costs of the final product are around €200.

The 3-D printed orthopedic insole supply chain – Three-dimensional printing technology offers significant advantages for biomedical devices due to its ability to manufacture low-volume or one-of-a-kind parts on-demand based on patient-specific needs, at no additional costs for various designs. (Bandyopadhyay, Bose, & Das, 2015) Orthopedic insoles can also be manufactured using 3-D printing technology. When insoles are fabricated by means of 3-D printing, the supply chain changes significantly as fewer types of materials are used and production quality increases. The orthopedist, again, takes a foam print from the client's foot, adds the required adjustments to the model. However, the orthopedist can also take a direct 3-D scan from the client's foot, digitally add the required adjustments and send the digital model to the 3-D printing manufacturer. The manufacturer produces the insole straight from the design. This time around, there's less room for human induced error. The strict integration between 3-D scan and 3-D print ensures that a single moment of contact between client and orthopedist should be enough for a correct fitting. The client can even decide to collect the insole at the production location, or to have the final product sent to his home address, omitting the fitting process at the orthopedist at all.

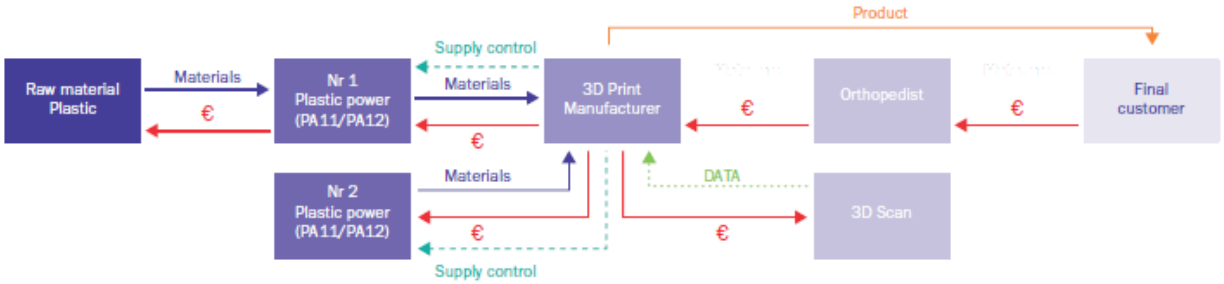

Figure 5: 3-D printed orthopedic insoles (Janssen et al., 2014)

There are several implications in terms of the impact of 3-D printing on supply chain management. For starters, the number of materials used in the insole is reduced. Instead of cork, a nylon powder (polyamides PA11 and/or PA12) is used. The polyamides have the advantages that the materials are widely available, reducing sourcing challenges and dependence on suppliers. At the same time, insoles can become thinner but stronger using these materials. Also, customization can move beyond the level of customization offered by traditional methods. For instance, color and finishing of the insole can be determined by client, as he or she might want bright colored insoles with his or her initials carved into the basis. When using 3-D printing, the cost for one pair of insoles can be competitive with traditional methods, or be even cheaper. And 3-D allows for a much shorter total lead-time, thanks to the "First Time Right" 3-D printing process. Also there is a potential for an innovative channel in which a client can make the 3-D scan herself, using an iPad and an app, using a process called photogrammetry. The insole is printed at a 3-D printing supplier of the company providing the service (one example is a start-up named Sols, webpage: www.sols.co) and directly shipped off to the client for approximately $ 100.

7. USAGE OF 3-D PRINTING IN SERBIA

There are only few players that engage into this industry, and they do not present direct competition to each other, because each of them manages different area in the field.
A small number of companies in Serbia found a sustainable business model in this field. Models that are used are the following:

1. Printing service - on demand printing
2. Design service - modeling and prepress
3. Protopyping service – design, prepress and printing
4. Distributor/vendor of 3D printer

"3D Impulse" Laboratory is a scientific research unit of the Faculty of Mechanical and Civil Engineering in Kraljevo founded in 2013, which contemplates the employment of digital technologies to develop new products. "3D Impulse" Laboratory collaborates with companies through small projects which help continuous development of new and improvement of existing products. The laboratory is a center that provides a common education, consulting and development services to companies that individually would not be able to afford the use of modern technical achievements. The Laboratory is the only center in region that engages with this kind of deployment. It owns modern and high-priced equipment which uses SLS technology for rapid prototyping, rapid tooling and rapid manufacturing. Aside from these, the Laboratory offers other services, such as digitalization of 3D objects, quality control, education, product development and product mentoring. The technology grants the usage of wide variety of materials: metal (margin steel, stainless steel, aluminum, titanium), plastic (polyamide-nylon 12), composites (polyamide filled with glass particles, polyamide filled with aluminum particles, polyamide filled with carbon particles). "3D Impulse"

collaborates both with companies and entrepreneurs, and has cooperated with many domestic firms, but with the ones in Great Britain and Italy, as well. Their customers are individuals and companies who are usually export-oriented and seek for new approach in product manufacturing, through the cost and time saving method. It is projected that 500 entrepreneurs a year upgrade their knowledge, reduce costs and stay competitive on the market, and 400 models and prototypes (for new and improved products) are to be produced. The results of the "Impuls" project in the first year are remarkable: 316 companies went through the assessment of creativity process, 100 companies gained the product analysis, 300 models and 120 prototypes were produced, 50 companies benefited from mentoring and 180 individuals went through training process. Further, the income in those companies raised by 58,7% and 105 new openings were made, which led to employment increase by 3,76%. In addition, production cycle for specific companies reduced by 40%. (http://www.3dimpuls.com/, 2016)

Voxellab is a company that is focused on 3D printing, 3D scanning, 3D modeling and software development. It is an example of prototyping service although it offers high precision models with high resolution with Polyjet technology which currently represents the highest quality and most accurate 3D printing technology in the world market. 3D models made with this technology are characterized by extremely high quality surface and solid mechanical properties suitable for product visualization, functional testing and end use. (http://voxellab.rs/, 2016)

3Dcaddit is a distributor of equipment and devices for 3D printing and covers wide variety of technologies and products. They often do on demand printing with the companies that have bought equipment from them, such as **3D svet**. Along with aforementioned active companies there are also many smaller companies and individuals that offer products and services made on amateur and semi-professional 3D printers. There are also numerous non-profit organizations, such as faculties and other educational organizations, that are equipped with some 3D technology devices, but they are often not available to the public.

Polyhedra is a registered “fab lab” (fabrication laboratory), a workshop equipped with 3D printers and other technologies for digital fabrication. They are trying to bring technology closer to entrepreneurs or any other individual who wants to make a product from an idea in an non-commercial way. While “fab labs” have yet to compete with mass production and its associated economies of scale in fabricating widely distributed products, they have already shown the potential to empower individuals to create smart devices for themselves. These devices can be tailored to local or personal needs in ways that are not practical or economical using mass production. (http://www.polyhedra.co/, 2016)

Along with other numerous projects, Polyhedra has started six projects regarding usage of 3D printing technology in biomedicine. Regarding the topic of the paper, only one of the projects will be elaborated and that is the one that considers usage in prosthetics. They are assembling an artificial hand, made of plastics for a specific individual who has lost his hand. The process of making such hand consists of several phases. First, they developed a static hand, followed with added mechanism with levers and strings. Then they integrated specific technology for controlling contractions of the muscle. Last phase will be completely mechanized system which allows a person to move the fingers of the prosthetics by himself. Needless to say that the price of such hand will be multiple times lower in comparison with artificial prosthetics made so far without 3D printer.

8. CONCLUSION

It is beyond any doubt that 3D printing is a technology that will have a massive impact on how many companies are dealing with their challenges globally. Additive manufacturing has been developing over the past couple of decades to that extent that the pioneers have already established themselves on the different markets. Not only specialized centers for providing different services of 3D printing, but also large corporations, such as car manufacturers, are proof that the potential of this technology has been recognized. Its impact is already considerable, but all implications are that it will have an even stronger influence, shifting its position from a potential industry changer to a regular tool of everyday business, especially after further developing its characteristics.

Benefits of the supply chain using the technology are numerous. Reduced transport and logistics costs, reduced inventory levels, less scrap materials, fewer stages of production and, consequently, fewer supplier and intermediaries in the process are just some of the reasons on the cost side that justify the usage of 3D printing. A massive argument for using it is also the possibility of endless customization at a minor cost.

Given the complexity of the products needed, it is no wonder that the medical industry has also become a significant user of additive manufacturing technology. Different apparatus needed are ideal candidates for

exploiting the potential of 3D printers. The fact that every patient is different puts additional value on 3D printing customization abilities. There are several research centers and companies in Serbia that are offering high-value products and services using additive manufacturing. There is no doubt that impact is going to be even bigger as the technology continues to evolve.

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SUPPORTING DEVELOPMENT OF TECHNOLOGICAL STARTUPS THROUGH MENTORING

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Abstract: *In the last few years, the field of technological entrepreneurship has been the main subject of interest for many researchers who have showed the awareness of the significance of the development of entrepreneurship and small and medium enterprises (SMEs), for job creation, new possible workplaces, as well as creating a better environment for a society. Technological startups are mostly being created in environment in which there are preconditions for their successful development. One of the preconditions of its development is organizations and individuals who through different forms of mentoring programs and education increase the chance for startups to become profitable companies. In this paper, with overview of contemporary literature within this field of technological startups mentoring as a means of support is analyzed during the process of development of technological startups. Also, key benefits of mentoring as a form of education during the development of technological startups will be explained.*

Keywords*: technological entrepreneurship, technological startups, mentoring*

1. INTRODUCTION

According to Petti and Zhang (2011), technology could be used for creating values only in the case when being implemented in new products, when those products find their market and when they are able to generate additional profit to companies, profit for the investors, acknowledgment for developers and benefits for society. These authors see scientific accomplishments, inventions and technological development as a base ground for creating values and competitiveness, but they emphasize that finding new technological market opportunities and their commercial exploitations as main reasons for creating competitive advantage on the market. According to these authors, technological entrepreneurship represents transformation of technology into value.

According to Petti (2009) technological entrepreneurship contains three main components:

1. entrepreneurial component – a set of activities which are implemented by individuals and companies in order to identify and use specific potential of new technologies and market opportunities,
2. management component – a set of activities done by individuals and companies in order to develop appropriate value offers which enables fast market entry, with business model which has been tested and with which identified market opportunities are being used,
3. environment component – a number of formal and informal organizations for support and resources which enable adequate conditions for development of technological new ventures (state policy, law and regulations, industrial standards, public and private organizations which support entrepreneurship development, culture, community and inter organizational connection).

In this paper the concept of environment of technological startup in a form of support during the development of technological startups will be further elaborated.

1.1. Technological startup

At the beginning of every new venture there is initial stage which is called startup stage (Crowne, 2002), and main characteristics are high dynamics and orientation towards the future. Taking into consideration new venture at this stage of development, as well as the fact that simplified terms are being used now days, “startup” and “new ventures” are going to be referred to as synonyms.

Blank and Dorf (2012) define “startup” as a temporary organization created in order to discover a sustainable business model with a high potential for growth. Duening (2015) had additionally explained Blank’s startup definition, stating that “repeatable” actually means that organization seeks for model which will consistently create and deliver value to customers, where “scalable: means ability of a business model to be created in accordance to customer base growth.

Kariv (2013) explains the term of technological startup as a specific form of entrepreneurship. According to this author, technological startups are new ventures in an early operating stage, which are created in the fields of innovations and newest technologies, and are characterized by high dynamics, orientation for growth, profit and creating new market values. Technological startups are usually created in environment in which there are preconditions for their successful development.

2. ENVIRONMENT FOR DEVELOPMENT OF TECHNOLOGICAL STARTUP

A number of connected institutions which have a common goal to support entrepreneurs throughout all stages of development of new ventures are called entrepreneurial ecosystem (Isenberg 2010). According to this author, entrepreneurial ecosystem can be defined as a network of services with entrepreneur in focus, towards which all of the activities are aimed at and who represents the measure of success of its existence. Mason and Brown (2014) define entrepreneurial ecosystem as number of mutually connected members (existing or potential), entrepreneurial organizations (for example: investment funds, angel investors and others), institutions (universities, public agencies, and financial organizations) and various entrepreneurial processes, which are formally or informally connected, mediating and managing performances of local entrepreneurial environment. Feld (2013) calls entrepreneurial ecosystem – "entrepreneurial community." According to this author, aside from ineffective clusters created by government institutions, entrepreneurial community is formed via informal way and with "bottom – up" approach. Also, entrepreneurial community is led by entrepreneurs, and its creation is based upon mutual networking among individuals and informal activities of entrepreneurs.

Neck with associates (2004) defines basic components of entrepreneurial ecosystem. These include formal and informal networks among entrepreneurs, universities, state and local government, professional consultants, owners of investment capital and talented candidates. Conceptual framework of entrepreneurial ecosystem was defined by Suresh and Ramraj (2012), which represents eight factors of support for entrepreneurs. According to these authors, the support for an entrepreneur can be: moral, financial, technological, market support, social, networking support, government support, as well as environmental support.

Components of startup ecosystem have individuals in center, who based upon their own ideas and inventions create their own innovative startups. Their environment consists of: support component (incubators, mentors, and companies for specialized services), market component (initial buyers/users and big companies), human resources component (individuals with knowledge and skill, and educational institutions), financial component (financial capital, angel investors, accelerators, investment funds, and others), cultural component (events, social norms and experiences), and political component (local and state government). One more term is very specific for this ecosystem, and it is common in new startup scene, and that is "startup community", which Feld (2012) explains in his work.

In this paper, mentoring as a very important support component, as well as the role of mentoring in different forms of support for technological startups will be elaborated.

3. SUPPORT IN DEVELOPMENT OF TECHNOLOGICAL STARTUPS

In the process of development of technological startups, different stakeholders can be identified. Type of stakeholders , depend on in which stage startup is in, and they can influence or be influenced by during the process of its development (Freeman, 2010).

Birdsall (2013) emphasizes as important in the process of development of technological startups the following stakeholders: the founders, angel investors, investment funds, corporate partners, mentors, business incubators, and alumni. Suresh and Ramaj (2012) give a conceptual framework of entrepreneurial ecosystem which they represented through eight types of support for entrepreneurs (table 1).

Table1.Types of support for entrepreneurs (Suresh &Ramaj, 2012)

Type of support	Participants and support form
Moral support	Family, relatives, spouses, friends and community.
Financial support	Closest family, banks, investment funds, friends, relatives, educational institutions, individual investors – business angels, accelerators, small market capital investors, foreign financial institutions, government bodies, and suppliers - creditors,
Technological support	Business incubators and accelerators, technical and technological educational institutions, talented candidates

Market support	Market opportunities, government reports and economy associations, fairs, and others,
Social support	Professional associations prizes, media, social acknowledgment as well and acceptance of entrepreneurial failure,
Networking support	National association of entrepreneurs, alumni associations, social networking websites, supplier and vendor networks,
Government support	Entrepreneur clusters, state educational centers, state incentive and rewards institutions, regulatory state institutions
Environmental support	Availability of natural resources and climate conditions

Startups usually find support for development of ideas within organizations/individuals that support development of entrepreneurship: business incubators, business accelerators, and business angels. Due to their significance for the success of technological startups, these three types of support will be further elaborated in more detail from the perspective of mentoring. Mentors within these types of support for technological startups can be successful entrepreneurs, people who have gone through mentorship programs themselves, big investors, business angels, or experts from various companies.

4. THE ROLE OF MENTORING AS A SUPPORT FOR DEVELOPMENT OF TECHNOLOGICAL STARTUPS

4.1. Mentoring

Garvey et al. (2009) described mentoring as a relationship where more mature and experienced person is engaging in a relationship with a younger and less experienced person in order to assist learner to integrate as a fully functioning person within the society they integrate, which is called the core mentoring model. Now days, a mentor could be a peer also, with the main purpose of the relationship which is transferring knowledge and skills. Beevers and Rea (2010) emphasized that *mentoring is about two people coming together with a view to helping one of them progress more easily through work, life or whatever context the mentoring is taking place in.* Also, mentoring is seen as a long standing form of training, learning and development and an increasingly popular tool for supporting personal development (CIPD,2009).

Beevers and Rea (2010) identify different models of mentoring: 1. group mentoring, 2. group peer mentoring, 3. online mentoring, 4. one-to-one mentoring, 5. one-to-one peer mentoring and 6. line manager mentoring. The most used model within technological startups is group mentoring and one-to-one mentoring.

Mentoring activity could be found in all sectors of society. Mentoring could be voluntary or paid activity but in most cases mentoring is associated with voluntarism (Garvey et al, 2009). As it is showed in CIPD Annual Survey Report about Learning and Development (2015) mentoring and budding schemes are in the top 3 most used talent management activities, and that ¾ of organizations use some kind of coaching or mentoring activities which is increasing every year. Therefore it is important to emphasize that there are various purposes of mentoring and that they could be (Beevers and Rea,2010) to provide role models so that mentees could look up to them, provision of a sounding board (a person with whom a mentee is going to able to discuss ideas, concerns or problems), provision of a advice from some who had had experience and who has been in similar situations, enablement of work-related development, provision of an advocate who could help support, represent and champion mentee when that is needed. Also a mentee could use the provision of contacts and access to opportunities, as well as having someone who will prepare a mentee to be adept while managing relationship and achieving their goals.

The authors state that in reality there is a very small chance that a mentoring relationship is restricted to just one of these activities, but that real benefit of mentoring is that mentors and mentees will work together in different ways to suit their concrete needs at any time.

To the question of who can benefit most from mentoring relationship, answer is presented by Noe (2010) who claims that both mentors and mentees can benefit. Mentees benefits are presented as career and psychosocial support provided by mentors. In most of the cases career support is seen through coaching, protection, sponsorship, providing challenging assignments, exposure, and visibility and psychosocial support includes serving as a friend and a role model, providing positive consideration and acceptance, and providing an means for the mentee to talk about anxieties and fears. Mentoring relationships provide opportunities for mentors as well such as to develop their interpersonal skills and increase their feelings of self-esteem and worth to the organization and society.
Additional benefits for mentees are connected to the learning activities as a result of a mentorship process which can result with gaining knowledge and developing skills. If we look at these learning activities it could

be stated that most of the learning is happening trough role modeling and observation as elements of social learning theory, meaning that in a mentoring context, mentees learn by observing the mentor (Jones, 2013) In order to implement successful mentorship programs first important issue is that mentors should be chosen based on interpersonal and technical skills, and second is that they need to be trained (Noe, 2010,page 373).

Looking at the specifics within mentoring entrepreneurs it could be stated that there is lot of benefits as well as power in it. This is the process in which successful entrepreneurs and business people act as mentors and advisors for entrepreneurship. As a good and helpful mentorship programs are considered programs in which the mentors provide guidance and support to entrepreneurs. Mentoring in an entrepreneurial context may encompass direct forms of help, more parallel to advising or even consulting, which could be argued as a broader than mentoring in other environments (Gimmon,2014).

Rigg and O'Dwyer (2012) have found that mentors could be recognized as significant for developing entrepreneurs and those could be understood as a source of knowledge transfer or as individuals who help aspiring entrepreneurs to reflect and construct knowledge. The mentoring network for a technological startup program could be viewed as a community of practice that provides orientation for entrepreneurs in order to stimulate their learning of how to survive, their acquisition of status and identity, not only their development of practical skills. The mentoring network is also open access to the social capital that is of such importance to the success of a new venture, being admitted into a community of entrepreneurs who recognize and acknowledge each other for their risk taking, nous, wits, achievements and bruises (Rigg and O'Dwyer, 2012).

4.2.Role of mentoring within different types of technological startups support

Organizations and individuals who support the development of technological startups have a significant role in entrepreneurial ecosystem offering services and help in development of their business, help with defining and creating initial products, identifying attractive market segments, providing capital and human resources – mentors and others. Further in the paper the following types of support will be explained in more detail: business incubators, business accelerators, and business angels, within which mentoring representationwill be observed.

Business incubators are organizations which support entrepreneurial ventures in process of development offering help with development of their business (Grimaldi & Grandi 2005). Fominiene (2010) defines process of business incubation as "business incubation is the innovative, heterogeneous (multiple) and able to transform the business development of SMB's process, during which the support is provided for newly formed and start-up SMB companies thus contributing towards establishment of new, independent and successfully operating in the market companies". Incubators contribute to the process of strengthening new companies before they become independent (Cohen 2013).

Cohen (2013) defines business accelerators as organizations which contribute new ventures with defining and building initial products, identifying attractive market segments, providing capital and human resources. They establish this through time-limited support program, and they usually last around three months. Program include initial investment, working space, networking, education and training by mentors who can be successful entrepreneurs, the ones who have been through the mentorship program, big investors, business angels or experts from various companies. The program usually ends with a demonstration day, where new ventures are presented to bigger audience or investors.

Business accelerators help build a good team of new venture, defining ideas and mentoring the development of a venture from idea, through prototype, and finally to the final product development (Hoffman & Radojevich-Kelley, 2012). These authors emphasize that mentorship program within business accelerators contribute to higher success because they provide contact with individual and big investors and conclude the following:

- Team motivation in business accelerators differentiate from team motivation within teams who develop themselves with different type of support.
- Ventures that have finished program within the accelerator have higher rate of success (the duration of business and investments) in comparison to those who have not.
- Accelerator use different criteria when selecting new ventures and analyzing ideas, in comparison to groups of programs for supporting development of ideas.
- Founders of accelerators and new ventures face the same obstacles and challenges.
- The additional value of accelerating program is that it provides mentoring and networking.

Huijgevoort (2012) in his research stated that number and quality of mentors engaged in development of new ventures also affects the value creation in accelerator. Quality of mentors is reflected in his expertise and previous entrepreneurial experience, which significantly contributes to value creation during the program, but in connection to other relevant stakeholders which mentor has. Also, this author states that it is important that each startup gets assigned with adequate mentor.

Miller and Bound (2011) also claim that accelerators have higher impact on success of new ventures in comparison to incubators because of implemented mentorship program amongst other things. Mentorship program consists of creating environment that will contribute to better development of a startup. That includes participation in lectures held by experts, after which individual meetings with the teams are being organized. The overall goal of these meetings is giving feedback about the new venture, but also creating a long-term relationship with mentors and experts which later on could be potential investors. On the other hand, accelerators organize different types of events, for example: legal aspect of entrepreneurship, tax policy, presentation skills, etc.

Another important stakeholder group is individual investors or "business angels". Either as individuals or as a group they give the initial seed to companies in making, and to their new ventures, but at the same time they give business advice (Cohen, 20130). A high number of those oriented to technological entrepreneurship have tendency to invest their own funds in new ventures with high risks, from whom a huge return on investment is expected (Aram, 1989). Freear (1994) states that they are part of informal capital market, and usually they are not that accessible to entrepreneurs. The same author describes them as people who are well educated, middle aged with a significant business experience and have had significant effect on the market.Business angles who have invested in startups mentor only when in need without defined development program as oppose to accelerators. Therefore their role is considered limited.

In her paper Cohen (2013) makes a difference between accelerators, incubators and business angels based on: the duration of development of new venture, characteristics of internal community, characteristics of a business model, the selection process and mentoring program, education and networking with other stakeholders. The similarities and differences between incubators, accelerators and business angels are represented in table 2.

Table2.The similarities and differences between incubators, accelerators and business angels(Cohen, 2013)

	Accelerators	**Incubators**	**Business angels**
Process length	3 months	1-5 years	Permanent
The joint team work	Yes	No	No
Business model	Investment	Rent	Investment
Selection process	Competitive, cyclic	No competition	Competitive, permanent
Stages of development	Early	Early or late	Early
Education	Seminars	Add hoc	None
Location	Usually at location	At location	Without permanent location
Mentoring	Intense	Minimal	Optionally

We can conclude that mentoring and education are mainly used within business accelerators, so in the following chapters a role and significance of mentoring in these organizations will be furthermore explained.

4.3. Mentoring in business accelerators

In his thesis Barrehag (2012) highlights three important components of stakeholder's network within accelerators: startup, mentors, and investors. Each one of the stakeholders has their own specific participation and benefits from realization of accelerator program. The impact model of these three stakeholders is represented in figure 1. Similar to this author, Birdsall (2013) states that the most important participants within the accelerators' programs of development are: founders of new venture, business angels, investment funds, corporate partners, mentors, incubators and alumni.

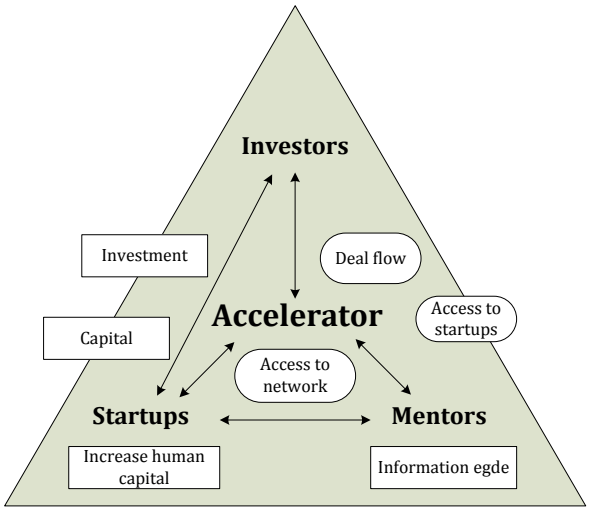

Figure 1.The conceptual model of the network of stakeholders in the business accelerators (Barrehag, 2012)

According to this same author, with a relationship with mentors, a startup has more chance to become profitable company. In this respect, education is highlighted as a key activity for many entrepreneurs which is not provided outside of participation in the accelerator. Based on the research that Birdsall (2013) conducted, the most important benefit for entrepreneurs is reputation their new venture gains after realization of a program within accelerator. When choosing accelerator program, entrepreneurs find as most important factors: quality of mentors, brand and reputation of the program and possibility for networking.

Stakeholders who contribute the most to increasing the value of new ventures are mentors, who are engaged in the program of an accelerator and who through the mentoring develop human resources of new venture (Huijgevoort, 2012). Also, mentors are one of the key factors of attractiveness of an accelerator. However, reason and motivation behind mentors' participation does not always have to be financial benefit, through part time or full time engagement, but it can also be of altruistic nature. Mentors are often very ambitiously oriented towards creating entrepreneurial community in their environment, and with participation in program within accelerators mentors remain in touch with the latest entrepreneurial ventures that develop.

5. CONCLUSION

In order to adequately explain the essence of this paper the role of mentoring in the development of technology startups is elaborated. Within the paper, technological entrepreneurship was firstly discussed and then the environment and its significant impact on the development of technological startups. The environment can provide various forms of support. In this paper support from the organization is emphasized (business incubators and accelerators) as well as support from individuals (business angels) as important elements within developed entrepreneurial ecosystem. Considering these forms of support, the role of mentoring is particularly analyzed and it was found that training and mentoring is mostly present in the business accelerators. It is shown that the key benefits from mentoring for mentees are career and psychosocial support. As Rigg and O'Dwyer (2012) have stated, mentoring in an entrepreneurial context includes direct forms of help, more parallel to advising or even consulting, which are explained as a broader than mentoring in other environments. Mentoring should provide orientation for entrepreneurs in order to stimulate their learning from how to survive their acquisition of status and identity, to as well as their development of practical skills.

Challenges for further research based on the analysis in this paper could be imposed through following question: Did the mentors have any training for the mentoring role, in other words are they lacking mentoring skills? Also, it is necessary to investigate the structure and performance of the mentoring programs, especially taking into account that during the incubation period a change of mentors happens often because most of them are not able to continuously work on the development of startups over a long period of time. Special direction for future research is proposed as structuring of performance indicators of mentoring engagement and mentoring programs in order to enable evaluation of the their contribution in technological startups development.

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EVALUATION AND SELECTION OF TECHNOLOGY STRATEGIES USING QUANTITATIVE STRATEGIC PLANNING MATRIX

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Abstract: *In this paper we present the application of the Quantitative Strategic Planning Matrix (QSPM) in order to effectively prioritize strategic goals and business strategies. Evaluation and selection of the technology strategies using the QSPM analytical tool was conducted in Comtrade Group, a multinational corporation committed to excellence in all its operations. The management, actively involved into optimizing and improving its operations and processes, seeks to push the limits, gain competitive advantage and set industry standards in engineering and information technology. The QSPM analysis was therefore performed, to raise the quality, efficiency and strategic planning capacities and meet the ever growing expectations of prime quality. By conducting an external and internal analysis, SWOT, TOWS and QSPM, the company succeeded into determining and prioritizing strategies, derived from the carefully selected metrics, industry and data insights. It was found that by focusing on its core competences and taking advantage of the extensive knowledge of its employees and company's experience in a wide array of industries, the organization will be able to thrive, strengthen its position as regional leader in IT and successfully expand into new markets.*

Keywords*: Comtrade Group, technology strategy, Quantitative Strategic Planning Matrix (QSPM), SWOT, TOWS, technology evaluation and selection*

1. INTRODUCTION

A company's success in the market and its ability to be driven by innovation largely depend on strategies that are carefully designed and developed (Schilling, 2013). Technology and strategy represent two very complex schools of thought and the interface between the two areas becomes a concern when technology significantly affects performance (Burgelman & Wheelwright, 2004). Technology strategy is one of the functional strategies of a corporation. Formulating a technology strategy will enable a company to assess its current position and determine its future orientation by taking advantage and focusing on its core competences (Schilling, 2013). It defines activities concerning generating, assessment and selection of technology. In formulating and implementing the technology strategy managers have to pay attention to different internal and external factors. Technology strategy includes the objectives, strategies and tactics related to development and application of technologies within an organization. (Floyd, & Wolf, 2010)

Evaluation and selection of a technology strategy is not infrequently a complex undertaking, involving significant uncertainty, risk and need for a strategic mindset (Tan et al., 2011). There is a variety of methods which can be used to evaluate and select a strategy, including economic and mathematical models, peer review, interactive methodologies, optimization of portfolio and machine learning and artificial intelligence systems (Tan et al., 2011; Henriksen & Traynor,1999). Nonetheless, many of the mentioned methods are too complex or require considerable time to be implemented Choosing the most optimal methodology is critical not only to be able to quickly respond to the fast changing environment but to also create flexibility and set future orientation for the company (Schilling. 2013).

Large organizations as well as smaller firms need to assess their position in the market, strive to gain competitive advantage and reach their strategic goals by focusing on their core competences and values. Not infrequently, it is easy to loose direction and risk pursuing ineffective and inefficient business strategies, failing to maximize profits and augment company's value. In order to effectively prioritize the different business goals and strategies an organization should use in order to achieve its mission, the Quantitative Strategic Planning Matrix (QSPM) can become an effective analytical tool to clearly set priorities and identify the most critical objectives that need to be addressed first (David et al., 2009; David, 1986; Nasab & Milani, 2012). In particular, businesses in the most diverse industries can thrive when using the QSPM for the

purposes of strategic planning and management. Evaluation and selection of the technology strategies has been used in the case of Comtrade Group, a multinational corporation committed to excellence in all its operations. Each year, the company sets standards higher and higher, in particular when it comes to the speed, quality and uniqueness of its products and services. The management is actively involved into optimizing and improving its operations and processes. It seeks to push the limits, gain competitive advantage and set industry standards in engineering and information technology. As a result, the QSPM analysis was performed, to raise the quality, efficiency and strategic planning capacities and meet the ever growing expectations of prime quality. By first conducting an external and internal analysis (PESTLE, Porter's five forces, stakeholder analysis, BCG matrix), SWOT, TOWS and QSPM, the company succeeded into determining and prioritizing a variety of strategies, derived from the carefully selected metrics, industry and data insights. It was found that the company should focus on “bring new technology into the market by using excellent employee knowledge and expertise in a variety of industries”. By focusing on its core competences and taking advantage of the extensive knowledge of its employees and company's experience in a wide array of industries, the company will be able to thrive, strengthen its position as regional leader in IT and successfully expand into new markets.

2. COMPANY OVERVIEW

Comtrade Group, leading information technology organization in Southeast Europe, was founded in 1990 and is specialized in "the fields of software solutions, system integration, and hardware distribution" (Comtrade, 2015). Comprised of twenty-two companies that operate in eleven countries across Europe and North America, Comtrade has a well-established reputation as a reliable partner to both small and large enterprises. Innovative information technology solutions and services have contributed to a comprehensive and diverse portfolio with more than nine hundred satisfied clients in the public sector, government agencies, healthcare, telecommunications, automotive, finance, travel, logistics, gaming, and hospitality industries. The company is considered "pioneer in the area of near shoring and external R&D services and is a trusted developer of end-to-end technology product solutions in various industries" (Comtrade, 2015). Comtrade has several business concentrations: software solutions engineering, system integration, distribution and media. The solutions engineering is oriented toward clients worldwide and provides software and IT solutions, while the system integration works closely with Governments, their agencies, ministries, as well as with local enterprises and private companies. The media comprises of operations oriented toward the digital, Internet based content and channels, while the distribution business involves significant and major partners locally and worldwide (more than fifty IT and consumer electronics vendors), and it effectively covers the entire process: from import to distribution, in addition to logistics, service and support, focusing on efficient stock optimization and improvement of inventory rates. Comtrade an invaluable and large customer base for its distribution business: Retail, Telco, System Integrators, Value added and Internet-based re-sellers, as well as PC assemblers. Main product categories include consumer electronics, mobile phones, and information technology. The organization's vision is to become world leader in delivering high value end-to-end technology solutions, products and services while reducing business complexity with technology solutions for storage, enterprise application management and gaming technology. As Comtrade strives to achieve its mission, it is focusing on creating a culture of innovation that is focused on valuing knowledge, professionalism, passion for high quality work, accountability, entrepreneurship and reciprocal trust and respect.

3. METHODOLOGY

Starting from the organization's vision, mission and strategic goals, the external and internal analyses were performed. Trough careful review of historical data, documentation, interviews, and personal experience, the SWOT, TOWS and QSPM analyses were completed. In the external analysis particular focus was on the PESTLE and Porter's Five Forces, establishment of the major opportunities and threats for the company, while on the internal the focus was on Comtrade's strengths and weaknesses. Stakeholder analysis and BCG Matrix were completed in the process but are not included in the paper. Using SWOT and TOWS as inputs, we have developed the Quantitative Strategic Planning Matrix. As David et al. (2009), David (1986), Nasab and Milani (2012) highlighted the QSPM as an extraordinary instrument in the decision making process and choice among different strategies in addition to assisting managers understanding the internal and external environments that will help them make the most optimal and appropriate decisions regarding strategy and direction. By collaborated with industry professionals and obtaining insight from the Comtrade Group's management team we have determined the external and internal factor evaluation matrix, assigned weights and ratings in order to set priorities for the strategic planning and decision making processes.

4. EXTERNAL FACTORS EVALUATION

In order to strategically assess the firms position in the market and the external environment in general, PESTLE analysis (analyzing the political, economic, social, technological, legal and environmental factors) and Porter's five forces (where threat of new entrants, bargaining power of buyers, bargaining power of suppliers, threat of substitute products and services as well as the intensity of rivalry among the competitors in the industry were considered) were performed. Due to the extensive evaluation and findings, the analyses are not included in the paper. Nonetheless, the External Factor Evaluation matrix (Table 1.) reflects some of the major findings. The External Factor Evaluation matrix (abbreviated EFE) is valuable as it provides critical strategic business information to management regarding the company's standing in addition to enabling the prioritization, through rating, of the various opportunities and threat the company is facing. Factors listed in Table 1. were assigned weights and ratings. The weights, values ranging from zero to one, zero representing the low level of importance and one indicating a critical factor. Summed up, they should all add up to one. Ratings on the other hand indicate the degree to which the company is responding to the factors (similarly to weights, a lower value shows a poor response, while four, the highest possible value that can be assigned, an effective and efficient response). It is important to note that weights are considered at the industry level while the ratings at a national level.

As shown in Table 1, the customer need for new technologies adapted to the Serbian market is one of the most important opportunity factors for the company, in addition to the possibility of expanding to new markets. Comtrade has offices and development centers worldwide and is continuously seeking to adapt its offerings and services to meet the ever-growing need and demand. Increase of market share in the international market is one of the goals of the company. As resources become scarcer it is vital to support sustainable development and invest in alternate sources of power. Comtrade is committed to reducing negative environmental impact of their activities and to continuously improve their environmental performance as an essential and core part of their business strategy and operating methods. Therefore, the possibility of creating and using the possibilities of energy substitutes is critical.

Table 1: External Factors Evaluation Matrix for Comtrade Group

External Factors	Weight	Rating	Score
Opportunities:			
Customer need for new technologies adapted to Serbian market	0.11	4	0.44
Greater foreign investments in R&D of technology	0.01	2	0.02
Better law regulations for partnerships with foreign companies	0.05	3	0.15
Expansion to new markets	0.10	3	0.30
Increased market share in international market	0.08	2	0.16
Possibilities of energy substitutes	0.06	3	0.18
Entering new technology in market	0.05	3	0.15
Development of new technology (patents) by the company	0.06	3	0.18
Increased reputation and customer satisfaction from company's services and products	0.05	4	0.20
Collaborating opportunities with emerging start-ups and already established companies	0.04	2	0.08
Threats:			
High competition in IT industry	0.10	3	0.30
Rapidly changing trends	0.03	4	0.12
New regulations and laws	0.05	3	0.15
Established competitors	0.02	3	0.06
Different customer needs and trends in countries of operation	0.04	3	0.12
Changes in government policies and official stance toward foreign, partner, countries	0.03	3	0.09
Unexpected entry of large and more powerful competitor into the local market	0.05	2	0.10
Increased cost of being in business due to government environmental rules and regulations	0.02	3	0.06
Increased cost of labor and raw materials	0.05	3	0.15
Total	**1**	**-**	**3.01**

The company should seek to enter new technologies in market and develop an increasing number of patents and technologies. According to the data from the Intellectual Property Office of the Republic of Serbia (2013, 2015), only few patents from corporations and other business entities are being submitted each year, far less than private persons, creating a significant opportunity for the company. Comtrade has been increasing its reputation and customer satisfaction thanks to quality products and services. By collaborating with emerging start-ups and already established companies it can take advantage of newly created opportunities and be able to quickly adapt to changing market tastes, environment and competition. On the other hand, the high competition in the IT industry can be a significant threat along with the increasing costs of labor and raw materials, and changes in government policies and official stance toward foreign, partner, countries. Rapidly changing trends may become an issue, just like new laws and regulations, presence of established competitors, change in customer needs and trends in countries of operation. Unexpected entry of a large and more powerful competitor into the local market can also become a threat in addition to increased cost of being in business due to government environmental rules and regulations.

5. INTERNAL FACTORS EVALUATION

Following the external analysis, an internal evaluation of company's strengths and weaknesses was conducted. As can be observed in Table 2., after the assignment of weights and ratings to the individual factors, it was found that the factors that were deemed most influential were the company's proactive approach to innovation at local and global levels, its expertise in a variety of industries, certifications (ISO standards, employee certifications) and the excellent reputation among customers, in addition to one of the main weaknesses being the high fluctuation of engineering staff.

Table 2: Internal Factors Evaluation Matrix for Comtrade Group

Internal Factors	Weight	Rating	Score
Strengths:			
Strong brand name	0.06	4	0.24
Excellent reputation among customers	0.10	4	0.40
Certifications (ISO standards, employee certifications)	0.11	4	0.44
Good technology (both hardware and software)	0.08	3	0.24
Excellent employee knowledge	0.08	3	0.24
Expertise in a variety of industries (automotive, financial, energy, high-tech, gaming, public sector, etc.)	0.09	4	0.36
Committed to reducing negative environmental impact of company’s business activities	0.02	3	0.06
Well established communication and network of customers and partners	0.05	4	0.20
Promotes innovation and is dedicated to educating younger generations (Fabrika znanja, EDIT, Girls in ICT)	0.05	3	0.15
Proactive innovation at local and global level	0.10	3	0.30
Large corporation but with a startup culture and approach when needed.	0.05	3	0.15
Weaknesses:			
High fluctuation of engineering staff	0.08	2	0.16
High R&D costs	0.03	2	0.06
Difficulties in penetrating new foreign markets	0.03	2	0.06
Complex network structure (company and employee level)	0.02	2	0.04
High frequency of ad-hoc changes on in-house projects	0.05	2	0.10
Total	**1**	**-**	**3.2**

6. SWOT & TOWS ANALYSIS

Following the external and internal analyses, SWOT and TOWS were performed to strategically assess the company's strengths, weaknesses, opportunities and threats. Table 3. features the SWOT analysis while the TOWS can be found in Table 4.

Table 3: SWOT analysis for Comtrade Group

STRENGTHS	**OPPORTUNITIES**
▪ Strong brand name ▪ Excellent reputation among customers ▪ Certifications (ISO standards, employee certifications) ▪ Good technology (both hardware and software) ▪ Excellent employee knowledge ▪ Expertise in variety of industries (automotive, financial, energy, high-tech, gaming, public sector, etc.) ▪ Committed to reducing negative environmental impact of company's business activities ▪ Well established communication and network of customers and partners ▪ Promotes innovation and is dedicated to educating younger generations (Fabrika znanja, EDIT, Girls in ICT) ▪ Proactive innovation at local and global level ▪ Large corporation but with a startup culture and approach when needed.	▪ Customer need for new technologies adapted to Serbian market ▪ Greater foreign investments in R&D of technology ▪ Better law regulations for partnerships with foreign companies ▪ Expansion to new markets ▪ Increased market share in international market ▪ Possibilities of energy substitutes ▪ Entering new technology in market ▪ Development of new technology (patents) by the company ▪ Increased reputation and customer satisfaction from company's services and products ▪ Collaborating opportunities with emerging start-ups and established companies
▪ High fluctuation of engineering staff ▪ High R&D costs ▪ Difficulties in penetrating new foreign markets ▪ Complex network structure (company and employee level) ▪ High frequency of ad-hoc changes on in-house projects	▪ High competition in IT industry ▪ Rapidly changing trends ▪ New regulations and laws ▪ Established competitors ▪ Different customer needs and trends in countries of operation ▪ Changes in government policies and official stance toward foreign, partner, countries ▪ Unexpected entry of large and more powerful competitor into the local market ▪ Increased cost of being in business due to government environmental rules and regulations ▪ Increased cost of labor and raw materials
WEAKNESSES	**THREATS**

Table 4: TOWS analysis for Comtrade Group

Internal *External*	**Strengths:** 1. Good technology (both hardware and software) 2. Excellent employee knowledge 3. Expertise in a variety of industries (automotive, financial, energy, high-tech, gaming, public sector, etc.) 4. Certifications (ISO standards, employee certifications) 5. Proactive innovation at local and global level 6. Large corporation but with a startup culture and approach when needed	**Weaknesses:** 1. High R&D costs 2. Difficulties in penetrating new foreign markets 3. High fluctuation of engineering staff 4. High frequency of ad-hoc changes on in-house projects
Opportunities: 1. Customer need for new technologies adapted to Serbian market 2. Possibilities of energy substitutes 3. Development of new technology (patents) by the company 4. Collaborating opportunities with emerging start-ups and established companies 5. Expansion to new markets	**SO:** 1. Use existing good technology and employee knowledge to develop new technologies adapted to Serbian market (S1, S2, O1) 2. Bring new technology into the market by using excellent employee knowledge and expertise in variety of industries (O3, S2, S3) 3. Use expertise in a variety of industries to satisfy customer needs and expand to new markets (S3,O1, O5) 4. Expand to new markets by proactively innovating at local and global levels (S5, O5) 5. Take advantage of the firm's startup culture and approach in order to develop new technologies (S6, O3) 6. Use expertise in a variety of industries and certifications as significant resource in collaborating with other companies (O4, S4, S3)	**WO:** 1. Increase the possibility of penetrating new foreign market by working on new technology as energy substitutes (W2, O2, O3) 2. Reduce energy use and costs with energy substitutes in order to render R&D more cost efficient (O2, W1) 3. Decrease R&D costs by adapting company's existing technology to the Serbian market (W1,O1) 4. Reduce high fluctuation of engineering staff by collaborating with emerging start-ups and established companies (W3, O4) 5. Use the development of new technology (patents) by the company to retain engineering staff (W3, O3) 6. Increase project management capabilities for in-house projects in order to more effectively penetrate new markets (W4, O5)
Threats: 1. High competition in IT industry 2. Increased cost of being in business due to new government environmental rules and regulations 3. Increased cost of labour and raw materials 4. Rapidly changing trends 5. Different customer needs and trends in countries of operation	**ST:** 1. Reduce costs of business induced by new environmental regulations by engaging excellent employee knowledge and expertise in variety of industries (T2, S2, S3) 2. Work on competitiveness in IT industry by combining company's good technology and expertise in variety of industries (T1, S1, S3) 3. Use expertise in variety of industries to readily face rapidly changing trends and meet different customer needs (T4, T5, S3) 4. Face increased cost of labour and raw materials by proactively innovating at local and global levels (T3, S5)	**WT:** 1. Look for ways to reduce R&D costs in order to beat competition (T1, W1) 2. Advance the possibility of penetrating new foreign markets by establishing partnerships with companies in countries with lower labor and/or raw material costs (W2, T3) 3. Keep up with the rapidly changing trends by structuring in-house projects in a more efficient manner (W4, T4) 4. Reduce the high fluctuation of engineering staff in order to rise competitiveness in the industry (W3, T1)

7. IMPLEMENTATION OF QSPM AND FINAL RESULTS

The results of SWOT analysis, external and internal factors with their weights are presented in the first column of the QSPM (Table 5). The information was directly derived from EFE and IFE matrix. The AS field indicates the Attractiveness Score. Attractiveness Score is obtained through the consideration of the critical success factors and asking the following question: “Do these factors affect the choice of strategy?" (Hamidi & Delebahari, 2011). Four experts from Comtrade Group were questioned, and attractiveness scores were calculated as the average value of their individual scores given in the following form: No attractiveness - 0 score, little attractiveness - 1 score, almost attractive - 2 scores, acceptable attractiveness - 3 scores and high attractiveness - 4 scores. The FAS indicates the Final Attractiveness Score, obtained by multiplying the factor weight and attractiveness score.

Table 5: Quantitative Strategic Planning Matrix (QSPM) for Comtrade Group

		SO-1		SO-2		SO-3		SO-4		SO-5		SO-6		ST-1		ST-2		ST-3		ST-4	
Factor	Weight	AS	FAS	AS	FAS	AS	FAS	AS	FAS	AS	FAS	AS	FAS	AS	FAS	AS	FAS	AS	FAS	AS	FAS
O1	0.11	4	0.44	3	0.33	4	0.44	2	0.22	2	0.22	1	0.11	-	-	3	0.33	4	0.44	-	-
O2	0.06	-	-	2	0.12	-	-	3	0.18	3	0.18	2	0.12	4	0.24	3	0.18	1	0.06	4	0.24
O3	0.06	3	0.18	4	0.24	3	0.18	4	0.24	4	0.24	3	0.18	3	0.18	4	0.24	1	0.06	4	0.24
O4	0.04	2	0.08	3	0.12	2	0.08	3	0.12	3	0.12	4	0.16	1	0.04	1	0.04	2	0.08	3	0.12
O5	0.10	3	0.30	4	0.40	4	0.40	4	0.40	3	0.30	2	0.20	-	-	3	0.30	4	0.40	1	0.10
T1	0.10	3	0.30	3	0.30	3	0.30	4	0.40	3	0.30	3	0.30	3	0.30	4	0.40	3	0.30	2	0.20
T2	0.02	-	-	-	-	-	-	1	0.02	1	0.02	1	0.02	4	0.08	2	0.04	1	0.02	2	0.04
T3	0.05	-	-	2	0.10	2	0.10	1	0.05	2	0.10	1	0.05	3	0.15	2	0.10	1	0.05	4	0.20
T4	0.03	3	0.09	3	0.09	3	0.09	4	0.12	3	0.09	2	0.06	-	-	2	0.06	4	0.12	1	0.03
T5	0.04	3	0.12	4	0.16	4	0.16	4	0.16	3	0.12	3	0.12	1	0.04	2	0.08	4	0.16	1	0.04
S1	0.08	4	0.32	3	0.24	2	0.16	4	0.32	3	0.24	3	0.24	2	0.16	4	0.32	2	0.16	2	0.16
S2	0.08	4	0.32	4	0.32	4	0.32	4	0.32	4	0.32	4	0.32	4	0.32	4	0.32	3	0.24	2	0.16
S3	0.09	3	0.27	4	0.36	4	0.36	4	0.36	3	0.27	4	0.36	4	0.36	4	0.36	4	0.36	2	0.18
S4	0.11	2	0.22	3	0.33	3	0.33	2	0.22	3	0.33	4	0.44	3	0.33	4	0.44	1	0.11	1	0.11
S5	0.10	3	0.30	4	0.40	4	0.40	4	0.40	4	0.40	3	0.30	2	0.20	4	0.40	3	0.30	4	0.40
S6	0.05	3	0.15	3	0.15	3	0.15	3	0.15	4	0.20	3	0.15	2	0.10	3	0.15	1	0.05	3	0.15
W1	0.03	2	0.06	2	0.06	2	0.06	2	0.06	2	0.06	3	0.09	3	0.09	2	0.06	-	-	1	0.03
W2	0.03	3	0.09	4	0.12	4	0.12	4	0.12	3	0.09	2	0.06	2	0.06	2	0.06	4	0.12	1	0.03
W3	0.08	2	0.16	2	0.16	-	-	1	0.08	3	0.24	1	0.08	-	0.08	1	0.08	-	-	1	0.08
W4	0.05	2	0.10	2	0.10	1	0.05	1	0.05	2	0.10	1	0.05	1	0.05	1	0.05	1	0.05	-	-
Total			**3.50**		**4.10**		**3.70**		**3.99**		**3.94**		**3.41**		**2.78**		**4.01**		**3.08**		**2.62**

		WO-1		WO-2		WO-3		WO-4		WO-5		WO-6		WT-1		WT-2		WT-3		WT-4	
Factor	Weight	AS	FAS	AS	FAS	AS	FAS	AS	FAS	AS	FAS	AS	FAS	AS	FAS	AS	FAS	AS	FAS	AS	FAS
O1	0.11	1	0.11	-	-	4	0.44	-	-	-	-	2	0.22	1	0.11	1	0.11	2	0.22	-	-
O2	0.06	4	0.24	4	0.24	-	-	-	-	-	-	1	0.06	4	0.24	3	0.18	-	-	-	-
O3	0.06	4	0.24	3	0.18	2	0.12	2	0.12	4	0.24	2	0.12	2	0.12	3	0.18	1	0.06	-	-
O4	0.04	1	0.04	1	0.04	2	0.08	4	0.16	-	-	1	0.04	3	0.12	4	0.16	1	0.04	1	0.04
O5	0.10	4	0.40	-	-	-	-	-	-	-	-	4	0.40	1	0.10	4	0.40	-		-	-
T1	0.10	2	0.20	2	0.20	1	0.10	3	0.30	3	0.30	1	0.10	4	0.40	3	0.30	1	0.10	4	0.40
T2	0.02	3	0.06	4	0.08	-		-	-	-	-	-	-	4	0.08	1	0.02	-	-	-	-
T3	0.05	2	0.10	4	0.20	1	0.05	1	0.05	1	0.05	-	-	1	0.05	4	0.20	1	0.05	1	0.05
T4	0.03	1	0.03	-	-	-	-	1	0.03	1	0.03	1	0.03	1	0.03	-	-	4	0.12	3	0.09
T5	0.04	1	0.04	-	-	2	0.08	-	-	-	-	-	-	-	-	1	0.04	1	0.04	-	-
S1	0.08	1	0.08	2	0.16	1	0.08	1	0.08	1	0.08	2	0.16	2	0.16	3	0.24	1	0.08	-	-
S2	0.08	1	0.08	1	0.08	2	0.16	1	0.08	1	0.08	2	0.16	2	0.16	1	0.08	1	0.08	1	0.08
S3	0.09	2	0.18	1	0.09	2	0.18	1	0.09	2	0.18	1	0.09	2	0.18	2	0.18	1	0.09	1	0.09
S4	0.11	1	0.11	1	0.11	-	-	2	0.22	1	0.11	1	0.11	-	-	-	-	-	-	2	0.22
S5	0.10	3	0.30	1	0.10	2	0.20	1	0.10	2	0.20	2	0.20	3	0.30	1	0.10	1	0.10	2	0.20
S6	0.05	1	0.05	1	0.05	1	0.05	2	0.10	1	0.05	3	0.15	3	0.15	1	0.05	3	0.15	3	0.15
W1	0.03	3	0.09	4	0.12	4	0.12	-	-	1	0.03	4	0.12	4	0.12	3	0.09	1	0.03	1	0.03
W2	0.03	4	0.12	-	-	-	-	-	-	-	-	2	0.06	1	0.03	4	0.12	-	-	-	-
W3	0.08	-	-	-	-	-	-	4	0.32	4	0.32	1	0.08	-	-	-	-	2	0.16	4	0.32
W4	0.05	-	-	1	0.05	-	-	2	0.10	1	0.05	4	0.20	2	0.10	-	-	4	0.20	2	0.10
Total			**2.47**		**1.70**		**1.66**		**1.75**		**1.72**		**2.30**		**2.45**		**2.45**		**1.52**		**1.77**

Based on the results obtained from the Quantitative Strategic Planning Matrix, (total values for each strategy as a sum of FAS values), priorities can be determined and ranked. The prioritized list of strategies is as follows:

1. Bring new technology into the market by using excellent employee knowledge and expertise in a variety of industries (SO2: 4.10)
2. Work on competitiveness in the IT industry by combining company’s good technology and expertise in variety of industries (ST2: 4.01)
3. Expand to new markets by proactively innovating at local and global levels (SO4: 3.99)
4. Take advantage of the firm's startup culture and approach in order to develop new technologies (SO5: 3.94)
5. Use expertise in a variety of industries to satisfy customer needs and expand to new markets (SO3: 3.70)

6. Use existing good technology and employee knowledge to develop new technologies adapted to Serbian market (SO1: 3.50)
7. Use expertise in a variety of industries and certifications as significant resource in collaborating with other companies (SO6: 3.41)
8. Use expertise in variety of industries to readily face rapidly changing trends and meet different customer needs (ST3: 3.08)
9. Reduce costs of business induced by new environmental regulations by engaging excellent employee knowledge and expertise in variety of industries (ST1: 2.78)
10. Face increased cost of labor and raw materials by proactively innovating at local and global levels (ST4: 2.62)
11. Increase the possibility of penetrating new foreign market by working on new technology as energy substitutes (WO1: 2.47)
12. Look for ways to reduce R&D costs in order to beat competition (WT1: 2.45)
    Advance the possibility of penetrating new foreign markets by establishing partnerships with companies in countries with lower labor and/or raw material costs (WT2: 2.45)
13. Increase project management capabilities for in-house projects in order to more effectively penetrate new markets (WO6: 2.30)
14. Reduce the high fluctuation of engineering staff in order to rise competitiveness in the industry (WT4: 1.77)
15. Reduce high fluctuation of engineering staff by collaborating with emerging start-ups and established companies (WO4: 1.75)
16. Use the development of new technology (patents) by the company to retain engineering staff (WO5: 1.72)
17. Reduce energy use and costs with energy substitutes in order to render R&D more cost efficient (WO2: 1.70)
18. Decrease R&D costs by adapting company's existing technology to the Serbian market (WO3) - 1.66
19. Keep up with the rapidly changing trends by structuring in-house projects in a more efficient manner (WT3: 1.52)

8. CONCLUSION

A company's success in the market largely depends on a carefully designed and developed strategy (Schilling, 2013). Technology strategy includes the objectives, strategies and tactics related to development and application of technologies within an organization (Floyd & Wolf, 2010). Formulating a technology strategy that will enable the company to assess its current position and determine its future orientation by taking advantage and focusing on its core competences is critical (Schilling, 2013). Comtrade Group, recognized the need of assessing and prioritizing its strategies, and performed evaluation and selection of technology strategies by using the Quantitative Strategic Planning Matrix.

The SWOT and TOWS analyses, crowned by the QSPM evaluation, clearly showed great possibilities for Comtrade's further development of its business by bringing in and developing new technology both in the Serbian as well as foreign markets. The principal strategy derived from the Quantitative Strategic Planning Matrix was to "bring new technology into the market by using excellent employee knowledge and expertise in a variety of industries". According to findings from the QSPM analytics tool, by focusing on its core competences and taking advantage of the extensive knowledge of its employees and company's experience in a wide array of industries ranging from medical, public sector, government, telecommunications, automotive, finance and travel to gaming and hospitality industries, Comtrade will be able to thrive, strengthen its position as a leader in IT and successfully expand into new markets. Further research is needed to confirm the relation between the QSPM prioritized strategy ranking and company's increased efficiency, profitability or success in the market.

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OPPORTUNITIES AND THREATS OF GLOBAL TECHNOLOGY AND OPERATIONS STRATEGY IN OIL AND GAS INDUSTRY

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Abstract: *Oil & gas industry in the era of globalization faces various opportunities and threats. Opportunities and threats are generated by different factors. Oil & gas industry represents driving force and is vital to all other economy branches. Although it is driven by supply and demand forces, it can influence them significantly. Due to limited reserves at home, majority of companies run their operations internationally and globally. Global approach gives wide range of opportunities, but it also imposes threats. This research concerns a range of global strategic approaches directed to use maximum opportunities and to overcome the threats. Used materials originate from international, global and national oil & gas companies websites. Research method is based on common theoretical approaches to international and global business strategies. Main conclusions and proposals of this research are necessity of transformation of companies into energy holdings and implementing new business models and broadening portfolio of products.*

Keywords*: opportunities, threats, oil & gas industry, energy, transformation, diversification, energy efficiency*

1. INTRODUCTION

Modern business operations in 21st century obtained global scales. Globalization as main trend in modern business is getting strength by removing trade barriers, standardization of production and neoliberal concept of economy. Large corporations take leading role in shaping world's economy.

The essential branch of every country's economy is its energy sector and the heart of the energy sector is oil & gas industry. It represents driving force for almost all other industries in the economy. Thus, oil & gas industry is considered as strategic one for every country's economy as well as the economy of the whole world.

Majority of leading oil & gas companies are internationally and globally oriented. International and global orientation of oil & gas companies is caused by various reasons such as limited resources of hydrocarbons in their home countries or conquering new markets and increasing market share and market growth.
As internationally and globally oriented, oil & gas companies need to implement strategies for coordinating business activities with the aim of improving their operations and technology as one of the main functions in modern companies' value chain.

The main objective of this research is global strategy and strategic approaches in technology and operations of oil & gas companies, the opportunities and challenges they face in running their businesses. In accordance to the main objective, following hypothetical framework of this research can be set:

1. *General hypothesis* is the necessity of oil & gas companies for transformation to energy holdings by introducing new business activities into value chain.
2. *First special hypothesis* is that oil & gas companies should improve energy efficiency since they are both energy producers, but also large energy consumers.
3. *Second special hypothesis* the necessity of oil & gas companies to use the unconventional hydrocarbons sources.
4. *Third special hypothesis* is the necessity of oil & gas companies to invest into R&D activities in the field of technology of using the unconventional resources of hydrocarbons, as well as the renewable energy resources.

The scope of this research is based on common theoretical approach to global strategy applied to oil & gas industry. It is limited to the operations of key international players in oil & gas industry (BP, Shell, Exxon Mobil, Gazprom etc.) and some national oil companies (Sonangol – Angola, NIS – Serbia, CNPC – China etc.). Limitations were also reflected in the impossibility to access to strategic documents of majority of the

companies as they are treated as confidential. Main conclusions had to be made from separate actions of the companies described on their relevant websites or elsewhere.

The research paper is divided into two main parts:

1. Global Business in Oil & Gas Sector, which provides main features of oil & gas industry as well as global business operations in it. Opportunities and threats of global operations in oil & gas sector are presented and described within this part.
2. Possible Solutions and Concluding Remarks, which represent a discussion on possibilities for oil & gas industry to improve growth and continue the business activities seizing the opportunities and avoiding threats and conclusions.

2. GLOBAL BUSINESS IN OIL & GAS SECTOR

2.1. Main Features of Oil & Gas Industry

Everyday life of millions of contemporary men and women all over the world hardly can be imagined without driving a car. Good and effective heating is also one of the essential requirements of modern world. Everyday shopping is almost impossible without plastic (nylon) bags. What makes connection between mentioned, on the first sight, separated segments of everyday life?

A car needs to be loaded with gasoline in order to perform its function. The most effective heating at relatively low cost can be achieved only using natural gas. Plastic bags are made mostly of nylon. All the three products are just a small part of large gamma of production of oil & gas industry. These examples just illustrate the fact that oil & gas industry plays one of the most significant roles in modern world.

Oil & Gas industry has vital significance to many other industries. Majority of economy branches are directly or implicitly dependent of it. Thus it is of great importance for the industrial civilization on the whole. On the national level oil & gas industry often is considered as strategic one and as such it represents critical concern for many nations. For that reason activities in oil & gas industry are often being planned both by the states and by companies. Strategic planning both on company and on state level will be further considered in this research paper.

In order to consider strategies in oil & gas sector, it is essential to understand main activities of the industry. One way of describing them is through the industry's value chain. The American Petroleum Institute divided oil & gas industry into five main business sectors: upstream, downstream, pipeline, marine, service & supply (www.api.org). Having in mind that marine may be related to upstream activities, service & supply to both upstream and downstream, and pipeline to transportation, oil & gas business is commonly divided as follows:

- upstream;
- midstream;
- downstream.

Upstream is related to exploration, development and production of crude oil and natural gas. Midstream refers to transportation of crude oil and processing and transportation of natural gas to the refining facilities or final consumers respectively. Downstream activities in oil & gas sector relate to refining and sales & marketing.

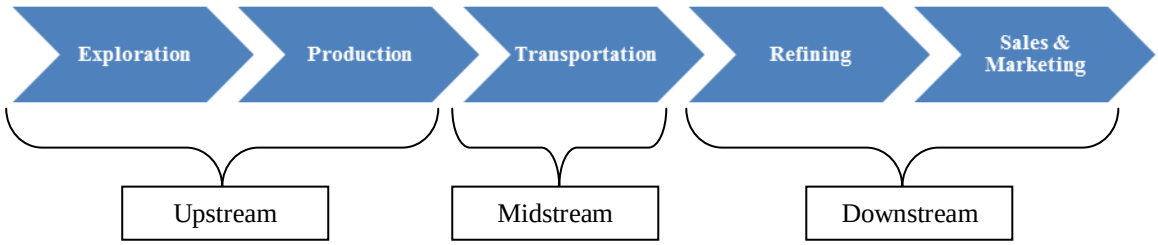

Figure 1: Value Chain of Oil Industry

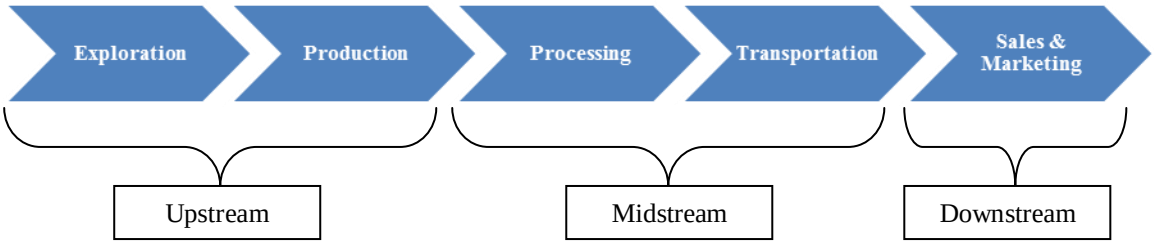

Figure 2: Value Chain of Natural Gas Industry

It is worth of mentioning that world's largest and leading oil & gas companies are fully vertically integrated, which means that they cover all of the activities of the industry value chain. Some of them are Royal Duch / Shell (Netherlands), BP Corporation (United Kingdom), Exxon Mobil Corporation (USA), National Iranian Oil Company (Iran), OAO Gazprom (Russian Federation), Petroleo Brasileiro S.A. (Brasil), Sonangol (Angola) etc.

2.2. Global Orientation and National Responsiveness of Oil & Gas Companies

Key players in modern energy sector, particularly in oil & gas, run their businesses globally. Majority of largest oil & gas companies form their resource bases by dislocating their upstream sectors overseas. Others increase refining facilities or broaden their sales and distribution networks by acquiring foreign companies or making strategic alliances with them.

Recently oil & gas sector has been facing growing demand for energy globally. According to recent research conducted for Bank of Scotland 77% of executives in oil & gas industry were planning company growth in 2013 and 2014 (White, 2013). Majority of growing companies especially those that are engaged in upstream and oilfield services act globally. They are predominantly oriented to emerging markets, especially those in Russia, South America and Far East (bordering area between China and Vietnam) as well as underdeveloped markets, such as those in Africa.

Oil & gas corporations usually benefit from economy of scale even at small local markets. As can be seen from above mentioned, companies that deployed their business in upstream activities of the industry value chain can act in different parts of the globe. Main reason for that is high standardization of exploration and production technologies and required equipment. Differentiation of services is unimportant and even negligible. Concerning the upstream sector, companies engaged in it may implement and apply global strategic approach. Centralized planning of operations as well as R&D activities in the field of technology can bring significant results. Still, some activities require specific approach for every region and even every country. More than 975 thousand millions of barrels of oil and 100 trillion cubic meters of natural gas (BP, 2013) which represent the biggest part of proved oil & gas reserves are allocated in emerging and underdeveloped countries. Main challenges of performing exploration and production activities as well as oilfield services are often political and legislative obstacles. Political obstacles such as violent changes of the regime, civil wars and other kinds of clashes can seriously jeopardize activities of foreign companies in the host country. The most recent example was Libya. Due to the escalation of violence in that country, some European companies were forced to abandon their equipment, which remained in Libya. Besides the losses of profit, the companies faced the loss of capital as well. Legislative obstacles are often the issues with property and property rights due to instable laws and regulations. Since oil & gas reserves have strategic significance for the host country, their nationalization by the government can represent serious challenge for operating company.

On the other hand, companies that are predominantly engaged in downstream sector (oil refining and sales and marketing) may face some challenges in implementing and applying global strategy. Companies like Kuwait Petroleum International (known by its trademark Q8) that are involved in downstream activities outside of their home countries usually face differences in particular quality standards or environment protection regulations in various countries or regions. Although these companies also benefit from economy of scale they have to take into consideration also national responsiveness in their approach to every particular market. National responsiveness approach in oil & gas field requires feasibility studies which include studies of legislature, standards and regulations concerning oil and gas refining and distribution of the host country, as well as culture and requirements of consumers. Apart from quality standards and safety

regulations, a company should respond to the requirements in regards with palette of additional products sold on petrol stations as well. They may implicitly refer to the climate conditions of particular country or region, or standard of living.

In case of companies predominantly involved in upstream activities, global strategy approach may be more centralized. It may provide more precise instructions to company's branches overseas about operations and technology they use. In other words, global strategy should set standards and regulations regardless of the region or country where company's branch operates. These standards and regulations often are adopted by other companies operating in the same region or country as well as by the legislature bodies of the host country.

In case of companies, which perform downstream operations overseas, national responsiveness approach should be dominant. Their global strategy should provide just basic guidelines for doing business. Decision making in these companies should be more decentralized and overseas branches must have certain autonomy in planning their operations. Special attention should be paid on making decisions of technology the company branch will use. Selected technology must cope with local standards especially in the field of pollution reduction and quality of fuel produced. The choice of technology should respond to the issues of origin and type of crude oil that is to be refined. Different types of oil require different technology approaches to their refining.

Planning sales and marketing activities must be decentralized to the highest extent. Consumers in different locations, however, have different level of brand awareness for certain brands, as well as different preferences.

In both cases global strategy should be implemented with different extents of integration of business. In case of upstream business integration can be made to the large extent, having in mind the nature of business and possibility of technology and operations standardization. In case of downstream activities, the level of integration is, expectedly, low.

2.3. Opportunities of Appliance of Global Technology and Operation Strategy in Oil & Gas Industry

Oil & Gas industry represents the most significant part of energy industry value chain. This industry is capital intensive and, what is more important, energy intensive industry. On one hand, oil & gas industry is the largest supplier of energy all around the globe, but on the other hand it is also a large energy consumer. In the past few decades, oil & gas companies invested a lot into R&D activities in order to decrease energy consumption in some parts of its value chain. In other words, most of oil & gas companies have been committed to implementation of energy efficiency projects. Due to advanced technologies, such as mild hydrocracking (MHC) or reduction of flaring of gas, refining sector demonstrated significant decrease in energy consumption. According to Global Gas Flaring Reduction partnership in the period between 2005 and 2010, flaring of gas associated with oil production has decreased by 22% all around the world (Accenture, 2012). Other sectors of oil & gas industry predominantly upstream may also see the opportunity in energy efficiency, since in this sector energy consumption has increased recently. The increase in energy consumption in upstream activities can be easily understood having in mind that oil & gas reserves are limited. As the time passes by, conventional oil & gas resources are being exhausted due to heavy extraction. Extracting the hydrocarbons from mature fields requires more energy consumption and is becoming more and more difficult.

As the main energy supplier, oil & gas industry is facing increasing demand for energy on the whole. Consumer demand for energy is predominantly driven by the countries with the emerging economies. It is estimated that by 2035 a number of passenger cars all over the world will reach 1.7 billion! Consequently, oil consumption will increase significantly. Majority of these end-consumers will come from non-OECD countries (Accenture, 2012).

This situation makes extraordinary background for planning and deploying operations overseas. As it was mentioned before, major players on oil & gas market started their upstream operations overseas. Main reasons for that usually are: the lack of oil reserves at home or low quality of hydrocarbons or preventing competitors to obtain access to oil and gas rich reserves in other territories.

Increasing number of end-consumers in emerging countries makes international oil & gas companies think on deploying their downstream operations to those countries. Downstream activities, both sales and

distribution and refining and processing make an opportunity of conquering new markets. Seizing this opportunity, a company may work on its revenue growth by collaboration with host country government and local companies to create and develop new markets or improve the existing ones and possibly open new sales and marketing channels. Working in new environment, the company will also be able to create new business models. Considering and adopting new business models can improve company's global strategic approach through decentralization of governance and making business decisions more independently and more efficiently.

One of the most important goals of applying of global strategy is cost reduction. Cost reduction can be achieved in various ways such as moving production to the regions with inexpensive labor or with weak HSE standards. Still, cost reduction can be achieved to significant extent by implementing energy efficient and waste reduction technologies in both exploration & production and refining processes in all globally deployed activities. Investment in innovation and successful technology management represent key factors for cost reduction.

Oil & gas industry shows deep devotion to innovation and creation of new technologies. There are several existing directions of innovation in oil & gas industry. One of them is creating of fully digitalized oil field which is covered with the most sophisticated information technology and systems of monitoring (Bigliani, 2013). Significant results have already been achieved in the field of innovation, but still much remains to be done. With possibility of transferring every operation from industry value chain overseas, oil & gas companies become global players in energy supply system. Yet, transferring the operations in modern business means transfer of technology. Since oil & gas companies are oriented to economy of scale, they have to standardize their operations both at home and overseas. Standardization is one of the basic requirements of quality management and quality control. Standardization further requires transferring of certain technology to newly obtained production or refining facilities or from them. Transfer of advanced technologies to less developed countries offers benefits both to the company and to host country. The company will probably be the first to use advanced technology in that country or region and will obtain competitive advantage on the local market. On the other hand host country will improve its industry and economy on the whole often improving its environmental standards which will be beneficial for the whole society.

One of the opportunities in that field also is partnership between national oil companies and international oil companies. NOC-IOC partnership usually provides experienced management of oilfields and expertize in operations. National oil companies usually benefit from government protection and often artificially increased prices of fuel. They have easy or even exclusive access to local oilfields and reservoirs as well. By creating partnering relationships with national oil companies, the international oil companies may also obtain some governmental benefits from local governments through their local partners. Forming strategic alliances with NOCs or entering joint ventures with them, the IOCs may obtain the access to the oil fields and perform activities that previously were exclusive right of NOCs. National oil companies may see the opportunity in joint ventures or other partnering relationships with international oil companies, in financing innovative projects, obtaining the access to advanced technologies and knowledge exchange. NOC-IOC partnerships can be successful in joint ventures on other "neutral" territories. An example of such successful partnership is development of Rumaila field in Iraq, performed by China National Petroleum Corporation (CNPC) and British Petroleum (BP, 2013).

An opportunity of contemporary global business in oil & gas sector can be seen in acquisitions and strategic alliances. By entering such models of business cooperation, oil & gas companies can gain new capabilities or improve the existing ones. They open new growth opportunities to the companies in the environment of increasing competitiveness, Expanding supply base, gaining access to new consumer markets, increase in market share or even obtaining significant market power are some of the benefits for companies entering in such ventures. One of the most recent examples for acquisition is Royal Duch / Shell acquisition of Repsol LNG assets outside North America. By this acquisition Royal Duch / Shell will now undertake additional 7.2 million tonnes per year of directly managed liquefied natural gas (LNG) supply in the Atlantic from Trinidad and Tobago and in Pacific from Peru (Oil & Gas Journal, 2014).

In addition to previously mentioned items, there is also an opportunity of accessing new process and product technologies, know-how or advanced state-of-the art technological approaches. Good example for that may be Technip acquisition of Stone & Webster process technologies and associated oil & gas engineering capabilities from the Shaw Group. By this transaction Technip will strengthen its position as technology provider to the refining and petrochemical industries. It will also diversify its onshore / offshore segment adding revenue based on technology supply. Technip has an opportunity to strengthen its relationships with clients and partners worldwide backed by Stone and Webster reputation. Expanding growth areas as the US with strong downstream markets that will benefit from the supply of unconventional gas is also an important gain of Technip. Finally skilled resources will be added to Technip in research in the US and engineering and

research in the UK and India. The newly acquired business is spread in the US (Texas and Massachusetts), the UK (Milton Keynes) and India (Mumbai). The acquired business generates revenues predominantly from technology licensing and process design engineering (Technip, 2012).

Possibly the most important opportunity of modern oil & gas industry can be the exploration and use of the unconventional sources of oil & gas. As it was mentioned above, traditional extraction from existing and mature oilfields becomes more and more expensive, as hydrocarbons reserves are constantly decreasing. The unconventional sources, such as oil sands, heavy or extra heavy oil or shale gas represent revolutionary opportunity for oil & gas companies to improve competitiveness in modern markets. Extraction and production of hydrocarbons from the unconventional resources requires the use of advanced technologies, which have already been developed to the certain extent. Main problems of processing the unconventional resources still are waste of energy and higher costs of exploration and production activities. The unconventional resources are deployed all around the globe.

The largest resource base of shale gas, for example, is in China with the approximate quantity 1,275 trillion cubic feet (TCF). China is followed by USA and Argentina with approximate quantities 862 TCF and 774 TCF respectively. Figure 3 shows approximate quantities of the shale gas per country (Chemistry Views, 2012).
Besides new technologies, main requirements for global players in oil & gas industry are improvement of global strategic approaches in obtaining the access to the reserves but also global management of technology, as the unconventional resources operations are technology intensive and deployed all over the world.

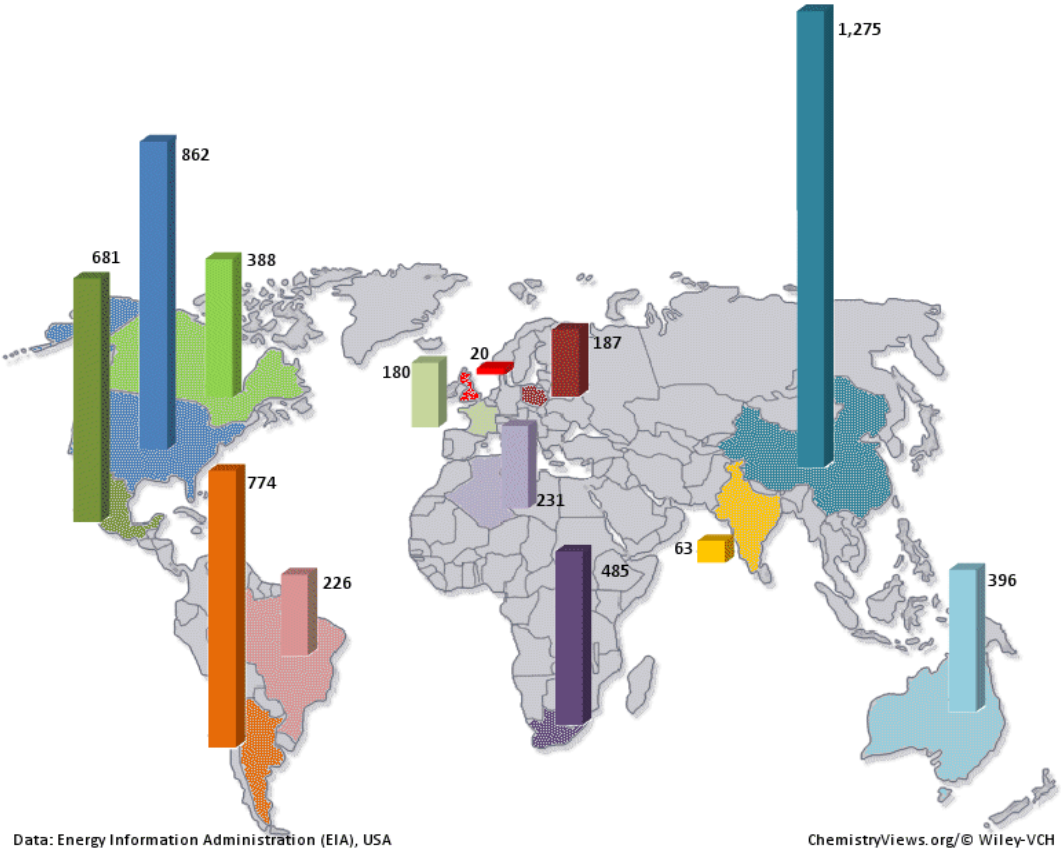

Figure 3: Approximate quantities of shale gas per country
Source: www.chemistryviews.org, based on EIA (USA)

Above presented and explained opportunities are just a segment of global opportunities which are growing and will be growing in the future. The process of globalization and increasing investments in R&D are constantly opening new opportunities in oil & gas industry.

2.4. Threats of Appliance of Global Technology and Operation Strategy in Oil & Gas Industry

Apart from great opportunities, oil & gas business carries certain challenges and risks as well. When considering threats, obvious fact that must be taken into account is that oil & gas industry deeply depends on government policies and attitudes.

Political instability in certain regions of the world represents substantial threat for investments and operations in oil & gas sector. In recent years the world witnessed the most extreme kind political instability in some oil & gas rich regions (e.g. Middle East or Northern Africa) causing even armed clashes and wars. The risks of such kind of political instability are well known. Companies that operate in those regions can be affected by losing return of investments, profit and capital. On the other hand prices of crude oil increase and subsequently end-consumers suffer oil products price increase as well.

Other types of political instability can refer to lack of strong legislation in the host country which may affect company's business on the whole in that particular country. Companies usually may face problems with the property rights in emerging and underdeveloped countries and problems with intellectual property protection. Property rights issues can jeopardize direct investments and building facilities in the host country. Yet, intellectual property rights issues usually affect R&D activities and technology transfer.

Another threat that can be referred to the politics is increasing role of government in managing the oil & gas resources. In planning operations and risk management activities it is substantial to take into account the fact that oil & gas products are strategically important products ones for every country in the world. It was mentioned before that oil & gas industry drives majority of other industries and this fact may lead to the conclusion that the greatest part of country's economy depends on oil & gas industry. One of the natural risks of oil & gas sector is decreasing amount of oil reserves in the world. This is serious threat not only to oil & gas companies but to their consumers as well.

Legislative threats derived from this natural risk are series of energy efficiency policies. These policies are being implemented in other economy sector, such as automobile industry, civil engineering and construction and many other industries with energy intensiveness as one of main features. They can be imposed as regulations or some incentives can be offered to the companies that implement new energy efficiency standards. Direct consequences of implementation energy efficiency policies affect consumption of fuels for operating passenger cars and other vehicles or heating. It further influences decreasing demand for fossil fuels and affects profit of oil & gas companies.

Although energy efficiency implementation can be considered as an opportunity for oil & gas industry as energy consumer and even as strong financial incentive for the industry, it is serious threat for oil & gas industry as an energy supplier.

Health, safety and environment issues represent key challenges for managing global operations in oil & gas industry. Oil & gas production and refining facilities are traditionally considered as high polluters. High level of pollution and lack of environmental friendly technologies invoked public debates and oil & gas companies are often target of attack of various global ecology organizations. More serious consequences of neglecting HSE issues may be explosion and huge scale of pollution in region which an oil & gas company operates in. Explosion of Deepwater Horizon drilling rig in Gulf of Mexico in 2010, Pemex pipeline explosion in 2012 and Amuay Refinery explosion and shutdown are just some of the most extreme examples of disasters concerning HSE issues. For Deepwater Horizon drilling rig explosion was claimed responsible by Greenpeace and criticized by many other organizations concerned with environmental protection (Bigliani, 2013).

HSE issues can cause a wide range of consequences for oil & gas companies from endangering their reputations by being criticized publicly because of explosions causing ecology catastrophes and even losses of human lives.

Rising threat for traditional oil & gas industries comes from new technologies and fossil fuel substitutes on the market. Launching new electric car models as alternative cars by BMW, Ford, Mitsubishi and many others in the future will probably invoke decrease of demand for fossil fuels. Recently founded company Tesla Motors produces exclusively electric vehicles. Production of electric vehicles is emerging branch of automobile industry in China as well. Apart from electric power used instead of fossil fuel, there are another types of fuel used in transportation sector. Biodiesel is one of alternative fuels that can be considered as substitute to traditional fossil fuels. It is typically produced by chemically reacting lipids with an alcohol. It is widely used in many European cities in public transportation sector.

In heating buildings and private houses all over developed world, alternative ecological fuels are more used recently than it was the case just few decades before. People are being encouraged to use alternative ecological fuels by authorities and various organizations concerned in environment protection through media campaigns and even through financial incentives.

At present appearance and use of substitutes does not represent serious threat for oil & gas industry. As it was mentioned before, all around the globe the demand for fuel is increasing due to overall population growth. Technology of production of alternative fuels is still in developing phase and that makes production expensive. On the other hand, production of vehicle motors and house facilities that will hopefully use new alternative fuels has not yet achieved the scale necessary for creating demand for fossil fuel substitutes. It should be rather considered as global threat for the future operations of oil & gas industry.

3. CONCLUDING REMARKS AND POSSIBLE SOLUTIONS

Based on overall known facts about oil & gas industry and research made in the field of opportunities and threats of introducing and implementation of global technology and operations strategy in oil & gas industry, several possible solution proposals and concluding remarks can be made.

As quantity of hydrocarbons reserves decreases all over the world oil & gas industry must consider possibilities of using of other unconventional sources of its primary raw materials (such as deep-water drilling or deep drilling in oilfields). Existing technologies for exploration and extraction must be improved for successful usage of the unconventional sources hydrocarbons.

Another possibility can be recognized in using unconventional fuels, such as the ones made from heavy and extra heavy oil and oil sands or shale gas. This new approach will require new technology of operations. Consequently significant investments especially in R&D sector are necessary to have this objective fulfilled.
Both international and national oil companies can broaden their global operations through IOC – NOC partnerships and cooperation. Having partnering relationships with national oil companies, the international oil companies may obtain the access to hydrocarbon reserves in the country, and national oil companies can penetrate international markets through their international partners and often obtain access to advanced technologies.

Acquisitions and strategic alliances are another type of cooperation between different oil companies that can be helpful in broadening portfolio of production, access to new advanced technologies and growing market share.

Besides opportunities, global oil & gas business faces also various threats. Political instability is one of major threats to growth of global companies. Possible government changes often followed by violence may cause losses of profit, capital and property. Another type of political threat is lack of legislative systems protecting property and intellectual property rights of foreign companies. These threats may be overcome by careful analyzing political situation in possible host countries as well as participation in founding legislative basis and its implementation in certain countries. It is especially present in emerging or underdeveloped countries.

HSE issues represent a major threat for modern oil & gas industry. Neglecting these risks may lead to various consequences from endangering company's reputation to more losses of property, human lives and high pollution and natural catastrophes. Overcoming these problems can be achieved by strict complying with HSE standards and even giving proposals to improve them and founding strong system of control and constant improvement of HSE education for working personnel. Social responsibility is desirable behavior of companies in that field.

Recent threats for oil & gas industry are new substitutes for fossil fuels. This threat should be considered as future threat as technologies of production and consumption still are not developed enough. Overcoming this threat can be achieved by developing technology of production of alternative fuels and consequently broadening portfolio of products.

Energy efficiency policies and technologies have ambivalent role with reference to oil & gas industry. They can be considered both as an opportunity and as a threat. From the point of view of consumer, oil & gas sector sees energy efficiency as an opportunity due to relatively high level of energy consumption in processes of extracting, production and refining. From the point of view of supplier, oil & gas industry may consider energy efficiency as a threat. Energy efficiency policies and advanced technology affect the demand for fuel especially in developed world. On the other hand, increasing number of people and fuel

consumers all over the world to the certain extent compensates potential losses and in a way neutralizes that threat. By this, the First Special Hypothesis is proved.

Accepting new business models, broadening portfolio of products and broadening the activities in the industry value chain may be the best strategic approach to threats response by turning them into opportunities. Some traditional oil & gas companies have already considered and even commenced with their transformations to energy holdings (British Petroleum, Gazprom, NIS…), producing both fuels and electrical power using flare gas and building wind and solar parks. By this, the Third Special Hypothesis is proved.

New approaches and ways of adopting business models, feasibility of including renewable or alternative resources into oil & gas industry should be studied and may lead to some new conclusions about profitability of such operations. Further researches in the field of management of new resource bases and coordination with traditional operations of oil & gas companies are also essential for future development of strategic planning in the field of operations and technology on global level. This proves the Second Special Hypothesis of this research.

All the mentioned activities lead to obvious transformation of oil & gas companies to large and well diversified energy holdings. These holdings are expected to respond to every energy challenge in modern societies. The fact that all the fields of activities of the holdings have common denominator – energy implies that all the business directions of the new energy holding are in perfect synergy. Thus, it proves the General Hypothesis of this research.

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DEVELOPMENT OF AN INNOVATIVE PROJECT

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Abstract: *Innovation can be defined as the application of new ideas to the products, processes, projects or other aspects of the activities that lead to increased "value". One of the Serbian entrepreneurs found a way how to add value to his country, how to improve society and support entrepreneurship as a formula for economic prosperity and recovery of the country through the Organization for Inspiring Entrepreneurship and projects that encourage young people to engage themselves in entrepreneurship. The project, which the Organization is currently working on, is MADE IN SERBIA. In this paper, a real-life example of a new-project development is given through the Stage-Gate model - generating ideas and the idea screen. MADE IN SERBIA is a project that aims to present Serbia abroad as a country that has a rich history, smart and noble people, but also high-quality products.*

Keywords*: Innovation project, Stage-Gate model, innovations, generating ideas, development*

1. INTRODUCTION

Innovation is a complex process. The genesis of innovation derives from a wide range of sources and its development involves various stages, often involving considerable investment. Companies are well aware that hidden in their dispersed, global operations is a treasure trove of ideas and capabilities for innovation (Rogers, Greenhalgh, 2010). While entrepreneurs and private firms are central actors in the process, there is a critical role for the government in providing a legal infrastructure and supplying basic scientific knowledge. The method of creating innovation is to discover, create, and develop ideas, to refine them into useful forms, and to use them to earn profits, increase efficiency, and reduce costs. Innovative ideas come from several sources, including unreasonable demands or goals and time pressures. However, there are many blocks to innovation. An innovative idea is not helpful to an organization unless it is tested and implemented which can be done by using the well-known Stage-Gate model.

Stage-Gate is a value-creating business process and risk model designed to quickly and profitably transform an organization's best new ideas into winning new products. When embraced by organizations, it creates a culture of product innovation excellence - product leadership, accountability, high-performance teams, customer and market focus, robust solutions, alignment, discipline, speed and quality. The Stage-Gate model takes the often complex and chaotic process of taking an idea from inception to launch, and breaks it down into smaller stages (where project activities are conducted) and gates (where business evaluations and Go/Kill decisions are made). In its entirety, Stage-Gate incorporates pre-development activities (business justification and preliminary feasibilities), development activities (technical, marketing, and operations development) and commercialization activities (market launch and post-launch learning) into one complete, robust process. Besides an ordering of activities, the approach required a go – no-go decision at the end of each phase. Since each subsequent phase will require more efforts and (financial) resources, it makes sense to reconsider the feasibility and chances on market success at fixed moments. Negative results of a business case will, for example, prevent the expensive development of a non-viable product (Iskander,2008).

2. PRE-DEVELOPMENT ACTIVITIES

2.1. Identify sources of ideas

There are millions of entrepreneurs and companies throughout the world and their testimonies suggest that there are many potential, various sources of new viable business ideas or sources of business opportunities. Some business ideas come from a careful analysis of market trends and consumer needs and others come from serendipity. Research suggests that the following are four major sources of ideas for every entrepreneur and companies (Baron, Reuber, Shane, 2007):

- Spotting Trends and anticipating their impact;
- Identifying a market niche;
- Copying ideas from other countries;
- Taking a scientific approach;

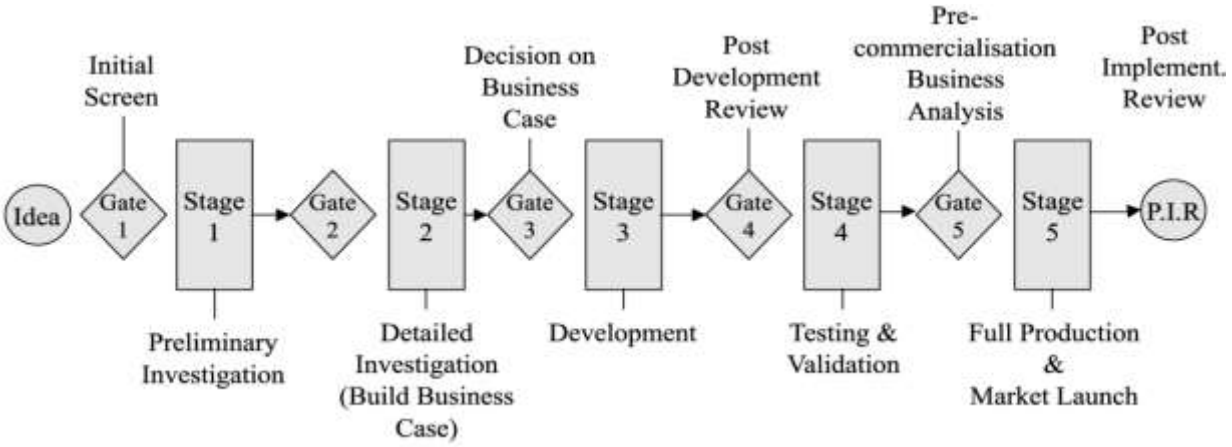

Figure 1 Stage-Gate model (according to Cooper, R. G. 2011)

Striving for constant innovation, great attention is paid to how to generate ideas. Some of the most applicable methods are:

Brainstorming - It means creating new ideas, solving problems, motivating and developing teams. Brainstorming motivates because it involves members of a team in bigger management issues, and it gets a team working together. Brainstorming places a significant burden on the facilitator to manage the process, people's involvement and sensitivities, and then to manage all required actions (Wilson, 2013).

Focus Groups - A focus group is defined as a group of individuals providing information in a structured format. A moderator leads the group of about 8 to 14 participants through an open, in-depth discussion rather than simply asking questions to solicit participants' responses. For a new product or services area, the moderator focuses the discussion of the group in either a directive or non-directive manner. The group is stimulated by comments from other group members in creatively conceptualizing and developing a new product or service to fill a market need. The focus group is an excellent approach for initially screening ideas and concepts. Existing company can use this method to expand a section or department to be able to achieve greater productivity in its services (Stewart, Shamdasani, 2014).

Problem Inventory Analysis – That is a method for obtaining new ideas and solutions by focusing on existing problems. In this approach, the customers or consumers are provided with a list of problems in a general product category. Thereafter, they are asked to identify and discuss product in each category that have a particular problem. This method is effective when an improved service/product is desired. When known product or services are related to suggested problems, a new product idea emerges. Result from product inventory analysis must be carefully evaluated as they may actually reflect a new business opportunity. For maximal result, it is advisable that problem inventory analysis should be used primarily to identify new product ideas from existing product before further evaluation (Hisrich, 2014).

2.1. The identification of gaps

Gap analysis identifies gaps between the optimized allocation and integration of the inputs (resources), and the current allocation-level. This may reveal areas that can be improved. Gap analysis involves determining, documenting, and approving the difference between business requirements and current capabilities. Gap analysis naturally flows from benchmarking and from other assessments. Once the general expectation of performance in an industry is understood, it is possible to compare that expectation with the company's current level of performance. This comparison becomes the gap analysis. Such analysis can be performed at the strategic or at the operational level of an organization (John, Acharya, Ashis, 2013).

3. GATE 1: INITIAL SCREEN

Strategic similarity
If two firms exhibit very similar resource allocation pattern as measured across a variety of strategically relevant characteristics, they can be considered to be strategically similar. Each company has a dominant logic, which represents the manner of utilization of resources, and which co-evolved with the resources within the firm. If two firms with dissimilar resource allocation patterns merge, the dominant logic of one firm will be applied to the resources of the other firm. This leads to the risk of mismatch of dominant logic and resources and thus to inferior merger success (Frensch, 2007).

Market attractiveness
The attractiveness of a target market lies not only in its size and growth possibilities but also in the promise of long-term profitability. Attractive segments attract competitors and intense competition can have a detrimental effect on future profits. Very important thing in evaluating the attractiveness of a particular target market is the selection of an appropriate set of evaluation criteria (Cant, Strydo, Jooste, Plessis, 2007).

- Market/customer factors
- Economic and technological factors
- Competitive factors
- Environmental factors

Also, determining market attractiveness is a four-step process (Sarin, 2013):

- Pre-select criteria that will be used to evaluate market attractiveness and competitive position
- Weight the market attractiveness and competitive position factors
- Rate each segment on attractiveness and competitive position
- Evaluate the implications of alternative positions within the market attractiveness/competitive position matrix for target market selection, strategic objectives, and resource allocation

After defining which products or services make money and which ones take money, evaluate which ones to invest in by looking at how attractive the market is. A widely used tool for conducting a portfolio analysis is the Market Attractiveness Framework, which provides a structure that works with your products and services. The framework looks at your portfolio based on the strengths of each product or service and its market attractiveness. The method of using the Market Attractiveness Framework is to fit your products or services in one of the three areas (Barksdale, Lund, 2006).

Technical feasibility
A business is considered technically and operationally feasible if it has the necessary expertise, infrastructure and capital to develop, install, operate and maintain the proposed system, and that by establishing such a system, the business will be able to deliver goods or services at a profit. Results from technology feasibility analysis efforts provide input to balanced portfolio development and technology validation plans. These analyses are very useful in determining which projects have the highest potential for near-, mid-, and long-term success (El – Sharkawy, 2005).

Legislative acts
With most new ideas key issue is the question of legal restrictions. Most companies in Serbia are trying to protect their originally made products. This protection will be based on the law on Geographical Indications. Geographical indications shall be the indications which identify particular goods as goods originating from the territory of the specific country, region or locality within such a territory, where a given quality, reputation or other characteristics of such goods can be essentially attributed to their geographical origin, and such goods are produced and/or processed and/or prepared within a definite geographical area.

4. REAL LIFE EXAMPLE - PROJECT: MADE IN SERBIA

The Organization for Inspiring Entrepreneurship "Živojin Mišić"
„He who dares, can. He who knows no fear, moves forward. "Živojin Mišić"

The Organization for Inspiring Entrepreneurship "Živojin Mišić" was founded in 2013 in Belgrade by a Serbian company "Devana Technologies" at the initiative of its employees. The original creator of the idea was Vladimir Prelovac, the company founder and president of the organization. The idea was born from the desire to improve society and support entrepreneurship as a formula for economic prosperity and recovery of the country. The company decided to invest a part of its profits in this idea in order to enrich the programs and projects of the organization, and to inspire young people and show them the path that will lead them to

success. As non-governmental and non-profit association, the organization invests all of the resources and decides on its own how the funds will be allocated, which of the social issues will try to resolve using its own initiative or a project, and where to focus its strategy. They are doing all that with the generous help and advice of associates and friends.
Once it was founded, established and had its ideas and goals well-structured, the organization successfully realized its first projects - “The new hopes of chess“ and “Serbian Teaching Awards“ in 2014. Using these projects, the organization found the essence of the problem, that is, the source of good qualities and skills people have - chess and strategic thinking, and the education of youth and their versatility. Every project of the "Živojin Mišić" Organization that came after it was driven by an idea to inspire young people in every possible way to be brave, innovative, shrewd and to create their own opportunities. In one word - to become entrepreneurs themselves. The foundation’s guiding principle is to care about the progress of children in Serbia and those who have the power to bring them to the right path and turn them into great and stable people. In addition, the Association promotes entrepreneurship, it aims to support entrepreneurs who have already established their businesses, trying to help the economic development of Serbia.

Therefore, the Association is initiating the implementation of the project MADE IN SERBIA. The realization of the project starts in March, and it is planned to be completed by the beginning of September. The project is led by the Project Coordinator of the Organization for Inspiring Entrepreneurship "Živojin Mišić", and externally it engaged a team consisting of three girls. Striving towards achieving these objectives the company is constantly looking for new ideas and projects. This kind of activity opens the possibility to strengthen the entrepreneurial spirit, the economy of Serbia and enthusiasm of young people. The project “MADE IN SERBIA” is just one of many innovative actions organized by this Organization.

4.1. Made in Serbia

MADE IN SERBIA is a project that aims to present Serbia abroad as a country that has a rich history, smart and noble people, but also high-quality products. In the world there are products that are of superior quality which originate from Serbia, but no one is aware of this fact. One of these products is the Manage WP, created by Devana Technologies, which is one of the world's premium products, and has customers like NASA, Stanford University, but no one knows that the idea of the product is developed in Serbia, where the product is still maintained and developed. The idea of the project Made in Serbia came precisely on the basis of the case of this product, and through further research it was concluded that there were a lot more products like Manage WP in Serbia.

The basic idea is to create an online platform which will be a perfect place for presenting the best products from Serbia. The products will be given the badge “MADE IN SERBIA”, and their promotion will take place on the portal. The portal should present our country, our famous people, as well as the products themselves and companies that made them.

Development activities of the project are:
- Activity 1. Define the project goals and establish cooperation with eminent national institutions
- Activity 2. Selection of companies
- Activity 3. Creating a site
- Activity 4. Promotion of the site and the companies

Activity 1

The aim of this project is to encourage the entrepreneurial spirit in Serbia through examples of successful local companies and their paths to success and also to explain to entrepreneurs that everything is possible.
The long-term goal is to change the image of Serbia and Serbian products in the world through examples of successful companies and successful people. Presentation of quality Serbian products to the world leads to the development of Serbian economy. Intention is to create a new brand MADE IN SERBIA that will become synonym for products with the best quality. Such lofty goals require the assistance of the eminent institutions of, such as the Ministry of Economy and the Serbian Chamber of Commerce. One representative in front of the each institution is a part of a committee that will choose which companies should be on the portal trying to present Serbia in the best possible way.

Activity 2

The website MADE IN SERBIA needs to present only products of superior quality. Therefore, selection should be done in the best way. The selection is defined by a set of criteria. The defined criteria serve as the

backbone of the determinants of quality. The criteria that should be taken into account through the selection process of companies are:

- MADE IN SERBIA - idea for the development of the product is developed in Serbia, the product produces, develops, maintains in Serbia
- Product quality
- Acknowledgement that the product has won
- The presence on the international and / or domestic market
- Innovation
- Social liability
- Tradition of the product

A professional jury from the database of companies will choose those that meet criteria - a product of high quality. The goal of the Association is to take out the best of each area and select representatives who will represent Serbia in the portal. This jury will include representatives of the Serbian Chamber of Commerce, the Ministry of Economy, EY company, as well as experts in the field from which products would be chosen. The company will not pay any compensation for the promotion on the portal and all costs of this project is fully covered by the Association. After the jury agree on about which companies deserves to be on the portal, it will be organized the ceremony at which companies will receive recognition and hear the importance of having a badge MADE IN SERBIA on their website. This project was not conceived as a competition in which companies must apply and then the jury chooses the best. The selection should be internal, and only companies that should appear on the portal will be invited and informed about the choice. Competitions of this type already exist and MADE IN SERBIA does not want to be one of them.

Activity 3

The most important thing in this activity of creating site is to use the opportunity and show what Serbia actually is, and what Serbia has to offer. This site should be divided into three sections:

- **Our business** is the part where will be presented products and companies. The goal is to get from each company a story that is characteristic for them. For example: How did they get the idea to develop the product? What makes this so special? In which countries is the company selling their product? These stories should motivate others to do something similar, which will in many ways affect the development of our country and economy.
- **Our country** - Serbia is a country of real natural beauty, irresistible taste, tradition and unforgettable entertainment. In this section, Serbian culture should be presented, beautiful parts of the country, food that is always interesting to foreigners and also the festivals that bring together the whole world in one place.
- **Our people** - Why people around the world do not know that Tesla, Pupin, Andrić, Đoković and many other successful people are Serbs? In this part of the site we would like to put the stories of great people from our past and their achievements.

Activity 4

At the end it remains to do a good promotion of portal in Serbia, but also around the world. Through the websites of companies which will have the MADE IN SERBIA badge, the story of our country and economy will become available to everyone. Promotion activities will be focused on digital media.

Digital media, which includes Internet, social networking and social media sites, is a modern way for brands to interact with consumers as it releases news, information and advertising from the technological limits of print and broadcast infrastructures. Digital media is currently the most effective way for brands to reach their consumers on a daily basis. Over 2.7 billion people are online globally, which is about 40% of the world's population. 67% of all Internet users globally use social media (Mulhern, 2009).

5. THE PROJECT „MADE IN SERBIA“ THROUGH FIRST GATE OF “STAGE-GATE” MODEL

Strategic similarity

Strategic similarity can be seen as a new concept of development of the project, which must be in accordance with the Strategy, the company itself.

As we can see, the main goal of the project „Made in Serbia“ is to demonstrate how much Serbian people have achieved. The story is not only about products, it is about people and quality which can make our entrepreneurs and our country proud. Through this first gate of „Stage-Gate“ model, the study was about how competitive and organizational similarity jointly affect cost savings, revenue growth and profitability improvement.

If we now make a comparison with main objectives of foundation „Živojin Mišić“ – „To encourage citizens and society in general to take initiative and believe in above-average results“, we can see that project „Made in Serbia“ fits easily in the field of the strategic focus of the foundation mentioned above and „Devana Technologies“, as the company founder. The line that connects them all is belief that starting your own business, self-employment and employment of others are a certain way to ensure economic progress and recovery of the country.

Market attractiveness

As the project clearly emphasizes the importance of domestic products and Serbian culture, a very important factor is attractiveness of Serbian market, economy and environment.

In 2015, the Serbian economy has emerged from recession into which it has entered in 2009. There has been growth in GDP of 0.8 percent. Fiscal adjustment and structural reforms have resulted in the improvement of the business environment in Serbia, and the realization of major investments, especially private ones. In 2016, faster growth in economic activity to 1.8 percent is expected based on exports and investment. The sectors that showed the highest dynamics are: manufacture of tobacco products, other manufacturing activities, manufacture of textiles, manufacture of machinery and equipment, as well as the production of basic pharmaceutical products and preparations. Currently, Serbia is characterized by improving foreign position - exports of goods and services recorded a faster growth compared to the growth of imports. The coverage of imports by exports was 74 percent, which represents an improvement compared to the previous year. National Bank of Serbia predicts that reducing external imbalances and strengthening the external position will continue in the coming years. The sectors that had the most significant share in exports were road vehicles, electrical machinery and equipment, fruit and vegetables, cereals and cereal products, and non-ferrous metals. As the most important export destinations stand out Italy, Germany, Bosnia and Herzegovina, Romania, the Russian Federation and the countries of the region (Serbian Chamber of Commerce).

Relying on that fact, domestic companies and entrepreneurs need to be aware of enormous potential that their country has. In addition to their awareness they also need to raise the trust in every citizen of Serbia and people beyond their borders. That is the main objective of the project „Made in Serbia“ – Trying to make a difference in the world and doing that every day.

Serbia is full of people with great entrepreneurial potential and because of that the number of employees in 2015 has increased. Spurred exit from recession, after two full years, legal entities were formally employed 1.35 million people, which is 31,000 more than last year (2.4 per cent). A positive trend was also recorded in the service sectors, which signals the "awakening" of entrepreneurship, and reducing the informal economy (Serbian Chamber of Commerce).

The most important is to inspire, encourage and teach young people how to engage in developing their own products and to raise awareness about its importance. Numerous examples have shown that Serbian market is very suitable for the development of products/services. One such example is the confidence of the French Government. In 2015, our Chamber has received about 130 pie foreign companies from France interested in local market (CCI France Serbie, 2015).

Technical feasibility

Trying to highlight the importance of local producers, project “Made in Serbia” is also focusing on finding the best way to ensure all potential investors that Serbia has a very fertile natural environment for all kinds of product and services. Some of the main poles of the development are:

- Transport
- Energy
- Real estate and construction
- Labor and human capital
- Telecommunications and information technology

Legislative acts

Company Devana Technologies, Foundation “Živojin Mišić” and consequently the project “Made in Serbia” are trying to protect the products which are made in Serbia. Because of that, the main problem will be to ensure foreign people that all the mentioned products are completely made in Serbia. This can be done using the law based on Geographical Indications.

6. CONCLUSION

With the great pleasure and pride based on objective parameters it can be concluded that most celebrated Serbian products can stand on the same level with the more affirmed international brands. However, their implementation on the world market request adequate representation of products in foreign countries, which as the most important characteristic recognize quality. Knowing the market development needs and potential of the regional and individual sectors and established investment strategy and the strategy of industrial development, are essential in order to identify desirable investors who want clear insight into the situation and potential of each sector to invest in what they are interested. That can help the development of Serbian economy in so many ways.

The best results of our technical and technological efforts must find their way to the prestigious “Planetary market”. A significant step is the quality, strenuous marketing and ongoing commitment to raising the reputation of our country in all aspects, both in Europe and around the world.

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