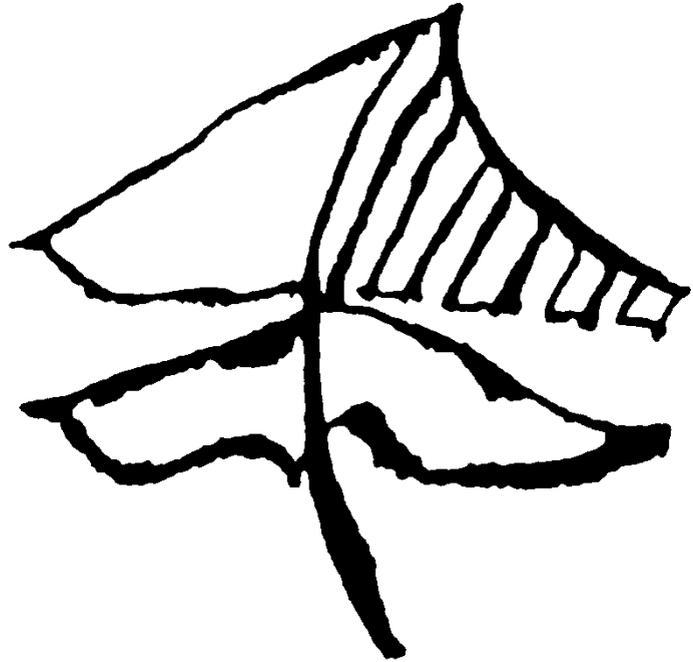


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Dear Readers!

Scientific Quarterly INTERCATHEDRA is the result of scientific, research and teaching cooperation of departments from Poznań, Zwoleń, Warsaw, Kraków, Tarnów, Trnava, Zlin, Žilina, Košice, Zagreb, Brno, Prešov and other Polish and foreign scientific centres dealing with issues of economics, organisation, programming, management and marketing, especially, but not only, in arboriculture.

No 29/2 contains articles ordered by the Editorial Board in 2013 year - approved for printing following reviewers' positive opinions and necessary amendments.

In 2013, the Scientific Conference ECONOMIC FORUM in Laski was suspended. So far, scientific meetings were held annually for 17 years - from 10 September 1996 till 20 September 2012. 15 Conferences took place at Laski Halls of Residence, Forest Research and Education Centre and Forest Experimental Department in Siemanice. In 1996 the first Conference took place at Zielonka Halls of Residence, Forest Experimental Department in Murowana Goślina. In 2004 the ninth meeting took place in Kępno, at the training center of the Ministry of Industry.

The most important reason for suspending the Economic Forum Scientific Conference have been financial problems related to its budget.

The articles which represented high quality as they were prepared for a much earlier announced Economic Forum 2013 Scientific Conference and underwent a full verification process carried out by the Editorial Staff - are partially published in this volume of INTERCATHEDRA journal. The remaining ones will be published in subsequent issues following earlier verification.

Scientific Quarterly INTERCATHEDRA are published under the auspices of IATM - International Association For Technology Management. The members of this scientific network volunteered to write their reviews, prepare materials for publication and organised 17 scientific conferences. I would like to take this opportunity to thank them for their contribution and dedication.

Wojciech Lis



*Irena Bekier*¹

INTERPERSONAL CONFLICTS IN AN ORGANIZATION AND THEIR CIRCUMSTANCES

Abstract: This paper presents the theory of interpersonal conflict. It discusses various definitions related to the core conceptual category of a conflict, occurring within an organization (company, enterprise). Typology of interpersonal conflicts in an organization, based on different criteria, was reviewed. Detailed description of beneficial and harmful conflicts, as well as major differences between them, were provided. Particular attention was paid to the circumstances of these conflicts, with special focus on the importance of the organizational culture.

Key words: interpersonal conflict, organization (company), functional and dysfunctional conflict, organizational culture, conflict-inducing factors.

INTRODUCTION

Conflicts are a regular part of our life. They are intrinsically associated with the nature of interpersonal relations and are not a bad thing. However, solutions to the conflicts may be wrong and detrimental, hence there is a need to acquire a constructive approach to a conflict, and to provide a possibility of creative solutions, beneficial for both parties. Such solutions make the parties understand each other better, facilitate setting out a cooperation strategy and bring them a lot of personal satisfaction. Therefore, our aim should be not to avoid conflicts, but to learn how to take advantage of their positive aspects, and mitigate the negative sides. Striving for cooperation rather than competition, focusing on the problem instead of pretending that everything is all right, looking for a positive, long-term solution that meets the needs of both sides, are the features of a useful and functional conflict, as opposed to a harmful and dysfunctional one. It is therefore important to gain some knowledge about the nature of conflicts, their characteristics, causes and methods of their management. Working out a constructive solution is also a useful skill. We need to be aware of the fact that interpersonal conflicts, including those within an organization or a company, occur when the actions of one person hinder or prevent the actions of another person. The conflicts may involve aims, ways of achieving them, needs and expectations. It is also important to know conflict detectors, circumstances and possible solution strategies. This makes it possible to increase the share of good solutions to problems in interpersonal relations, both in our professional and private life.

CONFLICT DEFINITION

The issue of interpersonal conflict has been investigated by researchers from different fields, including psychology, pedagogy, sociology, political science, history, and therefore it is difficult to present an unambiguous definition. From a lexical point of view, according to the Polish Dictionary [2012], interpersonal conflict is a disagreement between the parties, a difference in values, attitudes that can not be avoided.

According to psychologists, e.g. P.G. Zimbardo [2006], interpersonal conflict involves simultaneous presence of contradictory or mutually exclusive impulses, desires or incompatible reactions. Similar definition of a conflict was provided by J. Koziielecki [2000], who recognized it as the most important cause of thwarting human ambitions. Koziielecki discerned two types of a conflict: internal - motivational, and external - interpersonal, which occurs when there is a contradiction between the aspirations of an individual and those of other people. In addition, it was pointed out that a conflict is a declaration of war between parties that are dependent on each other

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[Adler, Rosenfeld, Proctor II, 2011]. Lack of recognition that the condition of one party depends on the actions of the other party constitutes a major obstacle to resolving the conflict. The authors believe that conflicts can not be avoided, thus the acquisition of creative tools to solve them is a must and constructive perception of a conflict is the only chance to change the conflict situation [McKay, Davis, 2007].

In the context of an organization a conflict is defined as a disagreement between two or more members or groups, resulting from the need to share limited resources or tasks, but it can also be the result of representing different positions, different goals, values, and different perceptions [Zimbardo, Ruch 2006]. Zimbardo and Ruch [2006] indicate that in an organization the concept of competition is parallel to the conflict. They are different in that the conflict occurs when one party can prevent the other from achieving their objectives, and there is no such possibility when the competition is involved.

TYPES OF CONFLICT WITHIN AN ORGANIZATION

Interpersonal conflict within an organization may occur between superiors and subordinates or between employees of the same rank. The cause of this type of conflicts is usually a misunderstanding or lack of understanding associated with the received order, or different perception of fairness concerning employee performance evaluation [Jurkowski 2004]. J. Stoner and Ch. Wenkel [1994], distinguished five types of conflict within the organization based on the conflict's subject. These are:

- intrapersonal conflict of an individual - when a person does not know what work is expected of them, or if the expectations of that person's actions are greater than their opinion of their own abilities,
- conflicts between individuals - a result of different personalities, the most common form is the conflict resulting from a professional position, e.g. between a manager and an employee,
- conflict between an individual and a group - a response to the pressure from the other employees, it leads to forced conformity,
- conflict between groups in the same organization - occurs between the employees and the management,
- conflict between organizations - it is usually associated with the competition, may result in new technologies, products or services.

Table 1. Differences between functional and dysfunctional conflicts

CONFLICT DIMENSION	FUNCTIONAL CONFLICTS	DYSFUNCTIONAL CONFLICTS
Relationship between the parties	integration	polarization
Perception of the parties	cooperation	opposition
Attitude towards the other person	approval	disapproval
Emotions of the parties	consent	coercion
Approach to the problem	de-escalation	escalation
Methods for solving the conflict	focusing on the problem	giving up
Perspective	farsightedness	short-sightedness
Effects	positive	negative

Source: compiled from: R.B. Adler, L.B. Rosenfeld, R.F. Proctor II, *Relacje interpersonalne. Proces porozumiewania się*, Dom Wydawniczy Rebis (Rebis Publishing House), Poznań 2011, pp. 371-378.

Interpersonal conflicts are often classified based on the criterion of functionality. R.B. Adler et al. [2011] distinguished two types of conflicts: useful - functional and harmful - dysfunctional. The main difference between these two types is not the subject of the conflict, but the individual communication style. Specific differences concerning different dimensions of the conflict are presented below in Table 1.

The features presented in the above table indicate that functional conflict is characterized by a common interest of the participating parties, and the awareness of the other person's needs. This integration is accompanied by co-operation, expressed by the desire to reach a solution satisfying for both parties to the conflict. Another feature is the approval, manifested by kindness and identified as lack of attempts to dominate the other person. A typical feature of these conflicts is also a desire for consent, as evidenced by the willingness to look for solutions that allow the parties to get what they want and expect. Creative problem solving is characterized by de-escalation, which means giving up the use of force, assault, threats and blackmail. This allows the parties to focus on the problems and identify them early on, thus demonstrating their foresight. Finally, the functional conflicts are characterized by positive effects. They enable the parties to create a space for expressing their feelings, emotions and tensions, without holding a grudge against the conflict partner.

The relationship between the parties of a dysfunctional conflict is based on the lack of respect, a belief in the greater fault of the other party and perceiving oneself as an open and trustworthy person, and the adversary as a deceitful and false individual. This situation, called polarization, does not allow the parties to notice their common objectives, and results in perspective-limiting short-sightedness. It facilitates building the opposition in a zero-sum game - "if you win, I lose." This approach creates a ground for a disapproval, expressed by attacking the other person. The development of negative emotions in this type of conflict results in a coercion, where one party exercises their advantage. Accumulating differences lead to bringing up the issues unrelated to the original problem. This way the parties become engaged in the conflict that often involves escalation, i.e. losing control over the situation and entailing numerous adverse effects [Adler et al. 2011].

Another classification of conflicts, based on different criteria, was proposed R. Jurkowski [2004], and is presented below in Table 2.

Table 2. Typology of interpersonal conflicts by R. Jurkowski

CRITERIA	TYPE OF CONFLICT	
	OVERT	HIDDEN/ULTERIOR
Actions	Actions: open, transparent, e.g. objection, appeal, competition	Actions: ulterior, e.g. the impression of "bad atmosphere"
Attitudes	REALISTIC They result from non-compliance of objectives and means of achieving them.	UNREALISTIC They are the manifestation of aggression motivated by a desire to harm or defeat the other party.
Reasons	RATIONAL Reasons: objectified Argumentation: logical	IRRATIONAL Reasons: subjective, e.g. aggression Argumentation: emotional
Effects	CREATIVE Bring about a positive change Relationship: "winner - loser"	DESTRUCTIVE Breaking the relationships, loss of confidence, negative attitude Relationship: "loser - loser" or "winner - loser"

Source: compiled from: R. Jurkowski, *Komunikowanie się: zarys wykładów*, Oficyna Wydawnicza WSM SIG, Warszawa 2004, p.130.



SELECTED CIRCUMSTANCES OF INTERPERSONAL CONFLICTS WITHIN AN ORGANIZATION

An organization is a place where the interpersonal conflicts are very well visible and their main causes include:

- sharing of resources
- incompatible objectives
- interdependence of work
- different opinions, values
- individual communication styles
- organizational ambiguity

Resources are the source of conflicts because of their limitedness. Their division results in diverse share allocated to individual groups. This causes competition, which may lead to the conflict or lack of cooperation. In an organization, each department has its own objectives and priorities, and tries to achieve them. Internal differentiation of both interests and points of view very often prevents effective execution of tasks, despite the fact that all the employees believe they work for the good of the company. Therefore, the level of objectives is another confrontational space within the organization. If two or more departments are interdependent while performing their tasks, the situation of work interdependence occurs. This shall cause conflicts in the following circumstances: firstly, when all groups are entrusted with too many tasks, and secondly, when even distribution of works is accompanied by varied wages. People in the organization present individual attitudes, have diverse views on many issues, or different value systems. This factor can also be a cause of the conflict, which may have its origin in such a statement as: "doing it your way is too expensive," "but we will lose the reputation for high quality, if we do it your way." When there is large group diversity, another conflict-inducing factor is an individual style characterized by the attitude towards work, the age, education and personal features of an employee. Apart from that, other reasons for conflict may involve ambiguous definition of an employee's duties, the tasks to be performed, and even objectives, the implementation of which should be striven for. The conflict also appears if there is a collision of competences, the ground of which is the lack of knowledge of other departments' work [Stoner, Wankel 1994].

Considering the context of conflicts within the organizations, one should remember the meaning of the organization culture, which, according to S. Čeřpa and T. Witkowski [2004, p. 46], is defined as "a system of values and attitudes expressed by complementary system of symbols created during human interactions". Taking into account the characteristics and patterns of the company management behavior, five the most conflict-inducing cultures can be distinguished. These are:

- **PARANOID CULTURE** - involves adherence of the company management to the so-called "conspiracy theory". Typical features include: fear, lack of confidence, reserved attitude towards people, not showing kindness and cordiality and surrounding themselves with security personnel, paying a lot of attention to security, e.g. codes, paper shredders, alarms.
- **FORCED CULTURE** - based on maintaining control over the entire environment by the management. What matters is the meticulousness and perfectionism. The structure of the company is based on seniority. Surprises and coincidences must be always avoided. Emotions are undesirable, and cooperation with this company is like dealing with a meticulous accountant.
- **DRAMATIC CULTURE** - opposite of the forced culture. Its main features are spontaneity and intuition. It is believed that rules and structures are not conducive to the execution of objectives. The management wants to be admired, they are often convinced of their genius

and charisma. They need to be the center of attention, and they take important decisions. New ventures, even dangerous, are enthusiastically adopted, and successes are sumptuously celebrated.

- **DEPRESSIVE CULTURE** - created by people who believe that they cannot influence the established order of things. Even if they may exert some influence they do not do that, as they think they lack competences. They make up pessimistic forecasts. Human behaviour in the company is determined by a routine. Power is divided and the fact of being powerful does not really matter.
- **SCHIZOID CULTURE** - characteristic features in the company include loneliness, distance, fear of engaging in anything. The management show indifference and lack of contact with other people, who are perceived as a potential threat. Working in such a company offers no excitement - there is neither anger nor enthusiasm.

In addition to the presented circumstances of interpersonal conflicts, intentionally selected due to their direct connection with an organization or a company, there are a number of other conflict-inducing factors, associated with personality or of environmental and social nature. They involve such characteristics as: gender, self-esteem, needs, fulfilling social roles, communication and other interpersonal skills, e.g. dealing with stress, etc.

CONCLUSIONS

The literature related to the issue of interpersonal conflicts lacks a single, universal definition of this concept. Conflict classification takes into account various criteria, such as the subject of the conflict, its functionality, causes and effects. The issue of conflicts is also considered in the context of an organization, and conflict-inducing factors are investigated. A particularly important factor, apart from such elements as: different objectives, work interdependence, individual style of organizational ambiguity, is the organizational culture. Efficient and effective performance, both professional and personal, requires knowledge on the nature of conflict, creative approach to conflicts, and the ability to solve them effectively. The level of this knowledge is an indicator of the emotional intelligence, that determines a success and achieving the set objectives in different areas of life. Each individual can acquire and improve their skills in this field.

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Emilia Grzegorzewska, Izabela Niziałek²

DETERMINANTS INFLUENCING CHOICE OF STUDIES – A CASE STUDY OF FACULTY OF WOOD TECHNOLOGY WARSAW UNIVERSITY OF LIFE SCIENCES (SGGW)

Abstract: Unfavourable tendencies resulting from global economic crisis influence economic situation on the job market and career prospects for college graduates. Obtaining a degree does not guarantee employment with the acquired qualifications. That is why more and more candidates choose subjects that provide greater chances of employment in the educated profession. One of such options is Faculty of Wood Technology in Warsaw (SGGW).

The article presents survey findings. The statistical survey was conducted at the Department among 180 full-time and part-time students regarding the primary factors determining their choice of studies.

Key words: higher education, wood technology, determinants of choice of studies

INTRODUCTION

Economic crisis, which has been fought with for a few years now by both private and state-owned companies, influences the society. One of the negative consequences of the crisis is the increase in unemployment – in May 2013 it was 13.5 % [www.stat.gov.pl]. Unemployment is one of the most important economic problems in the times of crisis. High and long-term unemployment means that the economic problem has not been solved and the crisis is taking form of a long-term recession [www.monitor-ekonomiczny.pl]. Another side effect of the events of recent years is the fall in economic growth visible in industry – in the first quarter of 2012 it fell to only 5% and in the second quarter it was 3%.

Economic crisis by definition is a strong and long-term fall in economic activity of a given society, organization or enterprise. Economic activity is measured as a quotient of two variables: employment and work efficiency. Level of employment in Poland (working population) is particularly low. Among EU countries Poland, in the first decade of the 21st century, ranked lowest as regards employment. The permanently (throughout the whole decade) lower unemployment rates were only in Italy and Malta, occasionally in Hungary and Slovakia. European Portal of Occupational Mobility (*Europejski Portal Mobilności Zawodowej*) posted: „Employment rates in Poland have been low for years. In the year 2011 the employment rate of working population in Poland (15-64 years old) according to Eurostat was 59.7 % and was lower compared to 27 EU countries, where the rate in question was 64.3%” [www.monitor-ekonomiczny.pl].

Wood sector is a key creator of numerous vacancies. In 2011 in more than 27 thousand enterprises functioning in the wood, pulp and paper and furniture industry 309 thousand people were employed (data by GUS). The key characteristic of the sector is a considerable percentage (90%) of small companies employing fewer than 10 people. In the context of job market and negative consequences of the economic crisis it is a positive phenomenon that wood sector is located out of big cities, in weakly urbanized regions and in the country [Ratajczak 2012].

HIGHER EDUCATION IN POLAND

In Poland since 1989 the number of colleges and students has been increasing. The situation was undoubtedly influenced by establishment of private universities and a rise in the number of

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courses run part-time. It has been visible for many years now that more and more people are interested in obtaining a degree, especially in economics, law as well as state administration. Unfortunately, the period of increasing university enrolment is coming to an end.

Factors influencing the situation undoubtedly are [Strategia Rozwoju... 2010]:

- predicted fall (at least 25%-30% until 2020) in the number of students caused by demographic reasons;
- the sustaining instability of public finances, which even with high rate of economic growth will restrict the greater burden on the budget as regards expenditure on higher education;
- Poland's engagement in EU initiatives and programmes regarding education sector and higher education.

Current education offer allows students to obtain education at different levels. The two primary options are: Bachelor's degree and Master's degree. It is also possible to continue studying at doctoral or postgraduate level. The greatest drawback of today's education system is its little flexibility in terms of curricula. In "Strategy for development of higher education until 2020" ("*Strategia rozwoju szkolnictwa wyższego do 2020 r.*") it was suggested that academic centres should be systematised regarding research interests and specialisation of the academic employees. As a result, four primary groups of colleges could be established [Strategia Rozwoju... 2010]:

- academic colleges – not known in the present education system offering multidisciplinary BA studies;
- vocational colleges – BA and MA studies preparing for a given profession;
- academic universities, conducting research which, apart from BA and MA studies, will be running doctoral studies covering the research in question;
- research academies – being a subgroup of academic universities characterised by outstanding research achievements in a number of fields and focusing on research activity.

Some colleges or even departments are beginning to realize that implementing changes in scientific and didactic activity is essential. An example to follow is set by Faculty of Wood Technology in Warsaw (SGGW) and Poznan University of Life Sciences. Both universities fit into the trend of vocational education.

WOOD TECHNOLOGY - CHARACTERISTICS

Wood technology borders on agricultural and forestry sciences. However, with its specificity it covers many technical areas, which has its foundation in the real economic demand (wood and furniture industry). Moreover, the major provides engineering skills and is by all means interdisciplinary, partially connected with forestry and to a lesser degree connected with material engineering, design, construction, as well as conservation and restoration of works of art.

Wood science and furniture design are one of the strongest branches of Polish industry – over 65 thousand subjects (firms), employing more than 250 thousand people, lack qualified employees. Graduates of wood technology are prepared to work in wood manufacturing plants (furniture, woodwork, wood-based panels and sawmill production), firms and trade agencies (trade in lumber, wood products, adhesives, painting and varnish materials as well as tools and machines for timber construction, shipyard and machinery, designing offices, scientific and didactic institutions as well as vocational education, and antique preservation and conservation offices.

Faculty of Wood Technology in Warsaw (SGGW) is the oldest European academic faculty covering the overall issue of wood science, founded almost 70 years ago. In 1946 the Section of Wood Technology was established within the Faculty of Forestry and since 1951 it has been functioning as an independent scientific and didactic section. Thanks to a long-standing experience, building close relations with the industry and creating professional scientific and didactic background the Faculty offers studies combining tradition and modernity. One can acquire there

different skills – a wood conservationist, furniture and technology processes designer as well as a manager of your own wood company.

An undeniable asset of obtaining Bachelor's or Master's degree in wood technology is the demand for such specialists on the market, both in Poland and in Europe. It manifests itself in particular attractiveness of job offers after graduation. Each specialisation broadens individual interests of the students. "Management and computing techniques in wood engineering" equips students with the necessary knowledge needed in managing teams of people or running own enterprise. "Furniture and wood constructions" allows students to acquire skills necessary in furniture design with the use of modern IT tools. "Conservation of antique wood" is a unique major in all Poland where students learn how to deal with valuable wood, more often than not being part of natural heritage.

In order to meet students' demands, Faculty of Wood Technology in Warsaw (SSGW) opened two new postgraduate studies which allow students to expand knowledge on industry development in wood sector as well as wood conservation. An initiative has been taken of broad cooperation with industry – paid traineeships for final years' students, both Bachelor's and Master's degrees. Some of the students after the traineeship are offered jobs in the given companies.

Faculty of Wood Technology in Warsaw (SSGW), monitoring the upcoming demographic decline has taken steps to provide the best education, research and development offer as well as tries to find the answer to the question why secondary school graduates choose this specific major.

STATISTICAL SURVEY RESULTS

Statistical survey was conducted at the Faculty of Wood Technology in Warsaw (SSGW) in November, 2012. Respondents of the questionnaire were students, both Bachelor's and Master's degree, full-time and part-time. The primary goal of the survey was to determine factors behind their decision to study at the Faculty.

180 respondents took part in the survey, including 105 full-time students (60%) and 75 part-time students (40%) (table 1). Overall the survey sample comprised 28% of women (51 women, including 33 full-time students and 18 part-time students), and 72% of men (72 and 57 respectively). Students of 1st, 2nd, 3rd and 4th year of BA studies and 1st and 2nd year of MA studies took part in the survey.

Table 1. Division of survey sample on the grounds of type of studies and sex.

Sex	Full-time	Part-time	Altogether
Women	33	18	51
Men	72	57	129
Altogether	105	75	180

Source: own study.

One of the most important questions posed in the questionnaire covered the information whether the Faculty of Wood Technology in Warsaw (SSGW) was the first choice of studies. Among those who decided to study full-time more than 55 gave positive answer which comprised 52% of the respondents. Opposite opinion was presented by 50 students which makes up 48% (figure 1). Among the questioned women studying full-time, 48% claimed that studying at the Faculty was their first choice. With regards to men, the percentage was higher and it was more than 54%.

As regards men studying part-time, similar tendencies as in full-time studies have been observed. More than 53% of them gave positive answer. Most of the female students (54%) said that the Faculty of Wood Technology in Warsaw (SSGW) was their first choice.

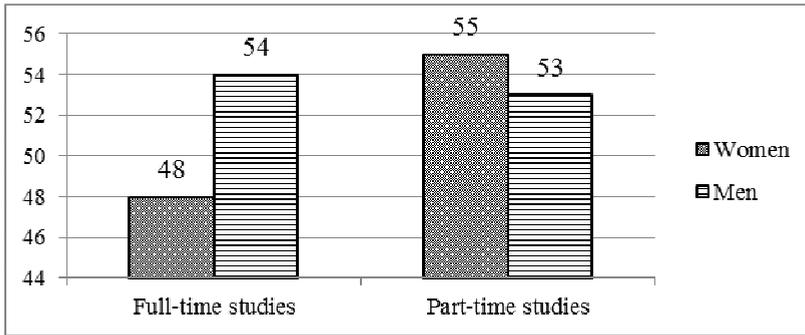


Figure 1. Percentage of students who gave positive answer to the question whether Faculty of Wood Technology in Warsaw (SGGW) was their first choice [%].

Source: own study.

An important aspect regarding the choice of studies is also students' experiences in the wood sector. Almost 70% of those studying full-time and more than a half of students studying part-time was not involved in any way in wood science before deciding to study at the Faculty (table 2). Almost 25% of the respondents (both full-time and part-time) said that their relatives are involved in wood sector. Only 7% of the respondents studying full-time confirmed earlier employment in the wood sector, in part-time studies it was 21%.

More than 70% of students of both types of studies, who took part in the questionnaire, had no connection with wood sector. As regards men, the percentage was much lower. In full-time studies 65% of the respondents had no experience, in part-time studies it was 47%. It needs to be noted that almost every third of part-time students already worked in wood sector. As regards women, it was only 6%.

Table 2. Percentage of students who answered the question: Were you involved in wood sector before beginning studying? [%].

Itemisation	Answers			
	No	Yes, because family members are involved in wood sector	Yes, I have worked in wood sector	Yes, because
Full-time studies				
Women	73	27	-	-
Men	65	24	11	-
Altogether	69	24	7	-
Part-time studies				
Women	72	22	6	-
Men	47	23	27	3
Altogether	53	23	21	3

Source: own study.

From the research conducted at the Faculty of Wood Technology in Warsaw (SGGW) it follows that more than a half of part-time students believe that their earlier experiences influenced their decision of choice of studies (table 3). For full-time studies the percentage is lower of 9 percentage points. It needs to be noted that as regards women altogether, smaller proportion of them

gave positive answer to the question. The situation was similar for both full-time and part-time female students.

Table 3. Percentage of students who answered the question: Did earlier experiences in the wood sector influence your decision of the choice of studies [%].

Itemisation	Answers	
	Yes	No
full-time studies		
Women	38	62
Men	45	55
Altogether	42	58
part-time studies		
Women	40	60
Men	52	48
Altogether	51	49

Source: own study.

An important aspect of the research was posed in the question regarding the primary reasons why respondents decided to study at the Faculty of Wood Technology in Warsaw (SGGW). The first one was good career prospects. Among those who study full-time this answer was put forward by every fifth respondent. In part-time studies the percentage was even higher (35%). Other reasons were: interest in the subject (12% - full-time studies and 14% - part-time studies), opportunities of knowledge expansion and professional development (9% - full-time studies, 18% - part-time studies). Moreover, part-time students emphasised current employment in wood sector.

CONCLUSIONS

Economic crisis, which began at the turn of 2007 and 2008 in the United States, has unfavourably influenced economic situation in most countries, including Poland. The situation triggered a number of negative consequences for both companies and the whole society. Consequences of the crisis are also visible on the job market. The relatively high long-term unemployment rate in Poland has been deepening the negative consequences on the market. Graduating from university does not guarantee employment with the acquired qualifications. That is why would-be students choose studies that offer good career prospects in the chosen field. One of them is the Faculty of Wood Technology in Warsaw (SGGW).

From the conducted survey it follows that 52% of full-time students and 56% of part-time students chose the Faculty as their first choice.

Positive answer to the question – were you involved in wood sector before beginning studying? – was provided by 31% of full-time students and 47% of part-time students. It needs to be noted that every fifth student of full-time studies has been and/ or still is employed in the wood industry. As regards part-time students, only 7% of them have been employed in the wood industry.

Survey findings showed that in part-time studies a greater proportion of students (9 percentage points) confirmed that their involvement in the wood sector influenced their choice of studies.

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*Emilia Grzegorzewska*³

ECONOMIC ASPECTS OF INNOVATION IN WOOD SECTOR ENTERPRISES IN POLAND

Abstract: Innovative activity is a key aspect in functioning of a company. Growth of competition resulting from market globalization, as well as a growing number of new customer expectations in the economic crisis force companies to look for new innovative solutions. However, deciding on innovation introduction needs to be economically justified from the perspective of the company. In the paper, economic aspects of innovative activity of companies functioning in the wood sector, compared to processing industry, have been presented.

Key words: Poland, wood sector, innovative activity

INTRODUCTION

In contemporary economic reality innovation is a key element of company functioning. Negative and long-term effects of economic crisis have in fact been noticed in all countries and in most industries. Insolvency spiral causes, for example, an increase in the number of companies going bankrupt, rise in the unemployment rate, deterioration of household living conditions and consequently fall in the demand for company services. These are only a few of the consequences of economic decline. Because of free commercial exchanges and consequent market globalization, not only European, but also global, negative effects of the crisis are more severe for both companies and the society. Crisis events that have taken place in the world economy in the last few years made it clear that the manufactured products and rendered services need to be better suited to the changing customer needs. Often meeting ever newer customer expectations leads to searching for innovative solutions. Hence, an important aspect of company functioning is innovative activity. The decision behind innovation introduction has to be economically justified, especially when it is taken in difficult and constantly changing economic conditions.

COMPANY INNOVATION – GENESIS AND DEFINITIONS

J. Schumpeter, an Austrian economist, is commonly referred to as the forefather of innovation. He was the first one to introduce the notion of innovation into literature. Since then a number of definitions of innovation have been put forward that emphasize their diverse technical and economic aspects. According to Drucker [1992] innovations apply to all spheres of company activity. That can refer to changes in product design, marketing method, offered price, service for the client or a change in organization or management methods. Hagen, on the other hand, lays emphasis on the practical aspect of application of innovative solutions. In his opinion, innovation is a process comprising all actions that lead to practical application of a new product or production method. Hence, innovations consist of two stages: discovery of new knowledge that increases demand for goods and services (labour cost per output unit), capitals and materials used for production and introducing this knowledge into production processes [Janasz, Koziol-Nadolna 2011]. Wide definition of innovation entails the need to name activities carried out in the field. According to J. Schumpeter, the list of industrial innovations determinants comprises [Świtalski 2005]:

- application of a new combination of production factors (components or proportions);
- new product manufacture (product functions, construction and materials);
- application of a new, not used before, manufacture method;

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- commencement of products manufacture in new factories (hence, the size of the machinery, speed and operation costs are better tailored to the needs of a given production process);
- setting up a new enterprise whose capital structure, means of financing or management system are better harmonized with the type of a new or existing product / process;
- manufacture and sale of already produced goods or new ones for the new market;
- bringing in production supply of raw materials and articles or machines and devices from new suppliers.

In literature numerous classifications of innovation appear. They adopt different criteria of their division. For example, as regards the source of innovation there are innovations based on: market research, modelling on activity of other organizations, or own study. As regards benefit criterion, innovations are divided into: brining costs reduction, generating multiplication or quality increase, improving safety and working conditions, protecting the environment [Kijek, Lisowski, Starzyńska 2013].

The most common typology distinguishes four types of innovations [Oslo Manual...2010]:

- *product innovations* – introduction of new or greatly improved products or services, that have not been used in the company as yet;
- *procedural innovations* – introduction of significant changes into the organisation of the company (among others, usage of new processes organisation method, or a change in the workplace organisation);
- *organizational innovations* – introduction of new for the company reformations in work organisation, or significant changes in establishing and maintaining relations with the environment;
- *marketing innovations* – introduction of a new marketing concept or strategy, such that will be significantly different from the methods used so far. Such innovations usually concern significant changes in packaging, appearance of the products, their promotion as well as pricing.

ECONOMIC DIMENSION OF INNOVATION IN WOOD SECTOR COMPANIES COMPARED TO PROCESSING INDUSTRY

Activity of companies from the wood sector plays a significant role in Polish economy. According to Polish Classification of Economic Activities (*Polska Klasyfikacja Działalności PKD*) wood sector comprises: manufacture of wood and cork products except furniture (16.0), manufacture of paper and paper products (17.0) as well as manufacture of furniture (31.0).

According to estimates by Central Statistical Office (CSO) worth of sold production in the wood sector in 2011 was 86.4 billion PLN which made up 9.1% of sold production in the whole processing industry. In the wood industry at that time more than 343 thousand people were employed, 160.7 thousand people worked in furniture sector, 126.9 thousand workers were involved in wood, cork and straw products manufacture, and in companies producing paper and paper products 56.1 thousand people were employed [Grzegorzewska 2013]. Furniture sector plays a significant part in Polish economy. Annually, worth of exported furniture comprises about 90% of the whole sold production. Poland ranks fourth in the world and third in Europe as regards furniture production. In the European market only Italy and Germany rank higher. In the world, apart from the above mentioned countries, China needs attention as the leader in furniture export [Grzegorzewska, Niziałek, Jencyk-Tołoczko 2012].

Important information on innovative activity of industrial companies, including wood sector enterprises, is derived from analyses by CSO entitled "Innovative activity of companies in Poland". According to the research in the years 2009-2011 in the wood sector the highest percentage of innovatively active companies (those which introduced at least one innovation or realized at least

one innovative project that was withdrawn or abandoned in the analyzed period, or has not been finished so it is being continued) was in paper and paper products manufacture (17.9%). The highest percentage of companies that introduced product, procedural and organizational innovations was noted in the above-mentioned group of companies. The leader in the innovative activity in the field of marketing was furniture industry – 8% of enterprises introduced such innovations. The least innovative turned out to be companies dealing with manufacture of wood, cork and wicker products [Grzegorzewska 2013]. It needs to be noted that innovative activity of companies in the wood sector, the same as other industrial enterprises, was chiefly financed with the use of own capital, next the money was obtained from bank loans.

According to the guidance in Oslo Manual one of the most important indexes used for assessment of economic effects of innovative activity is the share in the analyzed year in the sales income from new or greatly improved products, launched in the last three years in revenue altogether [Innovative activity of companies in the years 2009-2011]. The index shows what influence product innovations have on the overall structure of revenue and the level of innovativeness of a given enterprise.

The analysis of sales income levels from new and greatly improved products comprises [Działalność innowacyjna...]:

- new or greatly improved products for the market where the company operates, launched in the last three years;
- new or greatly improved products only for the enterprise, launched in the last three years.

It means that innovations that are new for the market as well as products and services that have not been offered as yet by a given company but were available on the market influence the economic aspect of company innovation.

According to CSO in industrial enterprises the share in sales income from new or greatly improved products altogether decreased in the years 2009-2011 from 10.5% to 8.9% (table 1). The percentage of sales income from new products for the market increased in the years 2009-2010 from 4.1% to 7.1% and a year later it decreased from 5.2%. However, new products for the company at the beginning of the analyzed period generated 6.4% of revenue altogether, in the consecutive years it decreased successively to 3.7% in 2011.

Table 1. Share in sales income from new or greatly improved products in revenue altogether in industrial enterprises [%].

Itemisation	2009	2010	2011
Altogether	10.5	11.4	8.9
new for the market	4.1	7.1	5.2
new for the company	6.4	4.3	3.7

Source: own study on the basis of "Działalność innowacyjna przedsiębiorstw w latach 2006-2009, 2008-2010, 2009-2011".

Throughout the analyzed period the structure of sales income from new or greatly improved products also changed: sales income from products new for the market made up 39%, products new for the company made up 61% of the sales income. At the end of the analyzed period the disproportions decreased, 58.4% - new for the market and 41.6% - new for the company.

In 2011 the highest index of economic aspect of innovation was noted in the voivodeships: Pomeranian (32.1%), Greater Poland (15.7%), Podkarpackie (10.5%). The smallest share in sales income from new or greatly improved products was noted in: Lubusz (3.5%), Lublin (3.6%) and Łódź (4.3%).

In the wood sector the highest index proving economic efficiency of introduced innovations was noted in 2011 in companies dealing with paper and paper products manufacture (14.3%) (Figure 1). Furniture manufacture ranked second where share in sales income from new or greatly improved products was 10.2%. As regards companies manufacturing wood, cork, straw and wicker products the index was 3.6% and was almost 60% smaller than its average value for the processing industry. It needs to be noted that in companies manufacturing paper and paper products sales income from new or greatly improved products in revenue altogether was 38% bigger than in processing industry. As concerns furniture enterprises the index was 13% bigger.

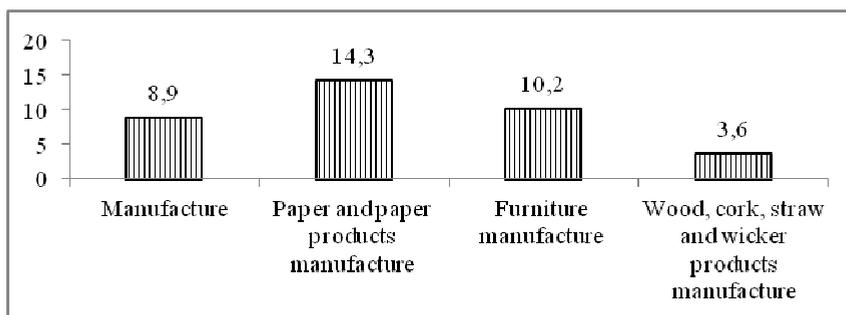


Figure 1. Share in sales income from new or greatly improved products in revenue altogether in wood sector companies compared to manufacture [%].

Source: own study on the basis of „Działalność innowacyjna przedsiębiorstw w latach 2009-2011”, p. 53.

An important element in assessing the level of innovativeness of a company is financial outlays on the undertaken innovative activity (table 2). In the years 2009-2011 funds for innovative activity in industrial enterprises were smaller, from 21 405.5 million PLN to 19 376.5 million PLN, 75%-82% of it was money for fixed assets. From 10% to 15% of the funds for innovative activity were spent on research and development. Moreover, the capital was assigned for knowledge and software purchase, employees training in innovative activity, as well as marketing covering new or greatly improved products.

Table 2. Outlays on innovative activity in industrial companies in the years 2009-2011 [million PLN].

Itemisation	2009	2010	2011
Altogether	21 405.5	22 379.0	19 376.5
R&D (Research and Development)	2 173.1	3 272.8	2 617.2
Knowledge purchase	267.8	910.6	257.8
Software purchase	356.6	451.8	428.6
Outlays on fixed assets	17 971.7	16 736.7	15 003.2
Employees training in innovative activity	44.6	88.3	64.8
Marketing covering new and greatly improved products	345.9	440.3	439.4

Source: own study on the basis of „Działalność innowacyjna przedsiębiorstw w latach 2009-2011”, p. 132.

Important information on innovative activity of wood sector companies is derived from research by CSO. Its results are presented in CEA groups: classes 16.0-18.0 (wood, cork, straw and wicker products manufacture, paper and paper products manufacture, printing and reproduction of recorded media) and classes 31-33 (furniture manufacture, other manufacturing, maintenance, repair

and installation of machinery). In 2011 outlays on innovative activity were about 855.5 million PLN and 669.5 million PLN respectively (table 3), 75% to even 90% of the funds were spent on purchase of fixed assets. Moreover, similar to industrial companies, funds were spent on: research and development, software purchase and employees training in innovative activity.

Table 3. Outlays on innovative activity in 2011 according to CEA [million PLN].

Itemisation	16-18	31-33
Altogether	855.5	669.5
R&D (Research and Development)	no data	127.5
Knowledge purchase	2.6	no data
Software purchase	22,9	11.3
Outlays on fixed assets	776.4	501.6
Employees training in innovative activity	2.0	2.8
Marketing covering new and greatly improved products	14.9	no data

Source: own study on the basis of "Działalność innowacyjna przedsiębiorstw w latach 2009-2011", p. 132.

Public support plays an important role in financing innovative activity. In wood sector it was paper and paper products manufacture that received the greatest public support among other innovatively active enterprises in the years 2009-2011. More than 34% of the companies in the field received public support in innovation. As regards companies producing wood, cork, straw and wicker products every fifth company could count on such aid. In furniture industry 21.2% of innovatively active companies received public aid. The first place among industrial companies as regards public support is occupied by: printing and reproduction of recorded media (36.7%) and production of other transport equipment (35.8%). The last ranked: maintenance, repair and installation of machinery (11.9%), beverages manufacture (14.9%) and clothes production (16.7%).

CONCLUSION

In the present economic reality deciding on launching innovative solutions is an integral part of functioning of a company. Competition growth resulting from market globalization, as well as ever changing needs and tastes of customers force companies to look for innovations in the field of the manufactured products or rendered services.

In the wood sector paper and paper products manufacture ranks first as regards the level of innovativeness. In this group the greatest percentage of companies introduced product, procedural and organizational innovations. As regards marketing innovations it was furniture sector that was the leader.

An important aspect of innovative activity is its economic effectiveness. One of the most significant indexes proving economic profitability of the introduced innovations is the share in the sales income from new or greatly improved products in the revenue altogether. In the wood sector it was again paper and paper products companies that scored the highest percentage (in 2011 14.3%). Furniture industry ranked second– 10.2% of all the revenue was sales income from innovative products. On average in processing industry the index was 8.9%. Moreover, it needs to be noted that in wood sector outlays on innovative activity covered mostly purchase of fixed assets (from 75% to 90%) as well as research and development.

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Martina Kalamárová⁴

THE PRINCIPLES OF BLUE OCEAN STRATEGY PRESENTED ON THE EXAMPLE OF IKEA COMPANY

Abstract: The article is focused on a type of business strategy called blue ocean strategy. The article points out the meaning of value innovation as the cornerstone of the blue ocean strategy and presents the main principles of that strategy on the example of Swedish company IKEA, offering a range of furnishing products.

Key words: blue ocean strategy, value innovation, IKEA.

INTRODUCTION

The objective of the article is a theoretical definition of blue ocean strategy and presentation of its main principles on the example of the Swedish company IKEA. This objective was fulfilled by analysis of using this business strategy – blue ocean strategy- in practise by IKEA.

Material, needed for processing this article, was obtained in secondary research, where we analysed existing and available literary and internet sources, which deal with issues of blue ocean strategy and value innovation. For analysing the business strategy of IKEA we used IKEA's concepts, vision and documents available on the official website of IKEA. During processing the article we applied methods of analysis, synthesis, abstraction, induction and deduction.

BLUE OCEAN STRATEGY AND ITS PRINCIPLES

Blue ocean strategy is a business strategy developed by W. Chan Kim and Renee Mauborgne. Blue ocean strategy (Kim, Mauborgne, 2005) is based on the value innovation and instead of focusing on beating the competition, the company focuses on making the competition irrelevant by creating a leap in value for buyers and company in opening up new and uncontested market space.

The key idea behind the blue ocean strategy perspective is encompassed by value innovation, or the pursuit of superior customer value at a lower cost. This perspective leads to a new definition of a target customer and focuses on what the customer needs and wants. Companies try to redefine the industry by searching for new customers and creating a new value proposition for customers instead of relying on imitation or incremental improvement over competitors (Lindič, Bavdaž, Kovačič, 2012).

Value innovation is the simultaneous pursuit of differentiation and low cost, which is creating a leap in value for both buyers and the company (figure 1).

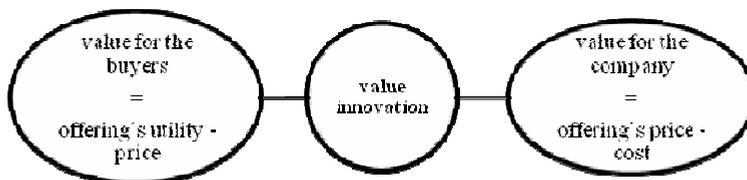


Figure 1. Value innovation

Source: Own elaboration based on www.blueoceanstrategy.com/concepts/bos-tools/value-innovation (cit. 2013-07-03)

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Value to buyers comes from the offering's utility minus its price, value to the company is generated from the offering's price minus its cost. Therefore value innovation is reached by balance of the whole system of utility, price, and cost (www.blueoceanstrategy.com/concepts/bos-tools/value-innovation, cit. 2013-07-03).

The value innovation is characterized by five main dimensions that differ from traditional strategic logic (figure 2).

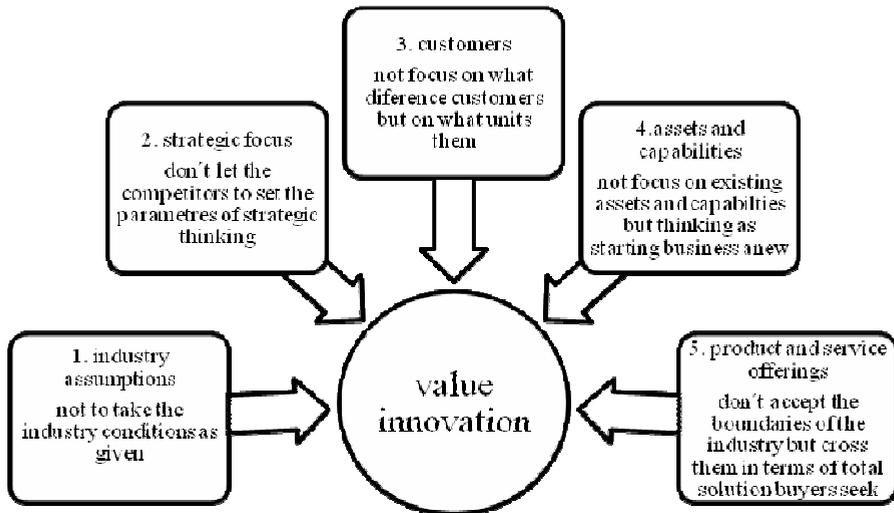


Figure 2. Dimensions of value innovation

Source: Own elaboration based on Kim and Mauborgne (1997)

The blue ocean strategy builds on the idea of a company's value creation in uncontested markets labelled "blue oceans", whereas conventional business strategy models focus on competing inside an existing "red ocean" by trying to beat the competition (Lindič, Bavdaž, Kovačič, 2012).

Blue ocean strategy is placed over red ocean strategy. Meanwhile red oceans are the areas known today as the icons in all industries and services and organizations engaged in the competition, blue ocean is a symbol of unknown space of business area and it is focused on the value innovation as a strategy that reduces the cost and time taken to create more value to the organization's stakeholders and simultaneously create new value for their customers (Mirrahimi, 2013).

The principles of creating blue ocean strategy are following (Kim, Mauborgne, 2005):

- create uncontested market space,
- make the competition irrelevant,
- create and capture new demand,
- break the value cost trade off,
- align whole system of a company's activities in pursuit of differentiation and low cost.

BLUE OCEAN STRATEGY PRESENTED AT THE EXAMPLE OF IKEA

The obtained theoretical knowledge of blue ocean strategy was used as the background for examining the use of blue ocean strategy's principles by Swedish company IKEA, as an example of company that has created new markets for their products through value innovation and uses blue ocean strategy in practise (table 1).

Table 1. Principles of blue ocean strategy declared by IKEA

Principle of blue ocean strategy	IKEA
New market space Make the competition irrelevant	Low prices from unconventional thinking – affordable prices by optimising all parts in their value chain; IKEA’s customers’ contribution to keeping prices low.
Align the whole system of a company’s activities in pursuit of differentiation and low cost	IKEA vision - offer a wide-range of well-designed, functional home furnishing products at prices so low that as many people as possible will be able to afford them.
Break the value-cost trade-off	Offer home furnishing products of good function and design at prices much lower than competitors by using simple cost-cutting solutions that not affecting the quality of products.

Source: Own elaboration

The IKEA vision (IKEA Group Yearly Summary FY12, 2012): “offering a wide-range of well-designed, functional home furnishing products at prices so low that as many people as possible will be able to afford them” put into practice the principle of blue ocean strategy to align the whole system of company’s activities in pursuit of differentiation and low cost.

Although IKEA had a European presence since the 1940’s, it entered the U.S. furniture market in the 1980’s, by creating their very own market. As is mentioned most blue oceans are created from within, not beyond, red oceans of existing industries. That is exactly the approach used by IKEA in America – they played off of the furniture market that offered furniture at steep prices and focused its efforts on furniture for every room of the house that could be easily assembled at home and for that reason purchased at very reasonable prices.

The IKEA Concept and innovative idea was to offer home furnishing products of good function and design at prices much lower than competitors’ by using simple cost-cutting solutions that did not affect the quality of products. Rather than selling expensive home furnishings that only a few can buy, the IKEA Concept makes it possible to serve the many by providing low-priced products (franchisor.ikea.com/concept, cit. 2013-07-02).

The main objective of IKEA is to reach many people and therefore their prices must be affordable. All IKEA’s product development starts with the low price in mind, challenging designers and product developers to find innovative ways to reach it.

IKEA works hard to create affordable prices by optimising all parts in their value chain by (IKEA Group Yearly Summary FY12, 2012):

- building long-term supplier relations,
- investing in a highly automated production,
- producing large volumes what reduces costs and secure a good quality over time,
- adapting the sizes and constructions of products to manufacture, packaging and transporting them in the most efficient way,
- partnership with customers (offering services for an additional charge, including picking with delivery, assembly and installation).

IKEA customers are more than consumers, they are collaborators in a process that makes stylish home furnishings available to the masses (VanGilder, 2013). The value innovation in IKEA is made by customers on one side and company on the other side (figure 3). Both of them contribute to affordable prices of the products. Customers as collaborators in the process, who select and pick up the products themselves, transport them in flat packs home and then assemble them themselves

are contributing that way to the value chain. This lowers the price by minimising transportation and storage costs. On the other hand, the company is making affordable prices by optimising all parts in their value chain. IKEA uses its vast knowledge of innovative, low-cost manufacturing processes to create functional products, large volumes of which are purchased to push prices down even further. In this way, the IKEA Concept uses design to ensure that IKEA products can be purchased and enjoyed by as many people as possible.

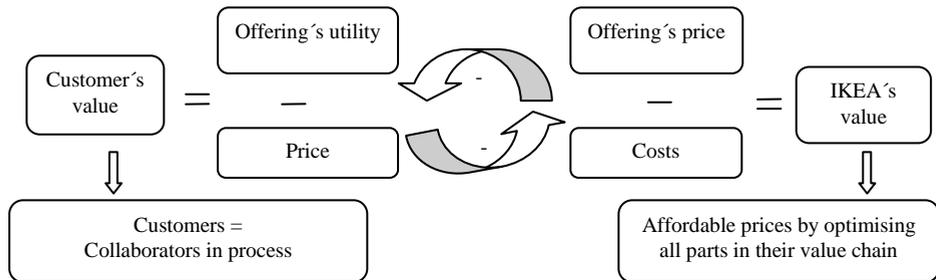


Figure 3. Value innovation declared by IKEA

Source: Own elaboration

CONCLUSIONS

The strategy is one of the central focus and critical issue in management studies. The paper focused on a specific type of business strategy – blue ocean strategy. That strategy is based on value innovation. The aspiration is to answer the questions how the company could eliminate and reduce the stated factors of the industry and market, which factors could be raised over the industry standards and find any factors, that have never the industry offered, to create. The clear example of company that has created new markets for their products through value innovation and uses blue ocean strategy and its principles in a practise is Swedish company IKEA.

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Vladislav Kaputa, Hubert Paluš⁵

USERS' ATTITUDES TOWARDS PRINT AND DIGITAL

Abstract: This paper deals with the end-users' attitudes towards print and digital information and preferences to use print or digital media. Results of pilot questionnaire survey showed that while digital media are preferred to be used for writing, printed media are still favoured for reading. Furthermore, users are rather traditional in storing written information in a printed form. The statistical tests carried out confirmed hypothesis that there are differences in preferences between defined groups of respondents categorised by gender, age and level of education.

Keywords: paper, print and digital, user's attitudes, preferences

INTRODUCTION

The invention of writing brought new possibilities to the area of exchange of information. Writing was invented independently in Egypt, Mesopotamia (4th millennium B.C.) and in China (3rd millennium B.C.). Since that time many changes have taken place. There are various media to carry information such as traditional paper used in many different forms – books, newspapers, magazines, or electronic media including TV, radio, Internet, PC, mobile phones, etc. Ability to read and write is an indispensable part of common life. These skills develop our minds and thus imagination. Literacy means that people can read and write in their native language, and therefore it represents a basic human right that should be supported and defended. Despite all the efforts to increase literacy in the world, there are still 775 million people who are illiterate and 85% of them live in 41 countries. Based on the fact that tens of millions of children do not go to school regularly, many countries will not be able to meet the global goal to achieve a 50% level of adult literacy by 2015.

In the past, people could primarily receive information through the printed media. However, due to the rapid progress in technologies, digital media outweighed the printed one. Digital media allow for broader acquiring of new information through a variety of appliances such as mobile phones, laptops, tablets as the Internet connection is presently widely available. Moreover, these media are enjoying popularity mainly due to the possibilities allowing for entertainment such as: listening to music, watching movies, playing games and using various applications.

There has been an increasing competition for traditional newspapers (radio, television and finally the internet) during the past decades. In many countries newspaper publishers found themselves in a very difficult situation. More and more people are no longer buying newspapers in paper form and have turned to reading their online versions. Such negative situation was even strengthened even further by the economic crisis. For example, the British company Trinity Mirror, which publishes the second best-selling newspaper Daily Mirror, lost 41% of the profit in 2009. Dozens of titles in the U.S. with over 100 years of history are fighting for survival. For example, daily Christian Science Monitor, the winner of the Pulitzer Prize, completely abolished the print issues and moved online.

In the world, however, there are still some areas where printed newspapers are still waiting for the greatest success. These are areas of Asia where the internet coverage is not yet as high. There are more daily newspapers issued in India than in the USA and newspapers are becoming an attractive medium for advertisers. However, in the long term, the future of the printed

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newspaper is uncertain. It is believed that newspapers, as we know them today will become luxury goods (Talarovič, 2010).

IAB Europe (2012) reported that classical newspaper is read by 82% of population in North Europe (NE), 70% in West Europe (WE), 56% in Central and East Europe (CEE) and 59% in South Europe (SE). Almost 430 million out of 652 million of adult Europeans use online environment. At average, people from CCE spend 16.1 hours, NE 14.8 hours, WE 14 hours and from SE 13.8 hours per week using the internet. According to Grabar (2012), reading is influenced by age, education, income and area of living. Up to 58% of people living in cities read for leisure compared to 47% of people living in rural areas. People in cities also read more electronic books.

According to Tušer (2010), there were 1,725 periodical registered in Slovakia in 2010. Sales of printed newspapers decrease and online issues are more and more popular. Rankov (2008) carried out a survey and concluded that up to 28% of respondents read printed newspapers and over 14% online newspapers daily. Over 30% of online readers hold university degree.

There is an increasing trend in reading electronic books. During the first quarter of 2013 one of the Slovak publishers sold 4,000 electronic books through its online shop. It is expected that this trend will continue. The global media company Piano Media has started its project of prepaid online information services (including newspapers) in Slovakia in 2011.

Fortunati and Vincent (2013) examined how students perceive the affordances of electronic reading/writing when compared to writing/reading on paper. This study has highlighted several points, first of all that writing on paper emerged as a task that has many more virtues than defects for the respondents. Reading/writing on paper seems to be a much more multi-sensorial experience than reading/writing on screen-keyboard. Even the paper itself is able to convey a multisensorial experience. On the whole, the emotional and sensorial experience on reading/writing on paper is much stronger than the digital one. From the research it emerged that handwriting on paper involves more of the body than the electronic typing on keyboards. Another aspect is that electronic writing, which is a great facilitator of the writing process, has had the effect of developing the production of writing, while it has not enhanced reading as well, which has moved forward little with the changing technologies. So if more technological innovation is needed in this process it is reading that requires it most. Finally, writing on a keyboard is a kind of 'augmented writing', because it is enhanced by the automatic corrections of orthographic, grammar and syntax mistakes, dictionaries, vocabularies, automatic translators, etc. From another perspective, however, electronic writing further promotes the loss of memory in comparison to the chirographic writing. Although writing on a keyboard saves time and offers greater functionality, at the same electronic writing increases the separation between the body and the product of its communicative activity. This research also concluded that multimodal communications media do not automatically convey richer communications in term of sensorial and emotionally intense experience. On the contrary multimodal communication media is barely able to offer the multi-sensorial experience enabled by reading/writing on paper.

METHODOLOGY

The new possibilities of paper utilisation and ongoing changes in end-users' behaviour (e.g. rapidly growing interest of consumers in digital media and digital information) attracted an interest of social researchers. This study was conducted using a pilot questionnaire survey in order to obtain information from end-users with the focus on their attitudes towards print and digital. The construction of the questionnaire allowed acquiring demographic data (gender, residence, age and education), and preferences for print or digital media and information. More detailed, the questions aimed at preferences for print or digital dealt with:

- preferences for storing written information in the print form compared to the digital one (Question 1)

- preferences for reading/writing on paper compared to reading/writing on screen/keyboard (Question 2 and 3)
- using an internet references (web page, QR code) by reading print article (Question 4) → augmented reality.

Answers were closed and responses were scaled using the 5-level Likert scale (from “Definitely yes” to “Definitely no”). Questionnaire was transformed to Google Docs document and distributed electronically via e-mails and social networks. The pilot survey lasted for one week. After this collection time the approach to the questionnaire was closed and data were processed using statistical methods - frequency and contingency analysis.

RESULTS

Totally, 316 respondents filled in and submitted the questionnaire. The sample consisted of 55% of women and 45% of men. A majority of respondents live in the towns (60 %) while the rest (40 %) in the rural areas. The youngest group of respondents (at the age 15-24 years) joined the survey with the share of 37%; exactly a half of sample size was represented by 25-40 years old respondents and those above 41 years represented 13%. The structure of respondents is shown in Table 1.

Table 1. Demographic structure of respondents

Gender		Residence		Age (years)			Completed education		
Men	Women	Town	Rural area	15-24	25-40	41+	Elementary	Secondary	University
45 %	55 %	60 %	40 %	37 %	50 %	13 %	6 %	49 %	45 %

Concerning the age structure of respondents, the results could be interpreted rather as attitudes of younger generation. Almost half of respondents (49%) finished secondary school/college, 45% completed a certain level of university education and 6% have elementary education (a part of those respondents may be studying at secondary schools presently).

Figure 1 shows preferences for storing information in a print form. It follows that about one third of respondents did not have unequivocally preferences for storing written information. Although, 43% of respondents preferred to store information in a print form and over half of them prefer it definitely.

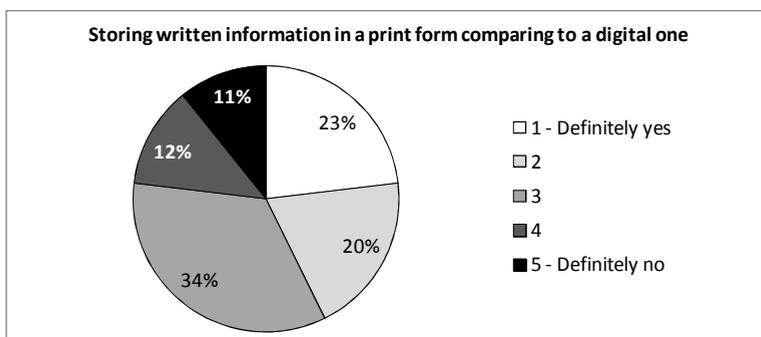


Figure 1. Preferences for storing written information in a print form compared to a digital one

Value of Pearson chi-square (Table 2) indicates statistically significant differences (at $\alpha=0.05$) between the respondents divided according to the education completed. A contingency analysis proved that significant share of respondents with the elementary education did not prefer to store written information in a print form comparing to other two groups.

Table 2. Pearson Chi-square values of Demographic data vs Question 1

Demographic factor	N	χ^2	df	p
Gender	316	8,654985	df=4	0,07033
Residence	316	1,306018	df=4	0,86035
Age	316	7,308580	df=8	0,50373
Completed education	316	17,07059	df=8	0,02938

Figure 2 showed that paper is still favourite medium for reading since 52% of respondents prefer it over digital media. Moreover, 30% of them prefer paper definitely. There is a high share (23%) of respondents with indifferent attitude. It may mean that they use both media more or less equally.

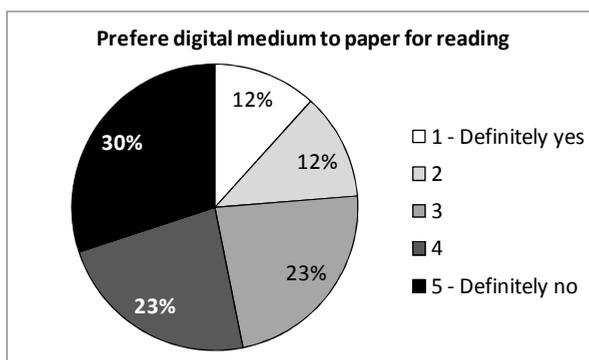


Figure 2. Preferences for digital medium (screen, display) to paper for reading

The results of contingency analysis (Table 3) indicated significant differences between men and women, where women markedly prefer to read from paper. Such a preference (although not statistically significant) appeared in the group of respondents above 41 years old as well as within university educated respondents.

Table 3. Pearson Chi-square values of Demographic data vs Question 2

Demographic data	N	χ^2	df	p
Gender	316	26,05261	df=4	0,00003
Residence	316	3,393888	df=4	0,49420
Age	316	9,204149	df=8	0,32537
Completed education	316	8,985133	df=8	0,34355

Preferences for writing on digital media are almost opposite comparing the previous one (Figure 3). Over half of respondents prefer digital media as PC, notebook or tablet for writing.

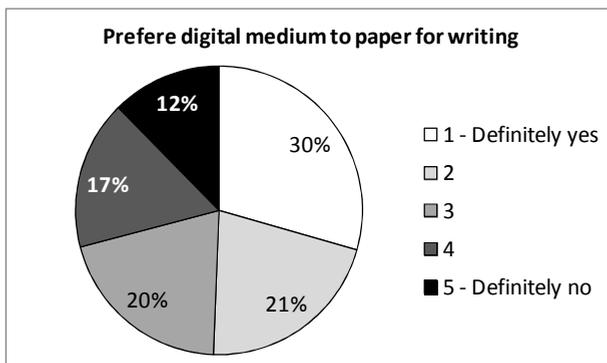


Figure 3. Preferences for digital medium (e.g. PC, tablet) to paper for writing

Values of chi-square (Table 4) pointed out statistically significant differences in preferences of men and women. The higher share of women (comparing to men) did not prefer digital media. The level of education is also a factor for which the answers are statistically significantly different. The highest preferences for digital media have university educated respondents. Conversely, the highest share of respondents who did not prefer digital media for writing is within respondents with elementary education.

Table 4. Pearson Chi-square values of Demographic data vs Question 3

Demographic data	N	χ^2	df	p
Gender	316	9,746695	df=4	0,04492
Residence	316	1,656157	df=4	0,79867
Age	316	11,95046	df=8	0,15343
Completed education	316	18,26991	df=8	0,01929

Some 43% of respondents use the internet references included in printed articles, meanwhile 31% have indifferent attitude (Figure 4). It could be interpreted as using internet references occasionally – depending on the topic and interest in the text being read.

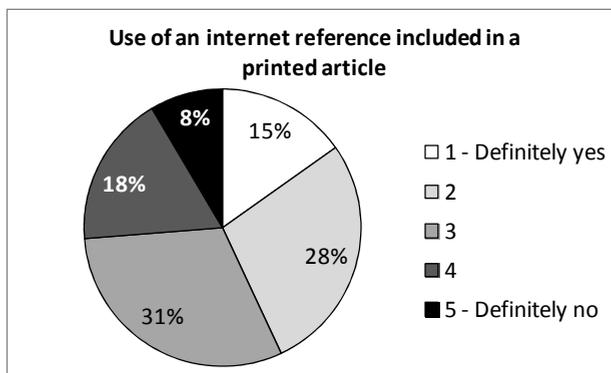


Figure 4. Preferences for the use of internet references (web page, QR code) included in a printed article

Statistically significant difference in preferences were found between age categories (Table 5), where respondents above 41 usually use an internet reference while those between 15 and 24 do not use it so often.

Table 5. Pearson Chi-square values of Demographic data vs Question 4

Demographic data	N	χ^2	Df	p
Gender	316	5,558400	df=4	0,23464
Residence	316	3,807236	df=4	0,43272
Age	316	30,53094	df=8	0,00017
Achieved education	316	11,79637	df=8	0,16052

CONCLUSIONS

Production and trade of pulp, paper and paperboard have increased steadily in accordance with the development of global economy. Europe reached record production and trade levels in 2004 and became the largest producing region, surpassing North America (Šupín, 2011). In spite of that fact, print has strong competitor in spreading the information. Digital media are broadly favoured and preferred especially on the markets of developed countries. This pilot study was aimed at identifying preferences for digital or print media and information. Results showed user's different attitudes in using these media. While digital media are preferred to be used for writing, printed media are still favoured for reading. Furthermore, users are rather traditional in storing written information in a printed form. Almost half of the respondents use the internet references included in printed articles, but almost one third of respondents have indifferent attitude to them.

We tested the hypothesis that there are differences in preferences between respondents divided into specific demographic groups (according to gender, residence, age, and achieved education). Contingency analysis showed some differences in preferences of certain demographic groups of respondents regarding specific questions. Especially differences between men and women in preferences for digital or print medium by reading and writing were statistically significant. Compared to men, women prefer to read from paper and even write on paper (although frequencies showed that women generally preferred to use digital medium for writing). The age plays a role concerning the use of internet reference (e.g. web page, QR code) by reading printed article. Surprisingly, respondents aged over 40 use it more when compared with the younger respondents.

Printed media still have future, although their structure on the market will be shaped following the development in digital technologies. New opportunities will arise in combining the print and digital. It is the approach which follows user's preferences and purchase behaviour.

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SOCIAL POLICY OF A COUNTRY UNDER CHANGEABLE CONDITIONS OF ECONOMIC SITUATION

Abstract: The European Union, consisting of integrated country organization, is very diversified when it comes to social policy models and vision of organizing social life. This article presents the most important European models considering economic aspects. The results of fighting the economic crisis and long term costs of different policies are presented.

Keywords: Social policy, social indicators, global growth indicators.

INTRODUCTION

Europe and especially the European Union as the most important association of European countries, is much differentiated in terms of social policy models. Each member state has its own vision of social life of its citizens, social justice and views on economics. Discrepancies between those visions are extremely deep, in some cases even contradictory. This paper is discussing the vulnerability of social policy models for changes in economic environment and social consequences for the citizens.

The current worldwide economic breakdown gives us a chance to conduct very important research analysis. In a situation where the global economy is stable and provides opportunities for fast growth it is difficult to state to what extent the model of social policy affects the economic development of a country. The difficulty lies in finding the causes of the overall amelioration of living conditions. These could be external factors such as economic growth of the biggest world economies or internal such as social policy role in managing the resources. The situation changes when the biggest economies are struggling with the economic crisis. In this situation one can exclude the positive external effects on economy or at least assume that its influence on economic growth is rather insignificant or sometimes even negative..

SCIENTIFIC HYPOTHESIS

1. Subject of the research.

Analysis of the main social policies in European Union and their effectiveness during global economic breakdown with special focus on social indicators.

2. Scope:

2.1. Essential. Social policy studies are designed to reveal a real vision of effectiveness of a given model in providing citizens with acceptable living conditions. To do this we will compare results from the period prior to the crisis with those that were collected during the crisis. The aim is to find if there are significant differences between social policies that are concentrated on supplying high living standards and those concentrated on market rules. The most effective model will not be the one that has the best social policy indicators but the one that will be characterized by the smallest negative changes of the indicators. To understand this approach one has to remember that the aim of social policy is to regulate the social life while the economic policy's aim is to ensure economic growth. However, these two aspects are closely related through the market that is shaped by social and political construction.⁷ While the economic area is susceptible to frequent volatility, the social area should be stable.

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⁷ Ha-Joon Chang, *The Role of Social Policy in Economic Development – Some Theoretical Reflections and Lessons from East Asia*, UN Research Institute For Social Development, Geneva 2002, s.3 (<http://www.unrisd.org>.)



2.2. Temporal. The research was divided into two sub periods. First was the time of economic high growth from 2005 to 2007, second the economic breakdown between 2008 and 2010. According to the economic cycles proposed by Clément Juglar the period of depression or boom lasts about 3 years. In this period the social policy should be efficient and worse economic situation should not be influencing the possibilities for taking actions.

2.3. Territorial. Research is based on European Union countries that represent each model of social policy.⁸

3. Description of research methodology:

The comparative analysis of indicators obtained from statistical database (Eurostat) Gathered data will be compared in a descriptive way in order to present changes between two periods.

DETAILED DESCRIPTION OF RESEARCH SUBJECT AND RESEARCH RESULTS

In the European Union countries there are 4 main socioeconomic models: Scandinavian, Anglosaxon, Continental and Mediterranean.

In developed democratic countries, with market economies, like the EU countries, economic results are strongly influenced by social attitudes towards the role of the country. Expectations towards social policy can span from welfare state to liberal policy. Each model can briefly be characterized by few distinguishing features:⁹

1. The scandinavian model can be distinguished by the high level of income redistribution in the society, the role of the country as a guarantor of social security and flexicurity. Countries that adopt this model have progressive income taxation with steep progression for the highest incomes. Thus, they reach one of the lowest indicators of statistical dispersion of income in society (e.g. the Gini coefficient), which at high levels causes social unrest and slows down development of the whole economy. This model fully accepts the Wagner rule, that the higher the national income per capita, the higher the part of the income should be taken over by government and transferred into social services. The role of the country is to provide security for its citizens in case of unexpected failure like loss of a workplace. Third characteristic feature of this model is flexicurity, a high elasticity of working possibilities (it's very easy to lose a job but it's also very easy to get a new one) combined with a sense of security – it's the country's role to care about its citizens in the period between losing a job and finding a new one.
2. In the Anglosaxon model very often the role of the country is compared with the role of a negotiator. First there must be a problem and afterwards the country tries to solve it, before that nothing is done (even if there are signs that it may become a problem in the immediate future). This model has a tendency to restrict the role of the country to assuring horizontal equity, i.e. to equalizing chances and access according to socially accepted norms. It permits diversification of income and one of the main aims of social expenditures is to assure continuity of employment.
3. The Continental model, also known as conservative-corporate, is a model in which the country anticipates social conflicts. While in the Anglosaxon model a country doesn't anticipate conflicts before they appear, in the Continental model a country tries to prevent conflicts when there are signals that they may appear. Social market economy or mixture of social security

⁸ Sapir A, *Globalisation and the Reform of European Social Models*, September 2005, (www.bruegel.org).
The main representatives of scandinavian model are: Denmark, Finland, Sweden and Holland; Anglosaxon: Great Britain and Ireland; continental: Austria, Belgium, France and Germany; Mediterranean: Greece, Italy, Portugal and Spain.

⁹ Esping-Andersen G., *The Three Worlds of Welfare Capitalism*, Cambridge: Polity Press, 1990, p. 167 -169;
The Mediterranean model was added to Esping-Andersen classification in 1996. Ferrera M., *The 'Southern Model of welfare in social Europe*, *Journal of European Social Policy* 1996, Vol. 6, No. 1, p. 17-37

with market mechanisms is characteristic for this solution. Countries should only correct market downsides. This model is rooted in the Christian Social Teaching especially regarding the principle of subsidiarity – a country intervenes only if smaller units like family or community can not address the problem themselves.¹⁰

4. The Mediterranean model is a quite recent model that evolved from the above. It assures social security like Nordic, provides economic liberty like Anglosaxon and accepts Catholic Social Teaching like Continental. In this sense, it is the model most oriented towards providing the best conditions for both social and economic development.

Popularity of each of these models depends on two factors, social attitude and economic situation. Each model requires an acceptance of socially accepted definitions of justice. Thus according to Miller¹¹ it is impossible to reach because justice contains three, mutually excluding elements: law (e.g. equality before the law, political freedom); merits (e.g. recognition for achievements); needs (provide standards and norms).

Table 1 presents the main indicators being used for evaluating the efficiency of social policy.¹² Four socioeconomic indicators have been chosen to make the comparison. The first one, Giny coefficient (ranging from 0 to 100%), defines if the economic changes have not caused social disparities, which the Scandinavian model will associate with social inequality. The higher the value of this indicator the bigger are the differences in incomes, which can indicate that the benefits or the costs of the economic processes are unequally distributed. The Scandinavian model is keeping the Giny coefficient on unchanged low levels regardless of the economic cycle. The Continental model is keeping its value on moderate level and allows a slight increase during economic crisis. The Anglosaxon and Mediterranean model reach high values of the coefficient which proves that income disparities are the feature of these models.

The second feature of the social policy is the spending on social security, a financial burden presented as the percentage of GDP. In the period of economic breakdown, this indicator has increased in all models. The increase was biggest in the Anglosaxon model with 5%. In the other models the increase was by 2%.

The third indicator, employment indicator is presenting the population of people employed in relation to population able to take employment. It is a better indicator than unemployment level due to the fact that it excludes the people that voluntarily do not undertake any employment. The Scandinavian model again keeps this indicator on the unchanged level, which is a good indicator of labour market solutions. The Continental model despite the economic breakdown period has increased the value of this indicator in relation to the economic boom period. The Anglosaxon model has shown high vulnerability to external conditions, showing high value during economic boom and medium value when the economy deteriorated. The fourth indicator, the poverty treat, is showing the percentage of the population for which the financial situation is very unstable. It is one of the main factors destabilising the situation of the family. Taking into consideration the danger of poverty, only in the welfare state countries this danger has diminished, in other cases it has grown slightly or remained unchanged.

Table 1 shows that the countries of Scandinavian model are characterised by the lowest dependency on external economic conditions, which indicates the stability of the system. It is supported by the fact that GDP per capita in Scandinavian countries, like the one in countries having

¹⁰ Orczyk J., *Polityka Społeczna, Uwarunkowania i cele, Akademia Ekonomiczna w Poznaniu, 2005, p.46.*

¹¹ Barr N., *Ekonomika polityki społecznej, Wyd. AE w Poznaniu, Poznań 1993, p. 70.*

¹² *The choice of indicators according to:*

Golinowska S., Hengstenberg P., Żukowski M., *Diversity and Commonality in European Social Policies, Wyd. Naukowe Scholer, Warszawa 2009, p. 23.*



other social policy models, has decreased of approximately 2%¹³ compared to 2007. Not much worse shows to be continental model. The biggest success of countries working according to this model is keeping the poverty endangered population on the same level and at the same time increasing the employment level. The most vulnerable to the external conditions is the Anglosaxon model, which despite the 5%¹⁴ growth in expenses for social security is experiencing a significant fall in employment indicator.

Table 1. Average values of main indicators for European social policy models

Policy models	2005 - 2007				2008 - 2010			
	Gini coef.	Spending on social security (% GDP)	Employment indicator	Poverty treat (% population)	Gini coef.	Spending on social security (% GDP)	Employment indicator	Poverty treat (% population)
Scandinavian	25,22	28,53	73,47	16,28	25,81	30,59	73,49	13,5
Anglosaxon	32,47	22,04	70,05	23,75	31,87	27,05	66,72	24,6
Continental	27,06	28,88	65,63	19,41	28,05	30,57	67,13	19,18
Meditarean	33,82	24,03	62,84	25,82	32,96	26,85	61,55	25,49

Source: own analysis based on data from Eurostat.

Democratically elected governments represent different social attitudes from social-democratic to liberal. Regardless of those attitudes governments must face the following problems:

1. Population growth;
2. Financial burden of the households;
3. Statistical dispersion of incomes;
4. Providing conditions for enterprise development.

The four challenges above of course aren't all of the problems that a government must face, but they are one of the main aims of social and economic policy. If we take the above challenges into consideration, we will find that the ideal social policy doesn't exist. Positive population growth is an effect of higher number of births than deaths in a period of time and/or a surplus of immigration over emigration. The preferred way of achieving the population growth depends on whether the dominant values in society favour financial stability for the families or possibilities for personal career and chances of personal development. In the first case social policy is a decisive factor, in the second the level of economic development is more important.

In a welfare state, banks are more likely to give credits because the government's support in a situation of deteriorating financial situation of their clients increases their security. In other models the banks have to carry the financial burden of their bad evaluations of their clients themselves, thus the phenomenon called "life on loan" is less likely to appear. Too high statistical dispersion of income is a negative phenomenon, but on the other hand, there is no agreement among scientists about the optimal level of this dispersion in regards to social stability and economic stimulation. Additionally it asks for social acceptance of vertical equity or transfer of income from groups with high income to groups with lower income, which according to mainstream classical economists has a negative effect on the level of investments. To provide favourable conditions for enterprise development calls for a balance between social interests and economic calculation that is attractive to investors, they on the other hand are more and more often moving the production to the countries offering cheaper labour and lower taxes.

¹³ Source: Eurostat

¹⁴ Ibidem.

The Scandinavian model seems to be the closest to the ideal. However, according to long term estimations made by research on Global Growth Generators until 2050, the countries that follow the Scandinavian model and are among the worldwide leaders of the highest income per capita today, will have to give a leading position to the countries that follow Anglosaxon or Continental model (see table 2). The Netherlands and Sweden that are now in the first 10, will gradually loose its positions in the ranking. Austria up to year 2050 will keep its place among first 10 wealthiest countries measured by GDP per capita, while Great Britain will appear in the ranking in 2030 and will gradually strengthen its position. In its aims EU has many economic aspects, like the one to be the most competitive economy in the world. Due to the fact that economic decisions are made centrally in Brussels and social policy is left in the competence of each member state, we should expect an evolution of the social policy models towards common social-economic ground. As it is shown in a table below, the market focus of the social policy is one of the factors securing the leading economic position of the country. The hybrid models can be expected. Even today it is hard to find a country that would strictly follow one social policy model. In case of an extraordinary situation, such as the current economic crisis, citizens form special attitudes and expectations towards the role of government participation.

Table 2. GDP per capita 2010 – 2050 (in PPP from year 2010)

Rank	Country	2010	Rank	Country	2030	Rank	Country	2050
1	Singapore	56,532	1	Singapore	99,880	1	Singapore	137,110
2	Norway	51,226	2	Hong Kong	79,041	2	Hong Kong	116,639
3	USA	45,511	3	Taiwan	73,219	3	Taiwan	114,093
4	Hong Kong	45,301	4	USA	67,687	4	Sth. Korea	107,752
5	Switzerland	42,470	5	Sth. Korea	63,923	5	USA	100,802
6	Netherlands	40,736	6	Canada	60,465	6	Saudi Arabia	98,311
7	Australia	40,525	7	Switzerland	58,690	7	Canada	96,375
8	Austria	39,073	8	Netherlands	57,185	8	GB	91,130
9	Canada	38,640	9	Austria	56,613	9	Switzerland	90,956
10	Sweden	36,438	10	Great Britain	55,839	10	Austria	90,158

Source: Buiter Willem and Rahbari Ebrahim, *Global Growth Generators, Citigroup's study of 3G nations, February 2011, p. 46*

CONCLUSIONS

The social policy is setting the way a country is influencing social life in the country. Each solution proposed by the social policy model as well as each economic decision is carrying the advantages as well as alternative costs. The Scandinavian model of social policy is showing the biggest stability as well as securing the best social conditions. The Continental model shows slightly worse results, moderate susceptibility on the external conditions. The most dependent on them is the Anglosaxon model as the most liberal one. The Mediterranean model, as the most vulnerable to external conditions, is the one least recommended to follow. From the results presented in table 2 we can draw a conclusion that the welfare state has its alternative costs in worsening the economic position of the country.

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METHODS OF REDUCING 4-DIMENSIONAL TABLE TO 3-DIMENSIONAL TABLE ON THE EXAMPLE OF STUDENT GRADING SYSTEM

Abstract: The analysis of grades listed on student diploma based on the academic regulations binding at the University of Life Sciences from the 1st of October 2012 following the completion of the first or second cycle of studies. The relations between the following grades were determined: cumulative grade point average (GPA), the grade assigned for dissertation, the grade for diploma exam – the grade listed on the diploma. Relations are expressed by parameters which make up a 4-dimensional table. The grade listed on the diploma depends on the student's knowledge and skills but also on the means of rounding the grade itself as well as its separate components. Methods of rounding are most often stipulated in binding academic regulations. A method of reducing 4-dimensional table including all potential relations to a 3-dimensional one has been proposed.

Key words: graduation rate, multidimensional table, final examination

ADMISSION

Diploma exam finishes undergraduate studies at tertiary level of education. The postgraduate education finishes with master's exam. First cycle of studies finishes with engineer's exam and awarding of a vocational engineer degree – at technical faculties (e.g. Faculty of Wood Technology at the University of Life Sciences in Poznan) or it finishes with bachelor exam (licencjat) and awarding of a bachelor's degree – at faculties of human sciences (e.g. Socio-Economic Faculty at the University of Life Sciences in Poznan). Second cycle of studies finishes with master's exam and awarding of a master's degree regardless of the faculty's profile.

The process of assigning grades for exams following the first and second cycle of studies is similar. In this paper grades following diploma exam have been put under analysis. The rules concerning grades rounding and reduction of matrix of relations –are the same for both exams leading to bachelor's and master's degree.

Assigning a fair and adequate grade is highly important and responsible task. The grade given to students at the exam finishing a given stage of their tertiary education is listed in their personal documents for the entire professional life that is for over 40 years.

GRADES EARNED DURING STUDIES

At the University of Life Sciences in Poznan in accordance with § 26 section 1 of academic regulations, a 6 grade system is used (corresponding grades in ECTS have been provided in the brackets):

1. very good – 5,0 (A),
2. good plus – 4,5 (B),
3. good – 4,0 (C),
4. satisfactory plus – 3,5 (D),
5. satisfactory – 3,0 (E),
6. unsatisfactory – 2,0 (F).

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Table 1. 4-dimensional table. Determining cumulative grade point average GPA on the basis of student's final diploma grade, the grade for diploma exam and the average grade for diploma thesis

Student's final diploma grade	Grade for diploma exam	Average grade for diploma thesis SP (tutor + reviewer)/2								
		3	3,25	3,5	3,75	4	4,25	4,5	4,75	5
3	3	3,00								
	3,5									
	4									
	4,5									
	5									
3,5	3	3,35	3,27	3,18	3,10	3,02				
	3,5	3,18	3,10	3,02						
	4	3,02								
	4,5									
	5									
4	3	4,18	4,10	4,02	3,93	3,85	3,77	3,68	3,60	3,52
	3,5	4,02	3,93	3,85	3,77	3,68	3,60	3,52	3,43	3,35
	4	3,85	3,77	3,68	3,60	3,52	3,43	3,35	3,27	3,18
	4,5	3,68	3,60	3,52	3,43	3,35	3,27	3,18	3,10	3,02
	5	3,52	3,43	3,35	3,27	3,18	3,10	3,02		
4,5	3		4,93	4,85	4,77	4,68	4,60	4,52	4,43	4,35
	3,5		4,85	4,77	4,68	4,60	4,52	4,43	4,35	4,27
	4		4,68	4,60	4,52	4,43	4,35	4,27	4,18	4,10
	4,5		4,52	4,43	4,35	4,27	4,18	4,10	4,02	3,93
	5		4,35	4,27	4,18	4,10	4,02	3,93	3,85	3,77
5	3								4,93	4,85
	3,5							4,93	4,85	4,77
	4				4,93	4,85	4,77	4,68	4,60	4,52
	4,5		4,93	4,85	4,77	4,68	4,60	4,52	4,43	4,35
	5	4,85	4,77	4,68	4,60	4,52	4,43	4,35	4,27	4,18

Source: own study

To emphasize an exceptional student performance one may list in book of records "excellent" grade in its full written form which however is equal to grade 5,0 (A), similarly to a "very good" grade.

Classes may be passed without a grade if they form a part of a module finishing with a grade.

Cumulative GPA following the period of studies is calculated by the administration officers from Dean's Office with accuracy of two decimal places. It cannot be lower than 3,0 and higher than 5,0.

Determining border points of the student cumulative GPA depending on the two known parameters: average grade for diploma thesis and average grade obtained during diploma exam – for an expected diploma grade - is presented in table 1. There are in total 25 unique border points. They are also included in the first columns of tables: 3 and 4.

GRADE FOR DIPLOMA THESIS

Paragraph 39 of academic regulations of the University of Life Sciences in Poznań (Uchwała 2012) stipulates that: "the grade for diploma thesis is an arithmetic average calculated from the

grades awarded by the tutor and the reviewer. This grade is listed in exam protocol and in student's book of records (following rounding up – in accordance with the scale provided in § 26 section 1)".

When calculating the grade listed on the diploma rounding to two decimal places is applied, hence in practice rounding with module: $0,5 / 2 = 0,25$ (second rows: in table 1 and table 2).

Table 2. Determining the sum of grades obtained by a student during diploma exam (SP + OE)

Grade for diploma exam OE	Average grade for diploma thesis (tutor + reviewer)/2 SP								
	3	3,25	3,5	3,75	4	4,25	4,5	4,75	5
3	6,00	6,25	6,50	6,75	7,00	7,25	7,50	7,75	8,00
3,5	6,50	6,75	7,00	7,25	7,50	7,75	8,00	8,25	8,50
4	7,00	7,25	7,50	7,75	8,00	8,25	8,50	8,75	9,00
4,5	7,50	7,75	8,00	8,25	8,50	8,75	9,00	9,25	9,50
5	8,00	8,25	8,50	8,75	9,00	9,25	9,50	9,75	10,00

Source: own study

GRADE FOR DIPLOMA EXAM

According to § 41 section 8 of academic regulations (Uchwała 2012) when evaluating performance at diploma exam one uses the 6-grade scale determined in § 26 section 1, the same as the one being used for the evaluation of individual subjects and their modules during studies.

Exam result: average grade for two questions asked during bachelor's exam and three questions asked during master's exam is rounded to calculate the result listed on the diploma applying 6-grade scale. The grade is determined by Faculty Exam Committee.

FINAL GRADE

In accordance with § 43 of academic regulations (Uchwała 2012) final result of studies is determined based on cumulative GPA from all modules and subjects obligatory in the programme of studies, the grade for diploma thesis and the grade for diploma exam.

„Final result is the sum of 3/5 of studies cumulative GPA, 1/5 of the average grade for diploma thesis and 1/5 of the average grade for diploma exam” (§ 43 section 2 of academic regulations). The rule regulating determining the final result is presented in formula 1:

$$WS = 0,6 * \acute{S}S + 0,2 * \acute{S}P + 0,2 * OE \quad (1)$$

where:

WS – final studies result,

$\acute{S}S$ – cumulative GPA,

$\acute{S}P$ – average grade for diploma thesis,

OE – average grade for diploma exam.

The final result is listed on the diploma according to the rule stipulated in § 43 section 2 of academic regulations (Uchwała 2012):

from 4,51 to 5,00 – very good,

from 4,21 to 4,50 – good plus,



from 3,71 to 4,20 – good,
 from 3,21 to 3,70 – satisfactory plus,
 to 3,20 – satisfactory.

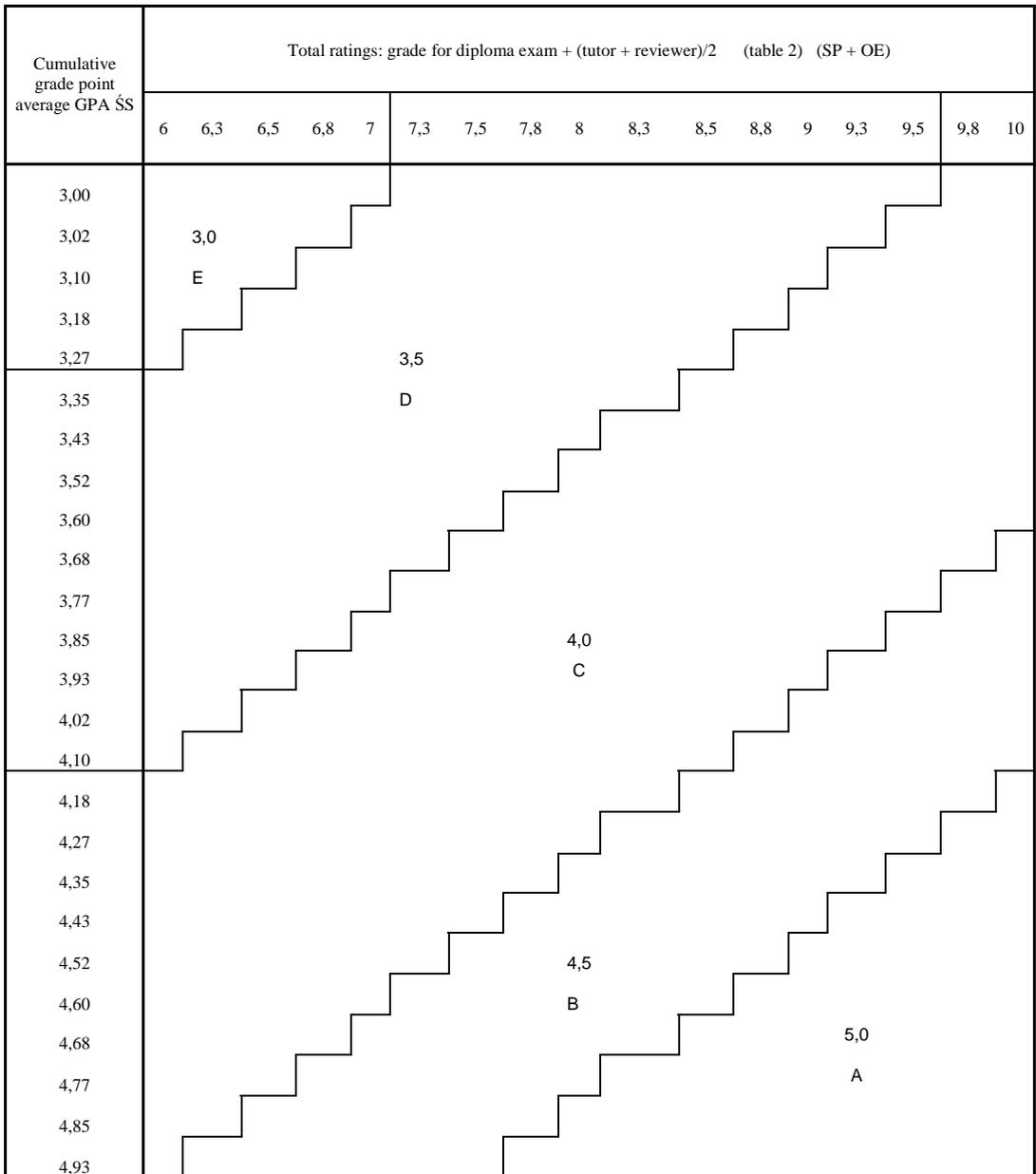
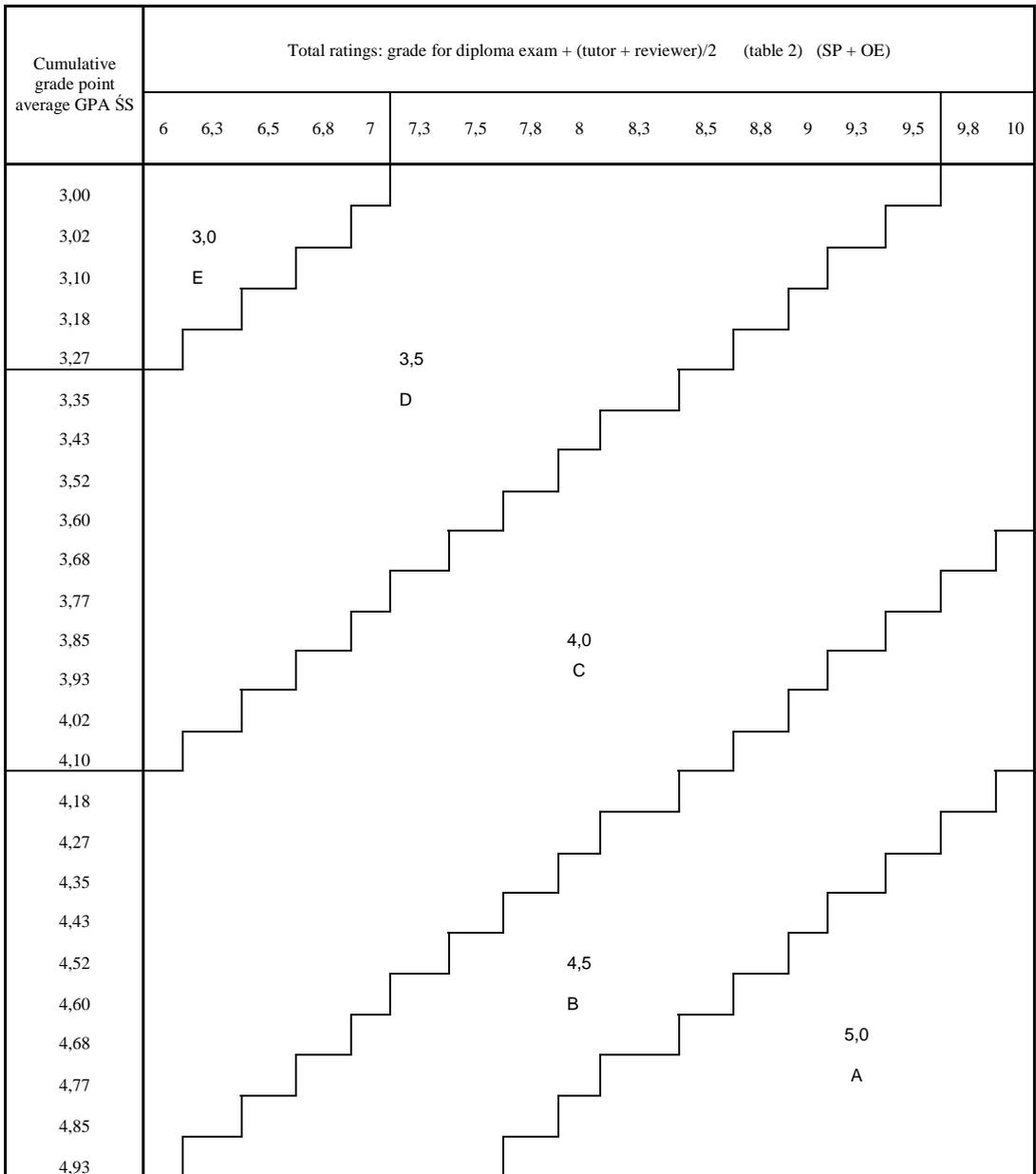
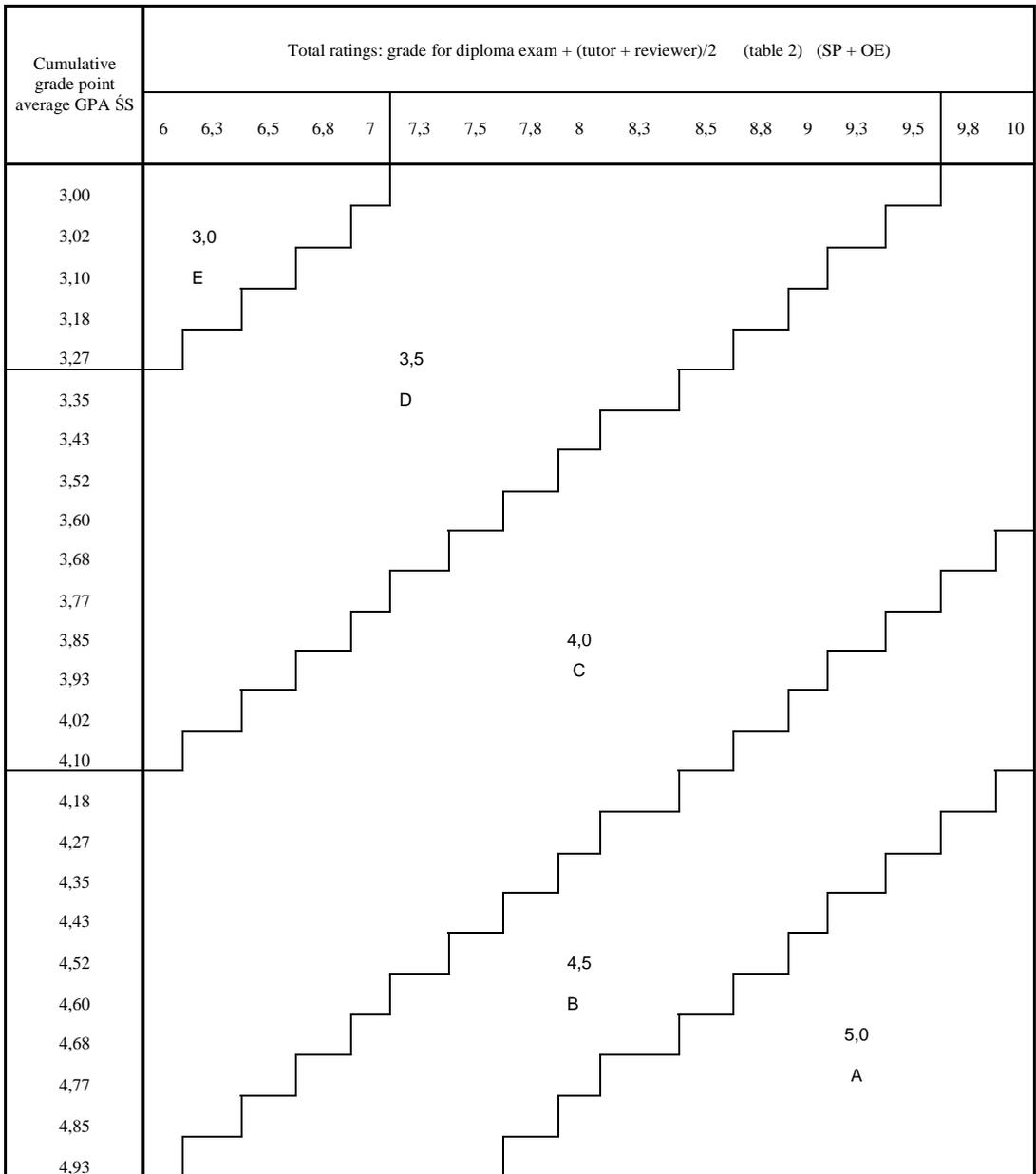
Table 3. 3-dimensional table. Determining student's final diploma grade on the basis of cumulative GPA and the average grade for diploma thesis + the grade for diploma exam

Cumulative grade point average GPA SS	Total ratings: grade for diploma exam + (tutor + reviewer)/2 (table 2) (SP + OE)																
	6	6,25	6,5	6,75	7	7,25	7,5	7,75	8	8,25	8,5	8,75	9	9,25	9,5	9,75	10
3,00	3,00	3,05	3,10	3,15	3,20	3,25	3,30	3,35	3,40	3,45	3,50	3,55	3,60	3,65	3,70	3,75	3,80
3,02	3,01	3,06	3,11	3,16	3,21	3,26	3,31	3,36	3,41	3,46	3,51	3,56	3,61	3,66	3,71	3,76	3,81
3,10	3,06	3,11	3,16	3,21	3,26	3,31	3,36	3,41	3,46	3,51	3,56	3,61	3,66	3,71	3,76	3,81	3,86
3,18	3,11	3,16	3,21	3,26	3,31	3,36	3,41	3,46	3,51	3,56	3,61	3,66	3,71	3,76	3,81	3,86	3,91
3,27	3,16	3,21	3,26	3,31	3,36	3,41	3,46	3,51	3,56	3,61	3,66	3,71	3,76	3,81	3,86	3,91	3,96
3,35	3,21	3,26	3,31	3,36	3,41	3,46	3,51	3,56	3,61	3,66	3,71	3,76	3,81	3,86	3,91	3,96	4,01
3,43	3,26	3,31	3,36	3,41	3,46	3,51	3,56	3,61	3,66	3,71	3,76	3,81	3,86	3,91	3,96	4,01	4,06
3,52	3,31	3,36	3,41	3,46	3,51	3,56	3,61	3,66	3,71	3,76	3,81	3,86	3,91	3,96	4,01	4,06	4,11
3,60	3,36	3,41	3,46	3,51	3,56	3,61	3,66	3,71	3,76	3,81	3,86	3,91	3,96	4,01	4,06	4,11	4,16
3,68	3,41	3,46	3,51	3,56	3,61	3,66	3,71	3,76	3,81	3,86	3,91	3,96	4,01	4,06	4,11	4,16	4,21
3,77	3,46	3,51	3,56	3,61	3,66	3,71	3,76	3,81	3,86	3,91	3,96	4,01	4,06	4,11	4,16	4,21	4,26
3,85	3,51	3,56	3,61	3,66	3,71	3,76	3,81	3,86	3,91	3,96	4,01	4,06	4,11	4,16	4,21	4,26	4,31
3,93	3,56	3,61	3,66	3,71	3,76	3,81	3,86	3,91	3,96	4,01	4,06	4,11	4,16	4,21	4,26	4,31	4,36
4,02	3,61	3,66	3,71	3,76	3,81	3,86	3,91	3,96	4,01	4,06	4,11	4,16	4,21	4,26	4,31	4,36	4,41
4,10	3,66	3,71	3,76	3,81	3,86	3,91	3,96	4,01	4,06	4,11	4,16	4,21	4,26	4,31	4,36	4,41	4,46
4,18	3,71	3,76	3,81	3,86	3,91	3,96	4,01	4,06	4,11	4,16	4,21	4,26	4,31	4,36	4,41	4,46	4,51
4,27	3,76	3,81	3,86	3,91	3,96	4,01	4,06	4,11	4,16	4,21	4,26	4,31	4,36	4,41	4,46	4,51	4,56
4,35	3,81	3,86	3,91	3,96	4,01	4,06	4,11	4,16	4,21	4,26	4,31	4,36	4,41	4,46	4,51	4,56	4,61
4,43	3,86	3,91	3,96	4,01	4,06	4,11	4,16	4,21	4,26	4,31	4,36	4,41	4,46	4,51	4,56	4,61	4,66
4,52	3,91	3,96	4,01	4,06	4,11	4,16	4,21	4,26	4,31	4,36	4,41	4,46	4,51	4,56	4,61	4,66	4,71
4,60	3,96	4,01	4,06	4,11	4,16	4,21	4,26	4,31	4,36	4,41	4,46	4,51	4,56	4,61	4,66	4,71	4,76
4,68	4,01	4,06	4,11	4,16	4,21	4,26	4,31	4,36	4,41	4,46	4,51	4,56	4,61	4,66	4,71	4,76	4,81
4,77	4,06	4,11	4,16	4,21	4,26	4,31	4,36	4,41	4,46	4,51	4,56	4,61	4,66	4,71	4,76	4,81	4,86
4,85	4,11	4,16	4,21	4,26	4,31	4,36	4,41	4,46	4,51	4,56	4,61	4,66	4,71	4,76	4,81	4,86	4,91
4,93	4,16	4,21	4,26	4,31	4,36	4,41	4,46	4,51	4,56	4,61	4,66	4,71	4,76	4,81	4,86	4,91	4,96

Source: own study

Therefore a five-grade scale is here in force with the elimination of final sixth grade (similarly to § 26 section 1 of academic regulations). Rounding to a full grade concerns only the grade to be listed on the diploma. In all other cases the result is provided with the accuracy of two decimal places.

Table 4. Reduced table. Determining student's grade listed on the diploma based on the cumulative GPA and average grade for diploma thesis + the grade for diploma exam

Cumulative grade point average GPA \bar{S}	Total ratings: grade for diploma exam + (tutor + reviewer)/2 (table 2) (SP + OE)															
	6	6,3	6,5	6,8	7	7,3	7,5	7,8	8	8,3	8,5	8,8	9	9,3	9,5	9,8
3,00																
3,02																
3,10																
3,18																
3,27																
3,35																
3,43																
3,52																
3,60																
3,68																
3,77																
3,85																
3,93																
4,02																
4,10																
4,18																
4,27																
4,35																
4,43																
4,52																
4,60																
4,68																
4,77																
4,85																
4,93																

Source: own study

Final studies result is the fourth dimension in the table (4-dimensional table), which additionally provides the data on: cumulative GPA, diploma thesis average grade and diploma exam average grade. In such table one needs to repeat one dimension at every other dimension. The least complicated table can be obtained when the dimensions (numbers) to be repeated are those least



frequently represented in the matrix. In the example under analysis the situation is represented by two results: the grade listed on the diploma and the diploma exam grade. Each of them contains 5 numbers (3; 3,5; 4; 4,5; 5). In total 25 variants were obtained. In table 1 in each row of the first column, that is for the grades expected to be listed on the diploma, grades for diploma exam from table 2 have been repeated.

SUMMING GRADES DURING DIPLOMA EXAM

Table 1 is a 4-dimensional table. The fourth dimension that is sought-after cumulative GPA is determined for the three given dimensions that is: average grade for diploma thesis, the grade for diploma exam and the grade listed on the diploma – determined precisely in accordance with academic regulations in force. Converting table 1 so as to integrate either in rows or columns studies cumulative GPA would demand a very complex table in which many numbers would be left unused and many would be repeated. To simplify the table and enhance its clarity and transparency – 4-dimensional table was reduced to 3-dimensional one. Mathematical rules concerning matrix reduction were implemented (Osterwalder, Pigneur 2010; Hanusz, Tarasińska 2006; Sobczyk 2010). In order to do this formula 1 was converted into formula 2:

$$WS = 0,6 * \acute{S}S + 0,2 * (SP + OE) \quad (2)$$

Symbols in formula 2 are the same as those used in formula 1. The sum of SP and OE – was determined in table 2. The number of possible variants is: 9 (average grade for diploma thesis) * 5 (grades for diploma exam) in total 45. Analyzing table 2 one may state that those 45 variants allow to obtain 17 different numbers (SP + OE). Numbers calculated in such way (SP + OE) – are to be found in the second rows and simultaneously are columns' descriptors (2 – 18) in tables 3 and 4.

Table 3 was converted into table 4 – in accordance with the requirements set out in § 43 section 2 of academic regulations. Those grades calculated from studies cumulative GPA and the sums of grades obtained during diploma exam are listed on the diploma (in accordance with academic regulations binding at the University of Life Sciences in Poznan from the 1st of October 2012).

DETAILED ANALYSIS OF SELECTED RESULTS

In tables 1 and 4 relations between grades were set out: cumulative GPA, the grade for diploma thesis, the grade for diploma exam – the grade listed on the diploma.

The table shows that if for example students during exam are awarded grade:

- 3 – in order to obtain final grade 5 – they have to have cumulative GPA not lower than 4,93 and get one or two very good grades for diploma thesis. When they have two very good grades for diploma thesis – their cumulative GPA can be 4,85.
- 3,5 – in order to obtain final grade 5 – they have to have cumulative GPA not lower than 4,93 and average grade for diploma thesis 4,25 (e.g. 4 and 4,5). When they obtain grade 5 for their diploma thesis their cumulative GPA may be equal to 4,68.
- 5 – in order to obtain final grade 4 – they have to have cumulative GPA not lower than 3,02 and average grade for diploma thesis 4,5. When they have two 3,5 grades for diploma thesis – their cumulative GPA cannot be lower than 3,35 (verification, in accordance with formula 1: $WS = 0,6 * 3,35 + 0,2 * 3,5 + 0,2 * 5 = 2,01 + 0,7 + 1 = 3,71$ – which equals to grade: “good” listed on the diploma).

Table 4 for example shows that if the student's cumulative GPA is:

- Not lower than 3,35 – then they may obtain “good plus” grade on their diploma when they pass diploma exam with grade 4 and obtain two 4 grades for their diploma thesis,

- in other words they have to get at least 8 points during their diploma exam. When they get less than those 8 points then their grade listed on the diploma will be 4.
- b. Not lower than 3,68 – then they may be awarded grade 4,5 on the diploma if they pass diploma exam with grade 5 and get two grades 5 for their diploma thesis. They get grade 4, when during diploma exam they earn 7,5 points; when the number of points will be lower their final diploma grade will be 3,5.
 - c. Not lower than 4,18 – then they may be awarded final diploma grade 5 – when during diploma exam they earn 8,5 points. Otherwise their final diploma grade will be 4,5.
 - d. Not lower than 4,93 – then their diploma grade can be at least 4 – and only when their grades for both diploma thesis and exam will be equal to grade 3. Their diploma grade will be 4,5 when at least one of the above mentioned grades will be higher than 3. Earning 7,75 during diploma exam (one grade for diploma thesis may be lower than 4 but not the grade for diploma exam) – will guarantee them final diploma grade 5 (verification according to the formula 2: $WS = 0,6 * 4,93 + 0,2 * 7,75 = 2,96 + 1,55 = 4,51$ – that equals to diploma grade: “very good”). There are four cases (table 2), when the sum of grades equals 7,75 (4,5+3,25; 4+3,75; 3,5+4,25; 3+4,75).

Cumulative GPA between 3,35 and 3,67 guarantees that student may be awarded two grades on the diploma either 3,5 or 4. In all other cases – obtaining one of three grades is possible (compare table 4).

Obtaining final diploma grade: 4,5 – requires cumulative GPA of at least - 3,68; in order to be awarded final diploma grade 5 – cumulative GPA has to be at least – 4,18 (compare table 4).

CONCLUSIONS

Student final grade listed on the diploma depends mainly on their knowledge, skills and diligence throughout the whole period of studies but it also depends on the way mathematical laws are being applied, among them the methods of rounding of individual components of the final diploma grade. Those methods are most often described in university academic regulations and there is little room left for the interpretation of the Faculty Exam Committee. It has been proven in this article on the basis of 3-dimensional table developed as the result of optimization of distribution in the matrix of four grade components: cumulative GPA, average grade for diploma thesis, the grade for diploma exam and the final grade listed on the diploma.

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INNOVATION VERSUS FAMILY LIFE CYCLE AS A PREDICTOR OF BEHAVIOUR

Abstract: Consumers demand ever newer products; therefore permanent development of new products and launching them on the market is inevitable in the competitive surroundings of contemporary markets. This paper deals with the relationship of innovation and the family life cycle as a predictor of behavior. We are dealing in her analysis of relationships between innovation and the family life cycle as a predictor of behavior, through a survey carried out. In the results are presented the facts about innovation at all stages of the Family life cycle.

Keywords: innovation, family life cycle.

INTRODUCTION

Innovation is the application of new solutions that meet new requirements, inarticulate needs, or existing market needs. This is accomplished through more effective products, processes, services, technologies, or ideas that are readily available to markets, governments and society. The term innovation can be defined as something original and new that diffuses the market or into society. One usually associates it with new phenomena that are important in some way. A definition of the term, in line with these aspects, would be the following: "An innovation is something original, new, and important - in whatever field - that diffuses into a market or society (Frankelius, 2009).

In business and economics, innovation is the catalyst to growth. Economist J. Schumpeter, who contributed greatly to the study of innovation, argued that industries must incessantly revolutionize the economic structure from within, that is innovate with better or more effective processes and products (Schumpeter, 1943). In addition, entrepreneurs continuously look for better ways to satisfy their consumers with improved quality, durability, service, and price which come to fruition in innovation with advanced technologies and organizational strategies (Heyne, Boettke, Prychitko, 2010).

Developments in the global economy have changed the traditional balance between customer and supplier. New communications and computing technology, and the establishment of reasonably open global trading regimes, mean that customers have more choices, variegated customer needs. Businesses therefore need to be more customer-centred. This new environment has also amplified the need to consider not only how to address customer needs more astutely, but also how to capture value from providing new products, services and customers' attitudes from different perspectives (Teece, 2010). We will focus on the perspective of innovation in relation to the family life cycle.

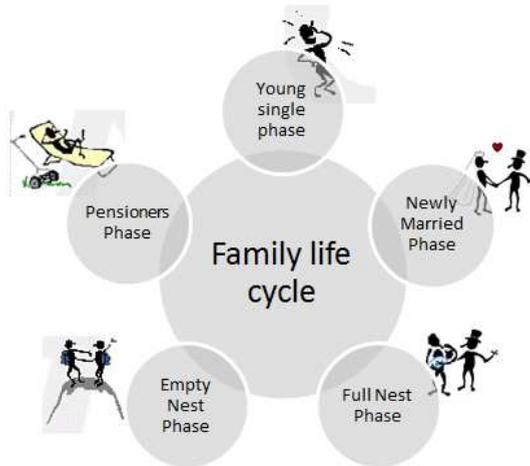
Family life cycle marketing is a method for separating the aspects of the family market at different stages of life. According to the Tutor 2U website, the family life cycle marketing model was created in the 1960s by Wells and Gruber. The marketing technique takes the size of a person's family into consideration, along with a potential customer's age and professional status (King, Media, 2013). We apply it in relation to innovation.

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METHODIC

Innovation versus family life cycle as a predictor of behaviour, these were assessed at different stages of family life cycle, as follows:

- Young single phase,
- Newly Married Phase,
- Full Nest Phase,
- Empty Nest Phase,
- Pensioners Phase.



Picture 1 Family Life cycle

Source: Chen, 2009 – modified.

Research method is a survey where we asked respondents using the questionnaire. For objectivity of the survey respondent sample was defined using the following:

$$n = \frac{Z_{1-\alpha/2}^2 \cdot \alpha \cdot S^2}{H^2} = \frac{1,96^2 \cdot 0,6^2}{0,1^2} = 138 \text{ respondents} \quad [1]$$

Where:

- n - Sample size,
- $Z_{1-\alpha/2}$ - Confidence level – 95 %,
- H - Confidence interval of +/- 10 %,
- s - Standard of Deviation – 0,6

In the questionnaire we asked:

- Are you are buying new products due to innovation factor?
- Are you willing to pay more for innovation?
- Who influences you when buying innovative products?



- Which types of innovation do you buy most often?

This calculation is based on the normal distribution. The sample size is an important feature of any empirical study. At each stage of the family life cycle 30 questionnaires were completed and the total number of respondents was 150. The results were processed into contingency tables.

INNOVATION AND LIFE CYCLE OF THE FAMILY AS A PREDICTOR OF BEHAVIOR

Table 1 describes the positive attitude to innovation of all participants in the family life cycle. With the exception of Pensioners Phase, this relationship is less positive. In this Phase there is only 43% of positive responses.

Table 1. Relationship Innovations and Family life cycle

In %	Are you buying new products due to innovation factor?	
	yes	no
Young single Phase	80	20
Newly Married Phase	93	8
Full Nest Phase	90	10
Empty Nest Phase	78	23
Pensioners Phase	43	58

People at Newly Married Phase are willing to pay more for innovation (table 2). But other family life cycle phases are not negligible, except Pensioners Phase.

Table 2. Relationship between price of innovations in Family life cycle

In %	You are willing to pay more for innovation?	
	yes	no
Young single Phase	55	45
Newly Married Phase	73	28
Full Nest Phase	50	50
Empty Nest Phase	53	48
Pensioners Phase	10	90

In each phase the family life cycle someone else influences people to buy innovations (Table 3). In the Phase “Young single” those are mainly friends and then partner or parents. In the Phase “Newly Married” the influence comes mainly from partner and then parents, friends and children. In the Phase “Full Nest” and “Empty Nest” the impact group are mainly friends and partner. The pensioners are influenced to buy innovations mainly by the children. Other responses included colleagues, Facebook, promotion and so on.

Table 3. Relationship between buying innovations and people who influence us to do so.

	Who influenced you when buying innovation?				
	partner	children	parents	friends	other
Young single Phase	28	0	23	40	9
Newly Married Phase	71	7	13	9	0
Full Nest Phase	41	43	0	13	4
Empty Nest Phase	52	34	0	13	2
Pensioners Phase	12	66	0	20	2

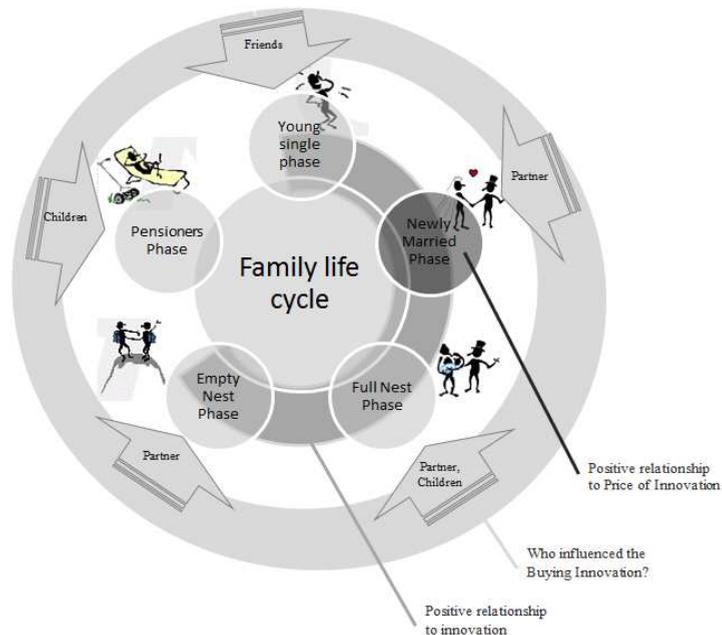
The family life cycle prefers the following types of innovation, as shown in Table 4. The initial phases of the family life cycle are diversified in their preferences for the type of innovations they buy. However Phase Pensioners specializes in buying innovations in food and medicine. In younger Phases people tend to invest in innovations from technological sector as well as clothes but also others such as software, toys and so on.)

Table 4. Relationship between the types of innovations bought and family life cycle

In %	Which types of innovation do you buy most often?								
	electronics as a PC and etc.	home appliances	wood product	cars	clothes	medicines	food	drugstore goods	other
Young single Phase	18	1	7	1	34	4	16	19	0
Newly Married Phase	13	14	4	6	23	0	26	10	3
Full Nest Phase	9	4	4	1	19	0	31	10	19
Empty Nest Phase	13	22	2	1	22	1	26	11	1
Pensioners Phase	0	5	0	0	0	40	45	6	3

CONCLUSIONS

Research shows the strong and weak points of innovation. It identifies opportunities for improvements in the situation of competition in order to keep you customers. It identifies the various types of innovations and how they affect customers behaviour in relation to phases of family life cycle (picture 2).



Picture 2. Customer Segmentation of an Innovation by Family Life cycle

Through segmentation we can distinguish smaller groups of customers and therefore facilitate better communication with different types of customers in ways that are most appropriate for a given group. Wood products are a very small group of innovations that customers perceive.

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INFLUENCE OF SELECTED FACTORS ON THE VALUE OF SAWMILL RESIDUE PROCESSED INTO WOODEN PELLETT

Abstract: The most accessible and especially valuable for energy sector type of biomass is wood, its post-production residue as well as fuels based on wooden residue. One such fuel with the best prospects for further development is wooden pellet which due to its high stability and homogeneity guarantees the highest energy concentration per unit as well as the possibility for fully automated burning process. The aim of the article was researching the influence of selected factors on the increase in value of various types of wooden residue when processed into pellet. The research took into account the following variables determining this value: raw material intensity ratio depending on the type of material being used, sales price of a single unit of finished product, margin envisioned by the producer, production cost of wooden fuel and the cost of transport considered only in the situation when there is a need for purchasing raw material.

Key words: sawmill residue, wooden pellet, profitability of refining process

INTRODUCTION

Polish obligations to carry out the policy which is compatible with the strategy of European Union in the area of renewable energy mean continuing share of energy derived from renewable resources. In the structure of possessing that type of energy in Poland biomass holds a domineering position. In the production of electricity from RES (renewable energy sources) its share amounts to 54,4%, and in heat generation even up to 93,6%. Year to year its usage for those purposes shows steady growth. In comparison with previous year in 2011 there was an increase in using biomass for electricity production by 21,1%, and for generating heat by 25,2% [Energy from renewable resources 2012]. The most easily accessible and very valuable for energy sector type of biomass is wood, post-processing wooden residue as well as fuels based on it. It is assumed that 100 m³ of wood obtained from forest generates 64% of wooden residue, including 10 m³ of bark, 15 m³ of small wigs, 20 m³ of larger branches and stump wood, 19 m³ sawdust and chips. Main product that is lumber accounts for 36 m³ out of which only 20-25 m³ will be used in final products post-processing [Janowicz 2006]. Market research in the area of post-production wooden residue in Poland carried out by the Institute of Wood Technology [Ratajczak 2013] showed that the biggest share of post-production residue is generated by sawmills – approximately 60%. 15-17% of it comes from furniture production and 14-15% from wooden boards. Producers who are especially privileged in terms of that valuable raw material should consider alternative means of utilizing it and instead of selling it should start producing ecological fuels based on that residue.

The easiest form of wooden fuel is wood cut into pieces. Process of possessing it consists of felling a tree, separating branches from the trunk and cutting it into smaller elements. Such wood is also a by-product obtained during technological processes of mechanical wood processing. Material obtained in such way may be further ground in mechanical chippers. Chips obtained that way are more homogenous, due to which drying process aimed at increasing calorific value of that fuel is more efficient, while transport and loading becomes easier [Rybak 2006]. However the fuel of the future with the widest prospects for development is wooden pellet which due to its high stability and homogeneity guarantees the highest energy concentration per unit as well as the possibilities for full automation of burning process. Despite the fact that briquette production is easier and requires less

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financial investment, investor at whose disposal there is a large quantity of post-production residue should consider launching pellet production. The aim of this article is to research the influence of selected factors on the increase of value of sawmill by-products being processed into wooden pellet.

METHODOLOGY

The calculation of each type of by-products being processed into any wooden fuel is possible using the following equation (1) [Mikołajczak 2011]:

$$W_{pub} = \frac{1}{a} \left[c_j \left(1 - \frac{m_j}{1-p} \right) - k_{jp} - k_{jt} \right] \quad [\text{PLN/m}^3] \quad (1)$$

where:

- W_{pub} – Value of wooden residue being processed into any wooden fuel [PLN/m³],
- a – The amount of basic material (wooden residue) necessary to generate one unit of a given wooden fuel (material intensity ratio) [m³/t, mp/t].
- c_j – Sales price per unit of a given wooden fuel [PLN/t],
- m_j – Target net profit margin satisfactory for an entrepreneur, m_j : {0,01; 0,05; ... 0,15},
- p – Corporate Income Tax (CIT), in 2013 = 0,19,
- k_{jp} – Cost per unit of processing wooden residue into a given wooden fuel including the remaining operational cost per unit [PLN/t],
- k_{jt} – Cost of transporting a unit of wooden residue to the place where it will be processed in case it takes place outside the place of its origin [PLN/t],

The construction of the formula indicates that the variables determining the value of various by-products following their further processing are: material-intensity ratio depending on the type of raw material being used, price per unit of finished product, targeted margin level per unit, cost of production of wooden fuel as well as cost of transport, accounted for only in cases when there is a necessity of purchasing raw material.

The research focused on both cases when the entrepreneur processes residue at the place of its creation and (excluding cost of transport) as well as the case of entrepreneur whose pellet production is based on raw material purchased externally (including cost of transport). Production lines of various level of efficiency that is 1,5 t/h and 8 t/h have been considered due to the assumption that it affects the level of processing costs per unit. Calculations have been carried out for three different margins: 5%, 10% and 15%.

Juxtaposing the value of given material, taking into account assumed variables, with realistic sales price of the material which hasn't been processed allows for setting up efficiency level of processing various types of sawmill residue into pellet.

Final calculation of the value of sawmill residue being processed into pellet was shown in Tables 1 and 2.



Table 1. Value of individual sawmill by-products being converted into pellet on the line with capacity 1,5t/h

Raw material	Moisture [%]	Type of packaging	Price of raw material [PLN/m ³]	Raw material consumption ratio		1/a 1/[m ³ /t]	Pellet price [PLN/t]	Conversion cost [PLN/t]	Value of by-products converted into pellet excluding cost of transport [PLN/m ³]			Cost of transport [PLN/t]	Value of by-products converted into pellet including cost of transport [PLN/m ³]			
				a					margin level				margin level			
				[mp/t]	[m ³ /t]				0,05	0,10	0,15		0,05	0,10	0,15	
Sawdust	10	bb	120	6,8	2,24	0,45	649,00	169,00	203,11	179,94	161,92	68,00	167,37	149,34	131,32	
		sb	120	6,8	2,24	0,45	687,00	231,68	209,14	166,73	147,64	68,00	155,21	136,13	117,04	
		luz	120	6,8	2,24	0,45	602,00	162,50	183,24	164,33	147,61	68,00	150,45	133,73	117,01	
	50	bb	103	7,2	2,37	0,42	649,00	206,73	173,73	152,10	135,28	72,00	138,69	121,86	105,04	
		sb	103	7,2	2,37	0,42	687,00	269,41	179,35	139,77	121,95	72,00	127,34	109,53	91,71	
		luz	103	7,2	2,37	0,42	602,00	200,23	155,18	137,53	121,92	72,00	122,90	107,29	91,68	
Chips	25	bb	D	120	4,2	1,76	0,57	605,00	210,55	203,55	182,26	160,98	42,00	179,61	158,32	137,04
			P	151	4,2	1,76	0,57	649,00	210,55	226,97	204,13	181,30	42,00	203,03	180,19	157,36
		sb	D	120	4,2	1,76	0,57	628,00	273,23	179,85	157,75	135,66	42,00	155,91	133,81	111,72
			P	151	4,2	1,76	0,57	687,00	273,23	211,33	187,16	162,99	42,00	187,39	163,22	139,05
		luz	D	120	4,2	1,76	0,57	577,00	204,05	192,28	171,98	151,68	42,00	168,34	148,04	127,74
			P	151	4,2	1,76	0,57	602,00	204,05	205,54	184,35	163,17	42,00	181,60	160,41	139,23
	50	bb	D	120	5,0	2,10	0,48	605,00	217,02	168,30	150,38	132,45	50,00	144,30	126,38	108,45
			P	151	5,0	2,10	0,48	649,00	217,02	188,12	168,89	149,66	50,00	164,12	144,89	125,66
		sb	D	120	5,0	2,10	0,48	628,00	279,70	148,58	129,97	111,36	50,00	124,58	105,97	87,36
			P	151	5,0	2,10	0,48	687,00	279,70	175,15	154,79	134,44	50,00	151,15	130,79	110,44
		luz	D	120	5,0	2,10	0,48	577,00	210,52	158,81	141,72	124,62	50,00	134,81	117,72	100,62
			P	151	5,0	2,10	0,48	602,00	210,52	170,07	152,24	134,40	50,00	146,07	128,24	110,40
Waste wood	25	bb	105	3,5	1,47	0,68	605,00	216,53	238,76	213,37	187,97	35,00	214,96	189,57	164,17	
		sb	105	3,5	1,47	0,68	628,00	279,21	210,82	184,46	158,10	35,00	187,02	160,66	134,30	
		luz	105	3,5	1,47	0,68	577,00	210,03	225,32	201,10	176,88	35,00	201,52	177,30	153,08	

bb – big bag, sb – small bag, luz – sales in bulk

D – defibred chips, P – pulp chips

Source: own elaboration



Saw wood use	Raw material Moisture [%]	Type of packaging	Price of raw material [PLN/m ³]	Raw material consumption ratio		l/a l/[m ³ /t]	Pellet price [PLN/t]	Conversion cost [PLN/t]	Value of by-products converted into pellet excluding cost of transport [PLN/m ³]			Cost of transport [PLN/t]	Value of by-products converted into pellet including cost of transport [PLN/m ³]		
				a					margin level				margin level		
				mp/t	[m ³ /t]										
									0,05	0,10	0,15		0,05	0,10	0,15
10	10	bb	120	6,8	2,24	0,45	649,00	126,86	216,93	198,91	180,88	68,00	186,33	168,31	150,28
		sb	120	6,8	2,24	0,45	687,00	180,51	208,84	189,75	170,67	68,00	178,24	159,15	140,07

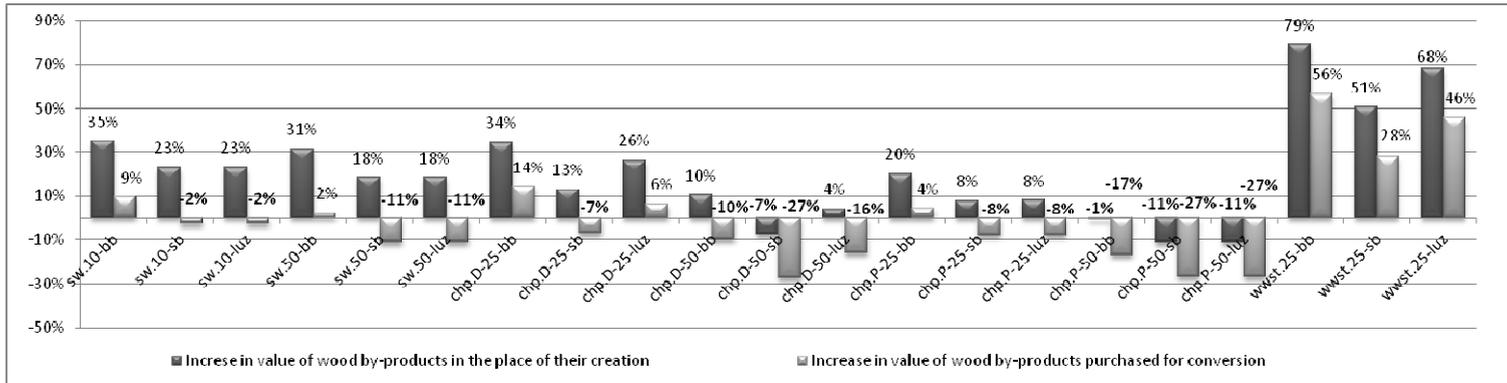
Table 2. Value of individual sawmill by-products converted into pellet on the line with capacity 8h

Chips	50	luz		120	6,8	2,24	0,45	602,00	120,36	200,02	183,29	166,57	68,00	169,42	152,69	135,97	
		bb		103	7,2	2,37	0,42	649,00	164,59	186,63	169,80	152,97	72,00	156,39	139,56	122,73	
		sb		103	7,2	2,37	0,42	687,00	218,24	179,07	161,26	143,45	72,00	148,83	131,02	113,21	
	25	luz		103	7,2	2,37	0,42	602,00	158,09	170,83	155,23	139,62	72,00	140,59	124,99	109,38	
		bb	D	120	4,2	1,76	0,57	605,00	168,41	227,57	206,28	185,00	42,00	203,63	182,34	161,06	
			P	151	4,2	1,76	0,57	649,00	168,41	251,10	228,27	205,43	42,00	227,16	204,33	181,49	
		sb	D	120	4,2	1,76	0,57	628,00	222,06	209,29	187,19	165,10	42,00	185,35	163,25	141,16	
			P	151	4,2	1,76	0,57	687,00	222,06	240,84	216,67	192,50	42,00	216,90	192,73	168,56	
		luz	D	120	4,2	1,76	0,57	577,00	161,91	216,30	196,00	175,70	42,00	192,36	172,06	151,76	
			P	151	4,2	1,76	0,57	602,00	161,91	229,67	208,49	187,31	42,00	205,73	184,55	163,37	
		50	bb	D	120	5,0	2,10	0,48	605,00	174,88	188,53	170,61	152,68	50,00	164,53	146,61	128,68
				P	151	5,0	2,10	0,48	649,00	174,88	208,35	189,12	169,89	50,00	184,35	165,12	145,89
sb	D		120	5,0	2,10	0,48	628,00	228,53	173,14	154,53	135,92	50,00	149,14	130,53	111,92		
	P		151	5,0	2,10	0,48	687,00	228,53	199,71	179,35	159,00	50,00	175,71	155,35	135,00		
luz	D		120	5,0	2,10	0,48	577,00	168,38	179,04	161,94	144,85	50,00	155,04	137,94	120,85		
	P		151	5,0	2,10	0,48	602,00	168,38	190,30	172,46	154,63	50,00	166,30	148,46	130,63		
Waste wood	25	bb		105	3,5	1,47	0,68	605,00	152,88	282,05	256,65	231,26	35,00	258,25	232,85	207,46	
		sb		105	3,5	1,47	0,68	628,00	152,88	296,72	270,36	244,00	35,00	272,92	246,56	220,20	
		luz		105	3,5	1,47	0,68	577,00	146,38	268,60	244,38	220,16	35,00	244,80	220,58	196,36	

bb – big bag, sb – small bag, luz – sales in bulk

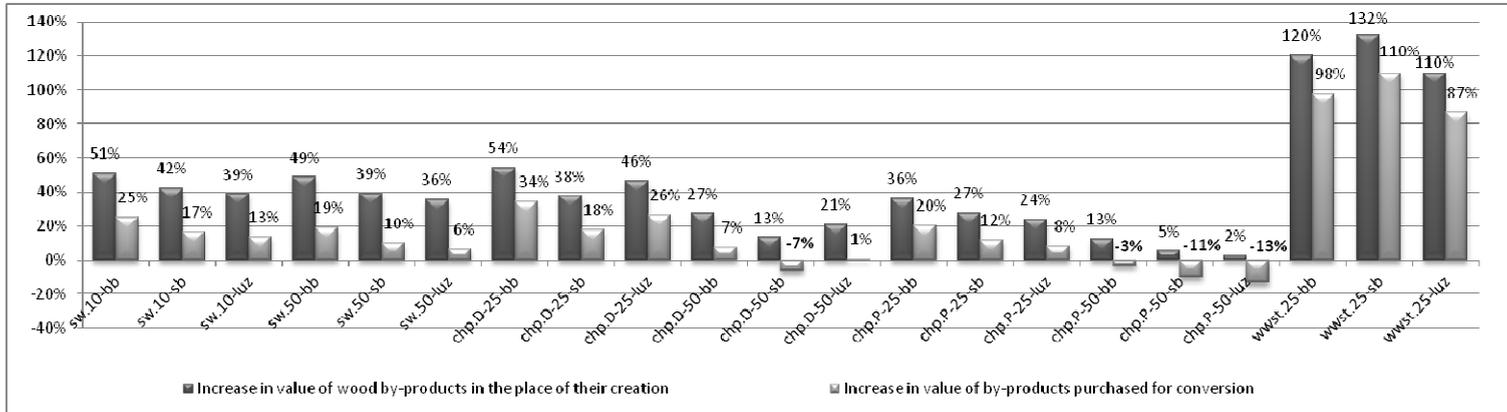
D – defibred chips, P – pulp chips

Source: own elaboration



sw – sawdust, chp. – chips, wwst – wood waste

Figure 1. Increase in value of wood by-products as the result of converting them into pellet on the line with capacity of 1,5t/h, at 15% margin
Source: own elaboration



sw – sawdust, chp. – chips, wwst – wood waste

Fig. 2. Increase in value of wood by-products as the result of converting them into pellet on the line with capacity of 8t/h, at 15% margin
Source: own elaboration

RESULTS AND ANALYSIS

Analysis of presented values show that for an entrepreneur being in possession of post-production residue its further processing into pellet will be profitable for each type of residue at any of the three margin levels on the line producing 8t per hour. However those who produce residue and process it using the line producing 1,5 t per hour are not able to reach 15% margin when using chips both pulp and defibered. Selling them unprocessed will generate more profit. It should be accounted for that due to lower processing cost per unit respectively higher value will be achieved by residue processed on production line of higher productivity level. The highest value is obtained during processing into pellet using wooden chips of 25% moisture content, sold in small bag packaging, due to low costs of processing, more than proportionally higher sales price of such packed product as well as low price of unprocessed residue being sold. The least profitable raw material when processed into pellet are pulp chips of 50% moisture content. Their high market price (151 PLN/m³) does not allow the entrepreneur treating pellet production as his primary business (using line with productivity of 8t per hour) to achieve 10% margin for the product sold loose. He is unable to achieve 15% margin packing the product using packaging of any size, as well as using cheaper (120 PLN/m³) defibered chips of 50% moisture content when planning to sell them in small bag packaging. Percentage increase in the value of individual groups of sawmill residue as the result of processing them into pellet, assuming 15% margin presented in Figure 1 for production capacity of 1,5 t/h and in Figure 2 for production capacity of 8 t/h, proves the above statements.

CONCLUSIONS

Used formula rationalizing the utilization of the stream of sawmill residue facilitated the selection of the most profitable, from the point of view of a sawmill, way of using post-production wooden residue as well as the evaluation of profitability level of pellet production being the primary activity of each entrepreneur using market material. The research carried out showed that the most profitable is processing chipwood of 25% moisture content sold in small bag packaging. For the line of 8t/h of production capacity it is possible to achieve each margin level: 5%, 10% i 15%, using each type of material. Due to lower processing cost per unit respectively higher in terms of value is the residue processed using productivity line of higher capacity. Significantly higher increase in residue value is achieved by an entrepreneur processing residue at the place where it was generated not incurring any transport cost. Those having to purchase raw material for pellet production have to be satisfied with a lower margin. In such case pellet production from chips even using production line of higher productivity level and selling the final product loose will remain unprofitable.

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THE PORTFOLIO MANAGEMENT AS SUPPORT FOR THE DEVELOPMENT OF NEW PRODUCTS IN THE FURNITURE INDUSTRY – PART I

Abstract: In recent decades many companies realize the importance of planning product families and managing their portfolio, in addition to developing products that meet customers' needs and assuring their quality. Considering the lack of similar research conducted in the furniture industry, this paper presents studies dedicated to furniture manufacturers. The aim of this paper is to diagnose the problems possibly resulting from new furniture implementation and describe main determinants influencing product portfolio. The case study was conducted in three large case goods companies. The conclusions indicate that the most important in determining the final size of product range at a furniture company are: new product strategies, the types and quality of raw materials, a sales price of the product (low, middle or high), and a level of difficulty of its constructing and manufacturing.

Key words: product development, new product, product portfolio management, product mix, furniture industry,

INTRODUCTION

In recent decades we have witnessed an unseen dynamism among companies, which is explained by their desire to engage in more activities that provide a high level of development and diversification. Many companies realize the importance of planning product families and managing their portfolio, in addition to developing products that meet customers' needs and assuring their quality. For this reason, managers would like to know how to analyse mix of products included in the firm's portfolio because this leads to a better understanding of the strategic position held by each product within a market. Additionally, it shows the performance potential of product portfolio and the financial aspects related to the resource allocation for particular products within the portfolio. The choice of right products to the offer for sale is a central factor which influences a company's chances of success. Therefore, firms must continually search for ways to improve the array of products in their portfolios in order to achieve organizational goals [Cauchick Miguel 2008, Ionescu and Curmei 2011].

Today's new product projects could decide about tomorrow's product or market profile of the company. Studies reveal that 50 percent of firm's sales come from new products launched within the last five years. Despite growing popularity of product portfolio management, Cooper's et al. benchmarking studies have identified that this is one of the weakest areas in managing new product development [Cooper et al. 1997a]. Pirtilä and Sandström [1996] claim that industrial companies (e.g. board industry companies) launch new products constantly in order to maintain their competitiveness. Therefore, the number of product variations tends to increase, even uncontrollably. Often new product variations are made just by marginally changing some of the product specifications. Considering the lack of similar research conducted in the furniture industry, this paper presents studies dedicated to furniture manufacturers. The aim of this paper is to diagnose the problems possibly resulting from new furniture implementation and describe main determinants influencing product portfolio.

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PRODUCT PORTFOLIO MANAGEMENT

A product portfolio is comprised of all the products which an organization has. A product portfolio may comprise of different product categories (e.g. tables, wardrobes, chairs), different product lines (e.g. furniture collections) and finally the individual product itself. Management is needed on all the three levels of a product portfolio: individual products, product lines and finally the complete portfolio [Bhasin 2012]. Over the decades, the literature has explored a number of issues under the general term of portfolio management. Early studies defined portfolio management as project selection. Later on, the term portfolio management was used to mean prioritizing the development of products and, more recently, to mean multiple project management [Cauchick 2008]. According to Cooper et al. [1997a, b] portfolio management is a dynamic decision process, whereby a business's list of active new product (and R&D) projects is constantly updated and revised. In this process, new projects are evaluated, selected and prioritized. Existing projects may be accelerated, killed or de-prioritized and resources are allocated and reallocated to the active projects. Portfolio management, Kahn [2012] also confirms, is a continuous process of allocating resources to best achieve the firm's business objectives. Having a portfolio of high-value projects that is properly balanced and directly tied to the business strategy is essential to optimizing the value realized. Leading firms constantly strive to balance their portfolio, determining the optimal investment mix between risk and return, maintenance versus growth and short-term versus long-term gains. Portfolio management keeps a firm's portfolio fresh and responsive to market and strategy shifts.

Product portfolio requires a systematic analysis. It is an analytical approach, whereby a company manager can view the company as a sum of products that must be managed in a profitable manner. That analysis must become routine activity undertaken by the company, through its carried out on a regular basis, so that decisions of earmarking of financial resources may be monitored, updated and modified with a view to accomplishing corporate objectives, correlated to the process of generation thereof carried out in an efficient way by each product [Ionescu and Curmei 2011]. Many businesses have moved to more formal portfolio management systems to help allocate resources effectively and prioritize new product projects. Portfolio management allows a firm to manage a set of investment projects that are aligned with the business strategy, balanced and generate the greatest economic return. Note that the best-performing businesses have more aggressive development portfolios and undertake a higher proportion of more innovative new products projects, while the worst-performing ones have a very timid new product project portfolio [Cooper et al. 1997a, b, Kahn 2012].

RANGE OF FIRM'S PRODUCT PORTFOLIO

Determining the appropriate number of entries in a specific firm's product line is a challenge for managers. Some firms have broad product lines, others have them more limited. Both approaches have some advantages and disadvantages, but what is an asset for one, for the other can become a defect. The possible effects of application of either narrow or wide product proliferation are presented in Table 1.

The success of these two different strategies emphasizes how the optimal number of entries in a firm's portfolio depends not only on the firm's market but also on firm specific characteristics such as the firm's cost structure. Specifying the optimal number of product entries is complicated, because firms define product lines differently. One firm might view two physically distinct, but highly similar items, as variants of the same basic product entry; another firm might view these items as distinct entries [Bordley 2003].

Portfolio management and new product projects prioritization should balance the optimal investment mix between risk versus return, maintenance versus growth, and short-term versus long-



term new product projects [Cooper et al. 1997a]. That’s why it is important to consider a mix of projects in development that builds both market position and desired development capabilities.

Table 1. Effects of narrow and wide product proliferation in firm’s portfolio

Product proliferation	
Narrow	Wide
<ul style="list-style-type: none"> ▪ enables the firm to have lower per unit production costs when scale economies are present ▪ can lead to lower design costs, lower inventory holding costs and reduced complexity in assembly ▪ can make easier to product portfolio management ▪ can favour to be a specialist in some product categories 	<ul style="list-style-type: none"> ▪ enable firms to satisfy the needs and wants of heterogeneous consumers more precisely ▪ can deter new firms from entering the market, which enable remaining firms to charge higher prices ▪ can help a company capture more value ▪ can increase chances for a big win and then the number of other product can benefit from a hit’s popularity ▪ can assure some financial protection when sale from company’s core products fall ▪ can favour innovativeness

Source: own elaboration based on Bordley [2003], Bharat [2008]

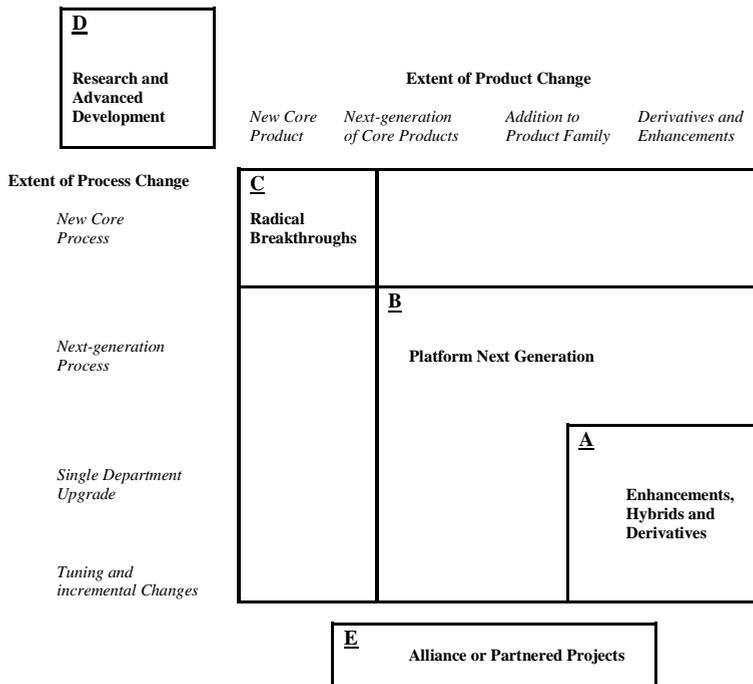


Figure 1. Defining primary “types” of development projects

Source: Clark and Wheelwright [1993]

The most useful method to classify development projects into different categories or types relies on assessing the degree of change represented by the project. As illustrated in Figure 1, the degree of product change and the degree of manufacturing process change can be combined to

define several types of development projects. In this sense, projects can be typed as breakthrough, platform, and derivatives [Clark and Wheelwright 1993]. When portfolio management is lacking, certain problems can arise. For instance, available resources can be limited while there are far too many projects to develop; the projects to be developed often do not fit the business strategy, and thus many projects can be disconnected from the strategic priorities of the business; “go or kill” decision points can be weak, so that poor projects are often not killed; wrong projects can be selected so the portfolio’s quality is poor [Cauchick 2008].

PRODUCT DEVELOPMENT PROCESS IN THE FURNITURE INDUSTRY

Due to the nature of the new product in the furniture industry, a detailed definition was proposed by Olkowicz and Szymanowski [2012]. ‘The new product’ is a single product (a piece of furniture) or the collection (line) of furniture (i.e. a set of products related to each other in the style of design and bearing the same name) which fulfil the criterion of novelty for 24 months, while the sale was booked by the manufacturer. ‘The newness’ can be expressed in a modified, improved design, construction, use of a new material, a new process application, a new method of customer service, satisfying new customer needs or in a better way meeting current needs.

The furniture industry has low potential for the implementation of critical product innovations, but higher with regards to making some changes (incremental innovation). Additionally, a high degree of industry division and conservative manufacturers’ market attitude significantly impedes the penetration of new market segments through the development of new products. Moreover, for that reason, products are likely to remain unchanged for longer than they should. However, that kind of industry has got assets, too. Firstly, it does not require a long period of time for new products development because of making modifications only in existing designs or continuing the firm’s product portfolio (e.g. a furniture collection).

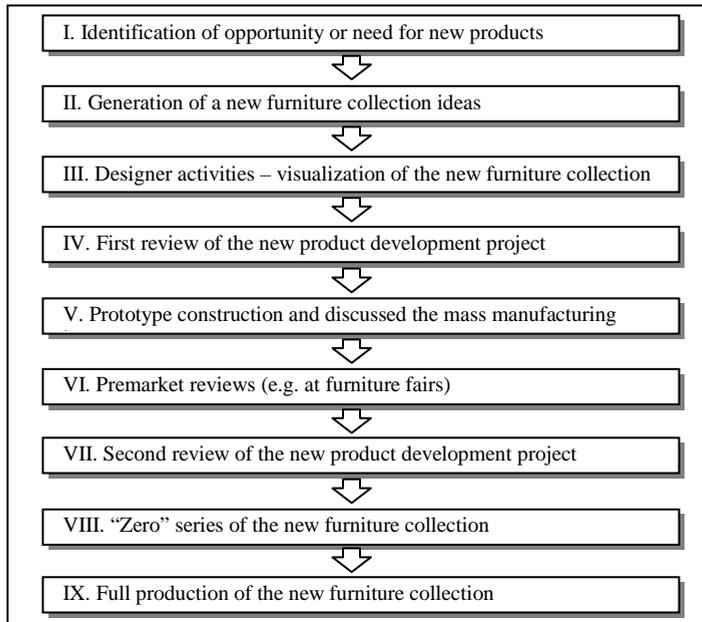


Figure 2. The simplified scheme of a new furniture collection development process

Source: own elaboration based on Bumgardner et al. [2001]

Secondly, it is resistant to failure of product innovations due to a low degree of changes introduced to new products. Third is a relatively short period of the new product development process – circa 2-6 months (in the plants not highly focused on design and innovation) – in relation to the duration of this process in other industries, such as food, electronics (circa 1 - 1,5 years) [Olkowicz and Szymanowski 2012]. The typical course of the new product development in case of large goods companies is presented in Figure 2.

THE CASE STUDIES

Conducted studies of domestic and foreign literature allowed to identify the current state of knowledge on portfolio management and a new product development in furniture industry. Noting the gap in this area, the aim of the research was to determine the level of assortment management and its specificity. They were described on the grounds of the deeper analysis that was carried on in the second half of 2011 in selected, large furniture (case goods) companies. The case study was adopted for the research method. Data was collected using the following techniques: a survey, an observation, an in-depth interview and examination of documents. From the companies, which after the survey have offered participation in the next stage of the research, only three were selected (each one employing about 500 people). The factories were chosen so as to have their market segments differentiated with respect to price and quality. Therefore, Plant I manufactures quite cheap furniture from chipboards or MDF-boards (the low-price market segment). The portfolio of Plant II presents the mid-priced products, i.e. the furniture with more complicated constructions, higher quality (application of solid wood elements) and which requires using higher technologies than first manufacturer applies. The last, third chosen factory - Plant III - delivers on the Polish and foreign market the highest class furniture. Usually they are manufactured from wood only.

All of the researched furniture plants made accessible qualitative and quantitative data and information about the firms' product portfolios and procedures of carrying out the development process from 2003 to 2011. There was one condition – to retain their anonymity (i.e. the firms' names or the other information that would help to identify the companies, can not be revealed).

This article (Part I) presents the results concerning the basic information about the portfolio structure of the three case goods companies. In addition, particular attention is paid to the conditions and circumstances of new furniture collection introduction to the sale offer. The second part of the results will be presented in the next article (Part II).

RESULTS

All plants made available qualitative data from the period 2003-2011. However, quantitative data came from different time periods. Plants I and II provided the data from the 96 consecutive months, and only Plant III from the 48 consecutive months (with reference to data of Plants I and II, the data of Plant III came from the period from the 49-th to the 96-th month). The reason of thereof lay in the difficulty accessing the earlier data from Plant III. It was caused by the modernization of databases having a place exactly in the middle of the assumed study period. The detailed scope of the obtained, quantitative data is presented in Table 2.

Table 2. Range of quantitative data in the studied plants

The Plant	Range of quantitative data *
I	01.IV.2003 – 31.III.2011 (the 96 consecutive months)
II	01.IV.2003 – 31.III.2011 (the 96 consecutive months)
III	01.IV.2007 – 31.III.2011 (the 48 consecutive months)

* The financial year at each researched plant spans from 01.IV to 31.III of the following year

Source: own studies

Analyzing the product range which is encompassed by the research (Table 3), it could be seen that at Plant I is the widest. In that case, it can be assumed that it also has the greatest ease in the introduction of new products. This certainly results from the lowest level of structural and technological furniture advancement, which allows for introduction of modifications and improvements to the product portfolio in a relatively simple manner. Probably, also product strategies have impact on its product range. In fact, there were cases where the same products, but under a different name, have been sold on various markets (e.g. Polish, English and German). However, excluding the fact that researched periods have different duration, product assortments of Plants II and III were about three times smaller than at Plant I. It means that a price of the product, a level of difficulty of its constructing and manufacturing is important in determining the final size of product range at a company.

Table 3. Product range in the studied plants on the basis of the obtained data

The Plant	Number of furniture collections in a product portfolio during the researched period*	Average number of furniture collections in a monthly sale offer during the researched period
I	426	98
II	143	47
III	63*	30

* Data from Plants I and II encompass the period: 01.IV.2003 – 31.III.2011, but from Plant III – it encompasses only half of that period: 01.IV.2007 – 31.III.2011

Source: own studies

The average duration of the new product development process in the furniture industry totals from 2 months in the plant with the cheapest range of products to 3 - 4 months at the factories from mid- and high-end furniture market. It also depends on the novelty degree of implemented products and on the specifics of the production plant, which is the level of technological advancement and product design. Therefore, the largest number of implementations of new furniture collections (349) was shown in the case of furniture of the lowest class (Table 4).

Table 4. Range of new furniture collections in the product portfolio of the studied plants

The Plant	Number of new furniture collections in a product portfolio implemented during the researched period*	Number of new furniture collections in a product portfolio implemented during the second half researched period **	Average monthly number of new furniture collections implementations in the researched period*
I	349	181	3,6
II	79	35	0,8
III	25	25	0,5

* The research period for Plants I and II: 01.IV.2003 – 31.III.2011, for Plant III: 01.IV.2007 – 31.III.2011

** 01.IV.2007 – 31.III.2011

Source: own studies

Plant I implements on average 3.6 new furniture collections per month. The reasons for this situation may be a few. Firstly, the introduction of new products with small changes in comparison

with older furniture offered by the firm, but giving them new names. The second possibility is the qualitative differentiation of new products which are identical in terms of design and technology. Sometimes they only differ in the quality of the raw material, from which they are made, and (or) the way of finishing, e.g. the surface (the colour, the type of film or laminate), which provide the basis for assigning different names to them. The third reason for such a wide product range in Plant I could be the new product strategies chosen by the company. The extent of typical furniture collection (i.e. how many pieces of furniture are included in one set) may also influence the high average number of implementations by month. It's likely that the furniture collections proposed by Plant I are less numerous than at the higher-end product manufacturers. However, that issue was not risen in these studies because it went beyond their scope.

Looking at the size of the new products range in Plants II and III, and in relation to Plant I, the scale of the implementation number could not be just ignored. During the researched period (96 months), the mid-class furniture manufacturer (Plant II) launched on the market approximately 4-5 times fewer new furniture collections (79) than the manufacturer of the low-class furniture (Plant I). Manufacturer of furniture with a high proportion of solid wood (Plant III), considering only the period of 48 months, has already prepared about 7 times fewer new collections (25) than Plant I. Nevertheless, a similarity between Plants II and III in the scale of the new product implementation is easily seen. It is also confirmed by the result of the monthly average launching of new products in the researched period, i.e. the 0.8 new furniture collection at Plant II and 0.5 at Plant III per month. However, in all studied furniture plants some common features were detected. That is the cyclical nature of some months, when the first sales of a greater than usual number of new products take place (Figure 3). Increase of implementation frequency is visible in April and June. A slight increase is also noticeable in: August, September and October.

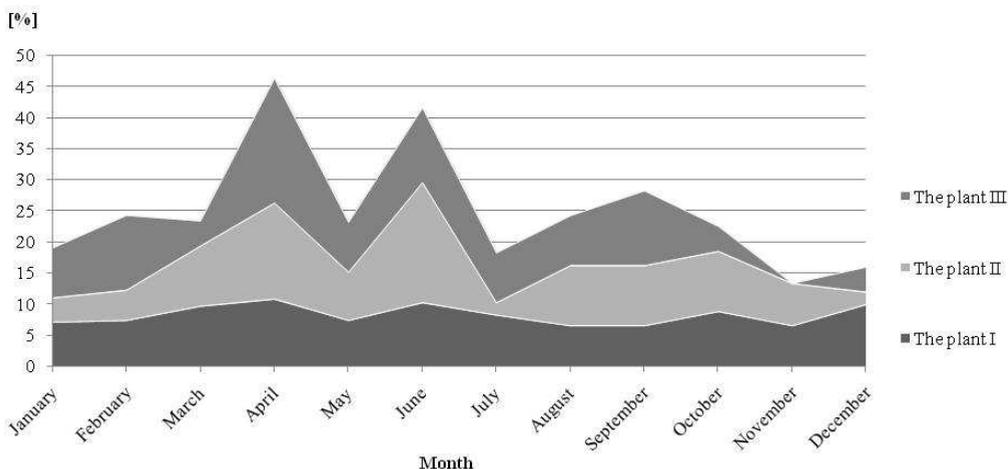


Figure 3. The total % implementation number of new products in the studied plants according to calendar months

Source: own studies

The spring growth of a new furniture collection implementation is probably a result of the first orders realization which were submitted at furniture fairs, that mostly take place just at this time of the year. In the autumn the first increase in sales of new products involves the fact that for a long time in furniture industry in general it is a period of higher sales. Today the average of about 30% of

annual furniture sales falls on the period from September to November, i.e. three months. Therefore, this phenomenon could be seen as seasonality.

CONCLUSIONS

Product mix decisions can have a critical impact on both the profitability and competitive position of a firm. The product mix problem is concerned with which products and how much of each product should be in the product mix for a given operating level [South and Oliver 1998]. Knowledge of the product portfolio division with respect to criteria: new and old products, the qualitative and price shelves or profitable and unprofitable products, furniture businesses can use to improve decision-making mechanisms at a company.

As indicated by the above results, a price (or quality) of the product and a level of difficulty of constructing and manufacturing it is important in determining the final size of product range at a furniture company. The lowest level of the structural and technological furniture advancement allows for introduction of modifications and improvements to the product portfolio in a relatively simple manner. The big impact on product range also have product strategies and the extent of typical furniture collection (i.e. how many single pieces of furniture is included in one set?). At that time, in the furniture plant with the cheapest range of products the average duration of the new product development process is about 2 months. In case of most complicated furniture, for example those with more prominent differentiation of design, construction and technology (middle and high end price of furniture), the new product development process takes from 3 to 4 months. Moreover, the product portfolio in that kinds of companies is few times (about 3) narrower than in factories which don't use solid wood. That furniture plants also have fewer implementations of new furniture collections. In comparison to the firm from the low case goods segment, the plant with middle class of assortment in the researched period had launched about 4 times less new products, and the plant with high class furniture – even about 7 times less.

Analyzing the case goods companies' portfolios the cyclical nature of months April and June, was noticed, when the first sales of a great number of new products take place. Nevertheless, the increase of sales of all products was found in autumn, because the on average about 30% of annual furniture sales falls on September, October and November.

The main conclusions indicate that the most important in determining the final size of product range at a furniture company are: new product strategies, the types and quality of raw materials, a price of the product (low, middle or high end), and a level of difficulty of constructing and manufacturing it.

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COMPARISON OF SLOVAKIA MAJOR COMPETITORS ON THE EU TIMBER MARKET

Abstract: This paper analyses the use of roundwood among the SR major competitors in the EU. The analysis compared the calculated variables on production and consumption of different roundwood assortments in the Slovak Republic, the Czech Republic, Austria and Finland. To ensure comparability, individual index methods are applied to the volume of import on production and consumption and export consumption over the period of five years. The results show different development of roundwood utilisation in analysed countries.

Keywords: comparison, competitiveness, timber, roundwood, fuelwood

INTRODUCTION

Currently, forestry and wood processing industry including their various sectors relating to the wood processing are influenced by many factors. For instance, changing climatic conditions, competition in harvesting wood, developing the technical complexity of the production process and innovations, and last but not least also legislative measures of national governments and international policy have strong influence and control on the potential use of wood. The use of wood is connected with many different parts of society, agriculture, energy sector, transport and many other industries. We can say wood has indirect influence on the living standard of each population. All those have an impact on rural development and the environment. Over the last two decades, there has been a visible increase in the impact of globalisation on wood processing industry. Globalisation in this sector is characterised by a degree of openness of the economy, an increased share of imports and exports on GDP, as well as by the rapid growth of imports and exports of the Slovak wood and paper products in comparison with the growth of total exports and imports (Šupín, 2011). For a country it is necessary to compare its own wood resources and competitiveness of wood processing industry with other countries on the foreign market. In this sense, we have to find comparative variables to obtain adequate results.

The European Union currently consists of 27 countries and forest area extends over 157 million hectares, which means that about 38 % of the area is covered by forests. In 2007 due to the global economic crisis the turning point in the wood production has spread to all sectors of the national economy, forestry and wood processing industry. In 2009 there was again an increase in production of wood in EU countries to almost 385 million m³. Subsequently, production of wood in 2011 has grown to a volume of 427 million m³. The analysis compared the calculated variables on production and consumption of wood raw material in the Slovak Republic, the Czech Republic, Austria and Finland. Production of wood in the analysed countries equals approximately 22% of the total annual EU wood production.

In 2011 the total area of forest in the analysed countries was 30 641 ha, which constitutes 19.47 % of the total area of forest in the EU. Finland and the Slovak Republic have comparable population, but forest area in Finland is much larger than in the Slovak Republic. Forest area per capita in Finland is about 4 ha and in Slovakia it is less than 0.36 ha. Next country is the Czech Republic. The Czech Republic has population twice the size of Slovakia and the forest area per capita is only 0.25 ha. Difference between Czech Republic and Slovakia is 0.11 ha per capita. In Austria, forest area per capita is slightly higher nearly 0.5 ha compared with Czech Republic. This is

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due to a smaller population compared with the Czech Republic, while the area of forest is in fact larger. In the analysed countries, growing stock of wood represents almost 20.8% of the total growing stock of all EU countries. The highest proportion of timber stocks accounted for 9.7 % in Finland and Austria with 5.3 % of the total stock of wood in the EU (Table 1).

Table 1. Basic data on wood resources in the EU (2011)

Country	Population	Land (mil. ha)	Forest area (mil. ha)	Forest cover (%)	Growing stock (mil. m ³)*
Czech Republic	10 496 088	7,724	2,659	34,43	737,65
Finland	5 388 271	30,389	22,157	72,91	2 024,00
Austria	8 423 635	8,240	3,892	47,23	1 106,72
Slovak Republic	5 398 384	4,808	1,933	40,20	477,60
EU	503 043 894	418, 172	157,370	37,63	20 941,52

Source: <http://w3.unece.org>

METHODOLOGY

Analysing the production and utilisation of wood in the EU, despite compatibility with the Slovak national standards with other international standards, will draw resources from international statistics based on international qualifications assortments of wood and wood products based on their usage.

Wood analysis in selected EU countries issued from characteristics of each country in terms of resources, wood production and foreign trade (export and import). In that sense, it is necessary to separately analyse industrial roundwood and fuelwood. Statistical method of calculating changes in individual indicators by simple indices to obtain the necessary information to compare the use of wood raw material for the EU countries in the period from 2006 to 2011. The comparison of selected indicators of the Slovak Republic were established to compare with the Czech Republic due to a comparable supply of timber and important economic link with the Slovak Republic, Austria based on mutual respect comparable supply of wood raw material and the existence of a business relationship with the Slovak Republic, Finland in relation to high forest cover within the EU.

RESULTS

In 2008 research reported a significant increase in production of roundwood in the Slovak Republic. The increase in production was to some extent influenced by wind blow calamity which supported supply of coniferous sawlogs. Finally, it has a significant impact on the efforts of roundwood supply owners and forest users to achieve better economic results. The following year 2009 in comparison with the previous year noted a fall in production due to the economic crisis. The Czech Republic at the beginning of the analysed period showed a decrease in roundwood production, which they tried to cope with over the period of 5 years. However, despite the recent years the Czech Republic failed to reach a situation from 2006. The difference between 2011 and 2006 was 2.297 million. m³. In Finland production of roundwood significantly declined between years 2008 and 2009. Although, there was a significant increase in 2010 (it represented the end of the analysed period). Development of roundwood production in Finland and Austria in that time was almost the same as in 2006. Also, there was a significant drop in roundwood production between 2008 and 2009, but then the production increased again in 2010. The difference between the beginning (2006) and the end (2011) of analysed period was higher in Austria than in Finland. In Austria differences in production amounted to about 439 thousand m³ of roundwood. Following

the development of roundwood production in Slovakia, this period was characterized by an increase in 2008, followed by a substantial decline. At the end of the period in question the amount of roundwood production compared to baseline from 2006 and it increased by about 1.34 million m³. Slovakia is one of the monitored countries which has an ultimately increasing trend in the production of wood in the period between 2006 and 2011.

Table 2. Annual index of production and consumption in selected EU countries

Table-on-year index of production of selected products in %					
index	product	Czech Republic	Finland	Austria	Slovak Republic
06/07	Roundwood	4,695	11,416	11,405	3,342
	Industrial roundwood	2,480	12,927	14,490	2,029
	Fuelwood	31,599	-1,585	1,942	35,675
07/08	Roundwood	-12,541	-10,495	2,243	13,984
	Industrial roundwood	-14,524	-10,583	1,518	12,951
	Fuelwood	6,215	-9,627	4,739	33,098
08/09	Roundwood	-4,232	-17,796	-23,253	-1,959
	Industrial roundwood	-3,760	-20,155	-27,593	-2,446
	Fuelwood	-7,819	5,252	-8,761	5,696
09/10	Roundwood	7,960	22,323	6,597	5,635
	Industrial roundwood	7,277	25,274	9,367	6,920
	Fuelwood	13,387	0,455	-0,743	-13,002
10/11	Roundwood	-8,096	-0,363	4,850	-4,023
	Industrial roundwood	-8,828	-0,980	2,628	-5,713
	Fuelwood	-2,595	5,342	11,334	26,104
Table-on-year index of consumption of selected products in %					
index	product	Czech Republic	Finland	Austria	Slovak Republic
06/07	Roundwood	5,56	6,36	5,72	-0,41
	Industrial roundwood	2,28	7,12	6,81	-1,17
	Fuelwood	49,42	-1,88	0,71	16,73
07/08	Roundwood	-11,37	-7,95	-2,65	11,06
	Industrial roundwood	-13,58	-7,97	-4,18	9,20
	Fuelwood	8,80	-7,70	4,77	46,15
08/09	Roundwood	-10,83	-28,01	-14,26	-10,74
	Industrial roundwood	-10,96	-31,89	-16,69	-11,26
	Fuelwood	-9,89	18,11	-3,45	-3,40
09/10	Roundwood	19,52	24,24	3,79	10,58
	Industrial roundwood	19,61	29,60	4,71	12,17
	Fuelwood	18,93	-12,45	0,28	-9,98
10/11	Roundwood	-14,64	-1,76	1,63	-1,83
	Industrial roundwood	-16,01	-2,25	-1,60	-4,47
	Fuelwood	-4,69	3,26	14,57	40,75



The differences between production levels in individual years describe a development of fuelwood production in Austria and Finland which was insignificant throughout the period from 2006 to 2011. The situation with production in the Slovak Republic and the Czech Republic was similar since 2007. There has been an increase in production of fuelwood, which had been on an increase for the whole period. The difference in the production of fuelwood in 2011 and 2006 was 569 thousand. m³ in the Czech Republic and less than 336 thousand. m³ in the Slovak Republic. Over the last six years the production of fuelwood in Slovakia recorded a significant increase. In 2011 the share of the exported volume of fuelwood in total output reached almost 24% in comparison with 2006. The volume of exported wood fuel accounted for less than 5%, which demonstrates the ever increasing need for the use of materials on the domestic conditions. The situation can be assessed as a result of steadily rising prices for fossil fuels in the Slovak Republic as well as increased interest in the use of raw wood as a renewable energy source. After Slovakia entered the EU (thanks to the increasing possibilities to apply for financial support from the EU funds) wood for energy propose, but also wood waste started to be more intensively used in energy sector. This growth has been also supported by the increasing prices of conventional fuels resulting in higher demand for wood as fuel used by households. It is also important to mention that with the increasing felling and deliveries of roundwood, the volume of energy generated from wood has been also increasing in absolute numbers. Production of roundwood in the Slovak Republic in 2011 reached a value almost 17% higher than in 2006, while consumption growth reached 7.2%. Export of wood noted rapid growth by almost 118%. The aim of the wood processing industry in the Slovak Republic was filling capacity specified in the forest management plans, and a fall in domestic prices could only be achieved by increased exports. Import of roundwood in Finland reached during the period of rapid decline of 155% (thanks to changes in trade conditions with Russia). In contrast, in the Slovak Republic, there was a large increase in imports by almost 151%. The individual annual indexes for roundwood, industrial roundwood and fuelwood in analysed countries are calculated in table 2.

The comprehensive analysis of the use of wood in selected EU countries was necessary to determine the apparent consumption of different assortments of roundwood and wood products largely influencing economic situation in a particular country. A significant effect on the consumption is the fact that the analysed countries are more focused on export of wood products abroad. This fact influenced competitive environment of the wood processing industry. According to assessment of data on wood and wood products production and consumption it can be concluded that only the Slovak Republic experienced an increase in both indicators.

CONCLUSIONS

The EU countries are committed to the creation of national action plans for renewable energy. As a consequence they increased the use of these wood resources for energy purposes. Based on the above mentioned analysis of the use of different wood assortments in selected EU countries, we found that within the period between 2006 and 2011 there was an increase in the consumption of fuelwood accompanied by a slight decrease in 2009. In analysed countries there is a precondition of fulfilling the quota by 2020 facing the action plans for energy use of biomass.

The presented analyses carried out in the period 2006-2011 shows evident fluctuation of production of analysed wood assortments in all four studied countries. Only in the Slovak Republic the consumption of all analysed wood assortments increased between 2006 and 2011. Austria and the Czech Republic registered an increase in fuelwood consumption and in Finland consumption of fuelwood was stable. The consumption of industrial roundwood assortments decreased during reported period. Wood consumption in the period was affected by several factors. For instance the global economic crisis has deeply affected the economy of EU countries. The negative impact of the crisis has contributed to a reduction in demand for roundwood. Slovakia is among those EU

countries that have significant potential for new ways of utilisation of wood. That is why, appropriate production, processing and its subsequent use are necessary to achieve effective utilization of productive functions of forests in conjunction with their sustainable management.

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SLOVAK AND EU MARKET WITH WOOD PELLETS

Abstract: This paper deals with the wood pellets market in the Slovak Republic and in the EU. Wood pellets are one of several processed biomass feedstocks that are traded internationally and used for energy. They are cleaner burning, have a higher energy density, and are easier to handle than firewood, chips, or other forms of wood fuel. In the growing market for renewable fuels, wood pellets are used as a supplement or substitute for coal in energy systems and as a thermal fuel source for commercial and residential heating. Advantages of wood pellets include (1) the main feedstock, which is wood waste from primary and secondary saw mills, and (2) the high energy density and consistency of the fuel, which allows international trade to be feasible. The aim is to analyse the current Slovak and European wood pellet markets including demand, supply and prices of pellets used for heating and power production. The focus of this market analysis is on the European market for pellet production and use, although the European trade of pellets does also include trade flows from non-European countries. The European Union is still the main market for wood pellets and will remain as such for the coming years.

Key words: wood pellets, biomass, international trade with wood pellets, forest product market

INTRODUCTION

The dependency of the European Union (EU), including Slovak Republic, on energy imports, particularly on oil and more recently on gas, forms the backdrop for policy concerns relating to the security of energy supplies. More than half of the EU-27's energy comes from countries outside the EU – and this proportion is rising. Europe produces only 48% of its energy needs. Production of energy from renewable energy sources mainly biomass is growing significantly. The demand for wood biomass has undergone significant changes. [3]

The international trade with wood and wood products will increase in the future. Trade may expand and have a significant impact in some markets or market segments. It could remain limited to a few markets and a few segments. It is also possible that in the longer term it could cease to have any significant impact. The deciding factor will be consumer reaction to the products which is far from clear at this stage. [7]

Rapid deployment of renewable energies plays an important role in efforts against global warming and strengthens the security of energy supply. Among the renewable energy sources biomass plays a specific role. It covers about two thirds of all renewables and is the fastest growing sector in absolute terms.

A variety of different biomass raw materials can be used for energy purposes. Many different conversion technologies are available to transform primary energy from biomass to heat, electricity or transportation fuels. The use of biomass and the potential for further development is closely related to forestry and agriculture and to the energy sector. [5]

The use of renewable energy sources for heat production has increased significantly during the past years, and according to the rising energy demand and the prospective climate targets a further increase in this field can be expected. Driven by the EU energy and climate change policy it is aimed to increase the share of renewable energy in the EU energy mix up to 20% by 2020, and consequently national action plans have been developed in order to realise these aims. Due to high

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costs and an unstable market for fossil fuels, as well as, political directives pushing the use of CO₂-neutral energy sources, a further increase in this field can be expected. For Slovakia the objective is to reach a share of 14 % of renewables in the total energy consumption by 2020. [10]

Currently, the main form renewable sources for heat production is biomass, mainly wood and wood energy products. The increasing demand in this field leads to a shortage of high-quality wood as a raw material. Concurrently, raw material prices and fuel costs are increasing and the attractiveness of renewable energy solutions compared to fossil fuel heating are increasing.

BIOMASS FOR ENERGY

Biomass is the biodegradable fraction of products, waste and residues from biological origin from forestry, agriculture (including vegetal and animal substances), and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste:

- Forest and wood-based industries produce wood which is the largest resource of solid biomass. Biomass procurement logistics from forest to bioenergy plants are subject to major improvements. The sector covers a wide range of different bio with different characteristics - wood logs, bark, wood chips, sawdust and more recently pellets. Pellets, due to their high energy density and standardised characteristics, offer great opportunities for developing the bioenergy market worldwide. [5]

- Agriculture can provide dedicated energy crops as well as by-products in the form of animal manure and straw. Available land can be used for growing conventional crops such as rape, wheat, maize etc. for energy purposes or for cultivating new types of crops such as poplar, willow, miscanthus and others.

- Biogenic waste is the biomass that can cover several forms of waste such as organic fraction of municipal solid waste, wood waste, refuse-derived fuels, sewage sludge, etc.

According to the official data published by Eurostat 2010 renewable sources were estimated to have contributed 12.4 % to gross final energy consumption in the EU27. The highest share of renewable energy in total consumption in 2010 was found in Sweden (47.9 % of renewable energy sources in total consumption), Latvia, Finland, Austria and Portugal. In Slovakia it reached 10.4 %. The lowest is found in Malta, Luxembourg, the United Kingdom and the Netherlands. [3]

Between 2006 and 2010, all Member States increased their share of renewable energy in total consumption. The largest increases were recorded in Estonia (from 16.1 % in 2006 to 24.3 % in 2010), Romania (from 17.1 % to 23.4 %), Denmark (from 16.5 % to 22.2 %), Sweden (from 42.7 % to 47.9 %), Spain (from 9.0 % to 13.8 %) and Slovakia (from 6.6 % to 10.4 %). [3]

According to the latest statistics, bioenergy remains the major source among renewables in Europe, accounting for almost 64 % of European renewables and showing steady growth patterns across the different market segments. Total gross inland consumption of renewables in EU27 was almost 152 Mtoe (million toe, 1 toe = 41,87 GJ = 11,63 MWh) in 2010, from which 118,22 Mtoe was biomass and waste or 8,16 % of the total final energy consumption in EU27 for the same year. Biomass is mainly used for heat (75 % of the total final energy consumption of biomass). The share of biomass in the final energy consumption varies significantly among Members States: Sweden, Latvia and Finland lead the way with more than 27 %, while Estonia and Lithuania follow with 25,7 % and 19,5 % respectively, in Slovakia 6,5 % only. [14]

The EUBIONET III partners have estimated that total biomass potential in Europe is 157 Mtoe (excluding biodegradable waste), of which 67 % is from woody biomass (forest residues 23 %, firewood 18 %, solid including wood residues 12 %, spent liquors 8 %, used wood 6 %). According to the same study, in Europe, 48 % of the annual biomass potential is currently used. [15]

WOOD BIOMASS

Forests and other wooded land in the EU cover approximately 177 million ha (over 40 % of the EU territory), of which 130 million ha are available for wood supply. Ecologically, the EU's forests belong to many different bio-geographical regions and have adapted to a variety of natural conditions, ranging from bogs to steppes and from lowland to alpine forests. Socioeconomically, the EU's forests vary from small family holdings to state forests or large estates owned by companies, many as part of industrial wood supply chains.

The EU Member States with the largest proportions of wooded area are Finland and Sweden, where approximately three quarters of the land area is covered with forests or woods. These same two countries recorded the highest areas of wooded land per inhabitant, approximately ten times the EU average. Sweden alone accounted for 17.5 % of all the wooded land in the EU in 2010, and the five largest wooded areas (in Sweden, Spain, Finland, France and Germany) collectively accounted for well over three fifths (62.5 %) of the wooded land in the EU. The least densely wooded member states are Malta, The Netherlands, Ireland and the United Kingdom.

Forests and other wooded land in the Slovak Republic cover 1,933 million ha, over 41 % of the territory, of which 1,775 million ha are available for wood supply. [4]

Between 2000 and 2010, wooded area in the EU increased through natural expansion and afforestation by a total of 3.5 million hectares, a rise of 2.0 %. In relative terms, the largest expansions in wooded area were recorded in Ireland (21.4 %), while Bulgaria and Latvia both recorded increases in excess of 10 % (in Slovakia plus 12 000 ha). Only four of the EU Member States recorded a fall in their areas of wooded land, with Denmark recording the largest reduction (-5.0 %) ahead of Portugal, Slovenia and Finland. [3]

As demand for wood increases from both wood processing industries and the energy sector, the question of whether there is enough wood is of great concern nowadays. In order to understand how much wood is available, it is essential to know how much wood is available in a form of growing stock in the European Union's forests and how much is removed.

The growing stock information on available resources as well as the basis for estimating biomass stocks is the most significant. The increment of the EU's growing stock was in excess of 700 million m³ in 2010, around 1.6 times as high as the volume of felling (only approximately 63 % of the increment is felled). The current growing stock is 439 million m³ in Slovakia. [4]. With Europe's forest area and growing stock expanding (including Slovakia), it would seem that a high level of wood removal for production is not incompatible with sustainable forest management in countries with relatively developed economies and stable institutions. The most common primary designated function of forests within the EU is production essentially of wood but also of non-wood forest products. Further downstream, arrange of manufacturing processes take these basic and primary wood products and transform them into a range of wood and paper products or as a source of energy.

A common measure of the magnitude of the extraction of wood from forests is roundwood removals: this comprises all quantities of roundwood removed from the forest or other felling sites and stripped of the bark (under bark).

The total level of removals in the EU in 2010 was 420 million m³ under bark. The largest volumes of wood removals were recorded in Sweden, Germany, France, Finland and Poland, which together accounted for close to two thirds of the EU total. The production of roundwood in the EU in 2009 was, in the main, composed of industrial roundwood (accounting for 79 % of the total), while the production of fuelwood covered the remaining 21%. The highest shares of industrial use are in Ireland, Slovakia, Belgium, Finland and Sweden. In Europe the production of fuelwood continues to rise despite the economic crisis, due to the increment in use of energy from renewable sources and price increases for fossil fuels. [11]

The total level of removals in Slovakia in 2010 was 9,559 million m³ under bark. The production of fuelwood was 509 thousand m³ (5,31 %) and roundwood covered remaining 94,69 %. [4]

Wood for use as an energy source comes not only from tree felling, but also from selective thinning of managed forests and other forestry practices (direct sources). Wood for energy use may also be derived as a by-product from downstream processing in wood-based manufacturing, for example, as off-cuts, trimmings, sawdust, shavings, wood chips or black liquor (indirect sources). End-of-life wood and paper products may also be used as a source of energy (recovered wood). [8]

As we said before it should be noted that some of the wood resources used for energy come directly from forests and the remainder from production residues. Around 42% of all mobilized woody biomass supply is used for energy purposes. But it should be noted that, despite the increasing rate of wood consumption for energy, the region's forests are increasing in area as well as standing volumes. [6]

Wood and wood waste was the principal source of renewable energy consumed in the majority of EU Member States, its relative importance ranging from 97.46 % in Estonia to just 12.87 % in Cyprus and 52,31 % in Slovakia (EU 94,69 %). [9]

WOOD PELLETS

The increasing popularity of biomass combustion leads to a higher demand of wood fuels, and consequently to a stronger competition for this raw material with other sectors of industry. The demand for wood biomass has undergone significant changes. Behind the rapidly growing consumption there are not only traditional industrial sectors such as pulp and paper and agglomerated wood based panels' producers, but also subjects of energy sector utilising wood biomass as an input.

Pellets can be used both for residential and commercial heating and for power production. Pellets can be used in large pulverized fuel or circulating fluidized bed power plants. These plants can be operated in co-firing mode with coal, be retrofitted from coal up to 100 % wood pellets or be newly built. The two first options allow to replace large amounts of fossil fuel by renewable fuel within a short period of time. The achieved greenhouse gas reduction will be more than 85 % with respect to coal or more than 70 % with respect to a reference natural gas power plant – taking into account all CO₂ emissions for pellet production and transport.

Wood pellets are made from dried and densified sawdust, shavings or wood powder. Pelletization is currently the most economic and energy saving ways of converting biomass into a fuel with high energy density and consistent quality. For this reason it is one of the fastest growing forms of upgraded biomass in Europe and worldwide.

Wood pellets are a clean, CO₂ neutral and convenient fuel, mostly produced from sawdust and wood shavings compressed under high pressure using no glue or other additives. They are cylindrical in shape and usually 6-10 mm in diameter. The average length is about 10-30 mm. Furthermore, due to their high energy content the convenient delivery and storage features, pellets are the ideal fuel for fully automatic small scale heating systems. With a rapidly growing share in the market, they are a key technology for increasing biomass utilisation in Europe. In the last few years pellets are increasingly used in power plants for co-firing. Pellets are also an excellent way of using local resources thus making a concrete contribution to environmental protection and climate change prevention.

Between 2009 and 2010 the global installed production capacity of the pellet industry has recorded a 22% increase, reaching over 28 million tons. The highest increase in production capacity was observed in North America (the U.S., Canada) and Russia, followed by traditional European producing countries such as Germany, Sweden and Austria. In 2010 the global wood pellet

production reached 14.3 million tons while the consumption was close to 13.5 million tons thus recording an increase of more than 110% when compared to 2006. [1]

In 2009 around 670 pellet plants (14 in Slovakia) [12] were active in EU, 30% of them with a rather small production capacity below 10,000 tons/y, however since 2008/2009 the rapid growth of pellet demand has stimulated investments in large scale plants in the range of several hundred thousand tons in EU as well as in the U.S., Russian Federation and other countries. [1]

WOOD PELLETS TRADE

In 2000, trade in wood pellets was almost nonexistent. The wood pellet market has experienced a large growth in the recent years. However, in volume terms, world trade of wood pellets has now grown to surpass that of ethanol and other bio-based fuels. Europe is currently the leading market for trade in wood pellets. The EU is the main consumer of wood pellets as well as a major producer. There is a high volume of wood pellet trade among EU member countries. The EU has a much larger wood pellet production than the United States or Canada but still requires imports of wood pellets in order to satisfy the demand.

The production of wood pellets has increased dramatically in recent years largely due to aggressive emissions policy in the European Union. However, the market is still small and fraught with uncertainty as the international trade of wood pellets increases.

Currently, the majority of demand for wood pellets originates from the EU, with particular interest in Nordic countries. Major exporters are the United States and Canada, although Russia and parts of Asia and South America have potential to become exporting markets. In addition to the possibility of other exporters, policy and economic factors have a large impact on the trade of wood pellets.

Historically, wood waste, such as pulp and sawdust, has been (1) used for energy within the wood product plants or for local municipalities, (2) disposed of in landfills, or (3) exported, especially to Japan. The supply of wood waste is driven by the demand for wood-based products, such as paper and sawn wood (lumber), rather than the demand for wood pellets. In times of low wood waste supplies, as was the case in 2008, some facilities have resorted to using roundwood and other higher-quality wood sources to produce wood pellets. Tracking the trade of wood pellets internationally is cumbersome. Trade statistics combine sawdust, wood waste, and wood scrap, whether or not agglomerated in logs, briquettes, pellets, or similar forms, into one category. Quantities of biomass traded for energy use are also obscured by countries that export forest products or agricultural products, which could be used for energy production, but the final end use is unknown at the time of export. [1]

Pellet trade in Europe is developing rapidly. Higher demand growth has affected prices; unit values of global wood waste and scrap imports, including wood pellets, steadily increased from 52€/t in 2001 to 140€/t in 2011. The new European quality standard (EN14961-2) facilitates cross-border trade, growing by more than 1 million tons per year from 2009-2011. The ENplus certification is another important factor to open new markets for pellet producer and traders. [2]. Portugal and Latvia are the biggest exporters of industrial pellets.

EU countries imported an estimated 7.6 million tonnes of wood pellets in 2011, 58 % of which represented intra-European trade. The balance of the EU's wood pellet imports - 3.2 million tonnes, with an estimated value of 620 million €, were from outside of the region in 2011.[3] The principal suppliers of wood pellets to Europe are Canada and the United States, although the Russian Federation is also a significant and growing supplier. Some additional trade in wood pellets flows to Europe from South Africa, New Zealand, and Australia, and from Canada to Japan. However, those volumes are presently very small. China is not currently a significant trader in this market.

Pellet imports into Europe are also growing quickly. This development is mostly spurred by industrial pellets and co-firing initiatives in BE, NL, UK, DK. Currently new production capacity is being built in the South-East of the USA as well as Russia.

Expansion of the Slovak pellets market started in 2006, when sale prices of pellets, exported mainly to Italy and Austria, were very high. By the year 2006 only enthusiasts were interested in pellet production, but since the expansion period the pellet production is run by businessmen, who expected high pellet prices to last indefinitely. But in 2007, pellet prices fell significantly and in second part of the year several pellet production units were temporarily or perpetually closed. The pellet production industry began to recover gradually in 2008 thanks to good pellet export opportunities, e.g. to Polish power plants. [13]

The energy potential of biomass is high in Slovakia and theoretically it can cover 15 % of the annual energy consumption, which is 800 PJ. Despite this huge potential, only 117,000 tons of pellets are produced annually in Slovakia, and hardly 15 % of this amount is consumed domestically. Due to the high raw material potential pellet production potentials can be estimated at 1 million tons per year. The same amount of pellets can be expected for pellet production from agricultural residues. [12]

All pellet production plants in Slovakia are relatively small. Therefore, production costs are high. The pellets which were exported to power plants were sold under 100 € per ton, which means that the pellets were sold beyond the production cost and it can be said that the pellets were sold only for maintenance of the production process and supply and customer relationships. Currently wood pellets price ranges between 165€ and 225 € per ton.

In Slovakia pellets are used mainly in small and middle boiler-rooms and family houses in locations where gas connection is unavailable. Medium scale users are usually schools, municipal offices, companies, hotels, bigger residential units, with a demand of 10 - 1,000 tons per year. This market share is growing most rapidly.

There are several distribution channels for pellets.

Wood pellets for biomass boiler rooms operated by BIOMASA are distributed by blower lorries. These boiler rooms are located in BIOMASA member municipalities, which are mostly smaller villages in mountainous regions, often with difficult access for transport in winter. Distribution plans are updated according to real consumption, depending on outside temperature and real boiler consumption.

Wood pellets for sales on the domestic market and for the export are packed in big bags of 1,000 or 1,200 kg and sacks of 15 kg. In some cases, they are marketed in Slovakia also in bulk and transported by own tank truck or in containers. [13]

Wood pellets are exported from Slovakia mainly to Italy, Poland and Austria.

Wood pellet utilisation in Europe is currently focused on a small number of Member States including Sweden, Denmark, the Netherlands, Belgium, Germany, Austria and Italy. Only in these countries pellets have been able to achieve a significant market penetration so far. In a number of other member states markets are still in an early stage of development with very low market penetration but signs of dynamic growth. [14]

Experiences in existing markets show that pellet utilisation can grow extremely fast, if the proper frame conditions exist. In Italy for example the market of pellet stoves grew within 10 years from virtually zero to over 250,000 stoves sold per year. In Austria the market share of pellet heating systems grew within 10 years to over 12 % of all new sold boilers for residential heating.

Three different types of pellet markets have developed in Europe. Pellet markets that are dominated by the utilisation in power plants — this is the case of Belgium and the Netherlands. The U.K. could become another large power plant market for pellets.



A second group of markets combines large scale and small and medium scale use – this is the case in Sweden and Denmark.

In the third type of market pellets are predominantly used for heating in residential or commercial buildings. Within this last sector again stove markets can be distinguished from markets where pellets are used also in boilers or commercial applications. Typical stove markets are Italy or the USA. In these markets pellets are only distributed in bags.

In Austria and Germany pellets are predominantly used in residential and commercial boilers for heating. In these countries bulk delivery is the rule. The fact that only few countries are currently using pellets extensively is due to dedicated policies supporting market development. It is a common experience that new energy technologies cannot penetrate existing markets without significant political support. Existing barriers are usually too high and competition from fossil fuel industries too strong to allow strictly market driven diffusion.

Up to now the raw material for pellets production was mainly sawdust and wood shavings of big saw mills and wood processing companies. In some countries with an already well developed pellets industry, like Scandinavia, this source is in many cases already in continual use. This makes it necessary to open other feedstock resources for pellets production.

The potential for that is very large. It ranges from wood residues, wood from forest thinnings and short rotation coppice to the use of agricultural residues, which also can be used to produce pellets. This wide range of feedstocks allows that up to 2020 a target for pellets production of 60 to 80 million tons seems achievable. The number of plants is increasing continually due to the dynamic market development. [11]

Therefore it can be estimated that the use of pellets for heating purposes in the residential, services and industrial sectors might reach 50 Mt in 2020, corresponding to 22 Mtoe. Demand will also increase for power production and the future development in this sector depends on political decisions. It might reach additional 20 to 30 Mt pellets or more if current policies stay in place, what corresponds to 10 Mtoe biomass and about 1/3 bioelectricity if converted in a coal fired power plant. [10]

CONCLUSIONS

The EU is the world's largest market for wood energy, and imports of woody feedstock continue to grow. Between 2008 and 2010, wood pellet production in the EU increased more as 20% and was estimated to meet about 81% of the EU demand for pellets. Certification programmes for wood pellet quality and environmental stewardship have emerged and are expected to be widely adopted.

The European Union is still the main market for wood pellets and will remain as such for the next several years. The production of wood pellets in EU increased, reaching 9 million tons in 2010, more as 60 % of the global production. In the same period, EU wood pellet consumption increased by 44 % to reach over 11.5 million tons in 2010, 85% of the global wood pellet demand.

Wood pellets dominate in international trade in wood energy. About two-thirds of all those produced worldwide are fired in power plants in the EU. The main exporters are Canada, the US, the Russian Federation and the Baltic States. In coming years Australia, Mozambique, South Africa, and several countries of Latin America are expected to become pellet exporters. Belgium, Denmark, the Netherlands, Sweden and the UK are the main importers of industrial pellets. The Netherlands serves as an import hub for northern Europe.

Canadian and US industrial wood pellet production is largely driven by demand from the EU, which has set a target to meet at least 20% of its total primary energy supply from renewable energy by 2020. More than 90 % of Canadian wood pellets are exported, of which 90 % are destined for Europe. In the US, about 80 % of pellets were used domestically, with the remaining 20% exported, almost entirely to the EU.

Demand from the EU is forecast to reach between 25-55 million tonnes by 2020 under the assumption that public policies will continue to support biomass to replace coal, carbon emission allowances for biomass, and other financial supports (e.g. tax credits for efficient pellet stoves). Additionally, demand from Asian countries, primarily Japan, China and the Republic of Korea may reach 6-10 million tonnes by 2020. However, as new markets emerge and existing ones continue to grow, competition for raw materials may increase production costs and limit their expansion.

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APPLICATION AND DEVELOPMENT OF QR CODE

Abstract: The paper presents the genesis and structure of the QR Code. It was shown that the development of applications for this code is connected with the growing number of users of mobile devices, particularly smartphones. Examples of applications of the QR Code are presented. Barriers and the potential for its popularization are discussed.

Key words: matrix codes, QR Code, mobile devices, smartphone

INTRODUCTION

Barcodes have become a great success wherever automatic identification of items is required, leading to numerous code applications in logistics, trade and manufacturing processes. Initially line codes were used. However, they could contain only a limited amount of information, mainly in the numerical or alphanumeric form. Soon market demand was observed for barcodes, which could store greater amounts of information and code its different types. This was particularly connected with the potential for coding of a complete set of characters of the American Standard Code for Information Interchange (ASCII), various types of scripts and alphabets (Japanese, Chinese, Hebrew, etc.) as well as graphics and photographs (e.g. fingerprint lines).

In response to such needs a bar line code (1D) evolved towards a 2D code, first as a stacked 1D code (e.g. PDF 417 - Portable Data File), followed by a two-dimensional matrix code. The 2D character of the barcode means that information is coded both in the horizontal and vertical direction. For this reason information is more densely packed and may occupy a smaller area in comparison to line codes. In this way it became possible to code all alphanumeric characters, binary data, graphics and provide a more effective protection of coded data against damage.

Increased interest in matrix codes has led to the development of a numerous group of such codes. Individual types of codes differ in their capacity, specific applications and the degree of data safety. The most commonly applied codes include the QR Code, the Aztec Code - in Poland used in vehicle registration documents, the DataMatrix - used on small electronic devices and the MaxiCode - applied by the American package delivery company UPS (United Parcel Service). These codes are available in the public domain, which means they may be used freely, with no license fees required. The code which applications are still being developed is the QR Code. The driving force for its development is connected with the growing number of smartphones, used to read the code. While line barcodes may store up to 20 digits, the QR Code is capable of operating several dozen to several hundred times more information²².

CHARACTERISTICS OF THE QR CODE

QR Code²³ (Quick Response code) is a two-dimensional matrix barcode. It was developed in 1994 by a Japanese company Denso Wave Incorporated, manufacturing readers for automatic data capture, programmable controllers and industrial robots²⁴. The QR Code quickly became popular in Japan, as it is possible to code with it Kanji and Kana scripts, used in Japanese writing. Kanji scripts are logograms, symbolizing words or morphemes. In turn, Kana is Japanese syllabic writing. The potential uses for the code are much more extensive. The code makes it possible to

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²² <http://www.qrcode.com/en/about/> (31.07.2013).

²³ QR Code is a registered trademark DENSO WAVE Incorporated.

²⁴ <http://investing.businessweek.com/research/stocks/private/snapshot.asp?privcapid=5554214> (31.07.2013).

code letters of Greek, Cyrillic, Hebrew and Arabic alphabets as well as graphics and symbols specified by the user.

Description of principles of code formation, i.e. symbols of the QR Code in 1997 were included in the Uniform Symbol Specifications (USS)²⁵ by AIM - the Global Trade Association of the Automatic Identification & Data Capture Industry as ISS - QR Code. In turn, in 2000 the symbols of the QR Code were adopted by ISO (International Organization for Standardization) as the ISO/IEC 18004 standard²⁶. The QR Code may be used in two standards: models 1 or 2. Model 2 is a new solution and has been recommended by ISO for popularization. The models are automatically distinguished by applications used in the reading of information contained in the code.

The QR Code is square in shape. Small squares, of identical size and filled with dark or light colors, are distributed over its entire area. Most frequently squares are black or white colored for better contrast. They constitute arbitrary units (modules), with which information is coded. Black squares correspond to ones in the binary system, while white squares are zeros. Series of black and white squares form code words representing coding signs. Information is coded horizontally and vertically.

CODE VERSIONS AND LEVELS OF ERROR CORRECTION

Dimensions of the whole code vary, but it is stepwise. They depend on the assumed version of the code, adapted to the type and amount of recorded data. Moreover, they depend on the assumed degree of error correction. The greater the amount of data to be coded, the greater dimensions need to be used. Selection of code size may also depend on the capacity of a scanner to read it. There are 40 versions of the QR Code (Fig. 1).

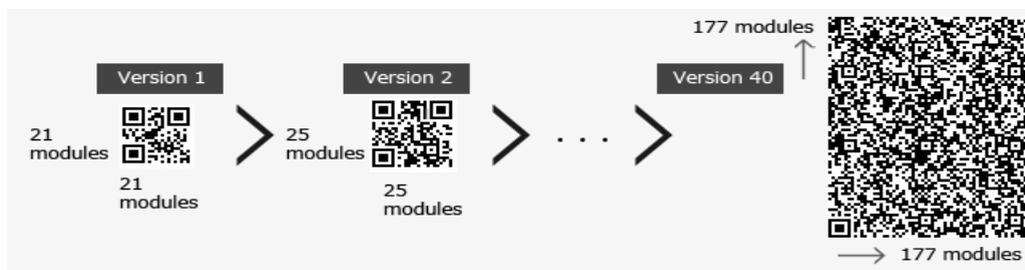


Figure 1. Versions of the QR Code and the number of modules

Source: <http://www.qrcode.com/en/about/version.htm>.

The smallest version is 21*21 modules in size and thus comprises 441 modules (Fig. 2). For example, it may store up to 25 alphanumerical signs (digits, letters and special symbols). Each successive version has sides extended by four modules. The biggest (no. 40) version of the QR Code is 177*177 modules in size. It is composed of a total 31329 modules and may comprise e.g. up to 4296 alphanumerical signs. The information capacity of the QR Code will be different when other types of signs are coded.

²⁵ AIM International Technical Specification, Extended Channel Interpretations: Part 1: Identification scheme and protocol (referred to as "AIM ECI specification").

²⁶ <http://raidenii.net/files/datasheets/misc/qrcode.pdf> (07.08.2013).

Each successive version of the QR Code additionally has four more levels of error correction. Error correction makes it possible to retrieve unread data if the code is smudged or damaged. Individual correction levels are denoted with letters L, M, Q and H. The levels refer to the percentage of the damaged code which may be corrected. At level L it is possible to repair damage covering approx. up to 7% code area, while for level H it is 30% area. Increasing the level of data correction increases the amount of coded data and requires the application of a higher version of the QR Code.

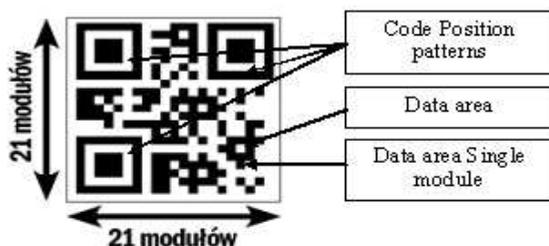


Fig. 2. The smallest version of the QR Code

Source: based on <http://www.qrcode.com/en/>, modified by the author.

Selection of the error correction level depends on the conditions at which the code will be operating. Levels Q (25%) and H (30%) are applied for codes used in the manufacturing environment. Level L (7%) is adequate when a slight degree of smudging is expected. Level M (15%) is selected most frequently, as it is suitable for code applications in public places.

The error correction function consists in the application of Reed–Solomon error correction²⁷. It is a system of error correction coding (ECC), which was developed by Irving S. Reed and Gustave Solomon in 1960. The system consists in the addition to the code of a specific percentage of redundant original data.

The QR Code version is selected based on the set of parameters published by Denso Wave Incorporated²⁸. A fragment of this set is presented in Table 1. The appropriate version of the code is selected in the following way:

1. From among types of data specified in the heading of Table 1 the one which is consistent with the type of coded data needs to be selected.
2. In the ECC Level column the level (row) corresponding to the conditions at which the code will be operating needs to be selected.
3. At the crossing of the column with the type of data and the row specifying the assumed level of error correction the value needs to be found, which is closest to the number of signs to be coded, but not lower than this number.
4. In the first column (Version) of Table 1, the appropriate version of the code is given in the row with the specified value, while the Modules column presents its dimensions.

For example assuming that 400 alphanumeric signs are to be coded and for the adopted level of error correction M the appropriate version of the QR Code will be version 12 of 65*65 modules in size (see Table 1).

²⁷ Stephen B. Wicker: *Error control systems for digital communication and storage*. Prentice Hall, 1995.

²⁸ <http://www.qrcode.com/en/about/version.html> (05.08.2013).

When coding various sign types, signs are converted to the number of bits. On the basis of the calculated value and the Data bits (mixed) column of Table 1 appropriate version of the QR Code is assumed. Specific principles for the calculations are presented on the website <http://www.qrcode.com/en/about/version.html>.

Table 1. The set of parameters required for the selection of the QR Code version

Version	Modules	ECC Level	Data bits (mixed)	Numeric	Alphanumeric	Binary	Kanji
11	61x61	L	2,592	772	468	321	198
		M	2,032	604	366	251	155
		Q	1,440	427	259	177	109
		H	1,120	331	200	137	85
12	65x65	L	2,960	883	535	367	226
		M	2,320	691	419	287	177
		Q	1,648	489	296	203	125
		H	1,264	374	227	155	96
13	69x69	L	3,424	1,022	619	425	262
		M	2,672	796	483	331	204
		Q	1,952	580	352	241	149
		H	1,440	427	259	177	109

Source: <http://www.qrcode.com/en/about/version.html> (10.08.2013)

The QR Code may be read with high speed and at any angle. Such an effect is obtained thanks to the application of position detection patterns of the code, placed in its three corners (see Fig. 2). Position detection patterns are surrounded with separators from the rest of the code. The structure of a single position detection pattern is presented in Fig. 3.

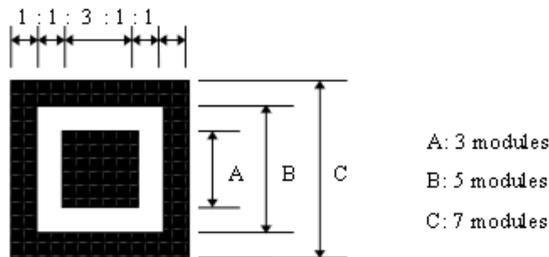


Fig. 3. The structure of a position detection pattern in the QR Code #

Source: http://raidonii.net/files/datasheets/misc/qr_code.pdf (10.08.2013).

Position detection patterns guarantee a stable and rapid reading and make it possible to eliminate negative effects of interference found in the background. Thus the code is applied in manufacturing or operating processes in which conveyor transport is used. Rapidly moving objects or goods marked with the code may be easily recognized by scanners. The other structural elements of the QR Code are presented in Fig. 4.

A significant role in the recognition of code properties is played by the so-called Timing Patterns. They are composed of two lines of one module in width (see Fig. 4). One line runs horizontally, while the other vertically between position detection patterns. Lines contain dark and light modules arranged alternately. Thanks to this it is possible to specify the version, code density and coordinates of recorded data. The type of coded information is recognized on the basis of a

series of modules situated adjacent and under the position detection patterns. In Fig. 4 the location of these markers is denoted as Format Information.

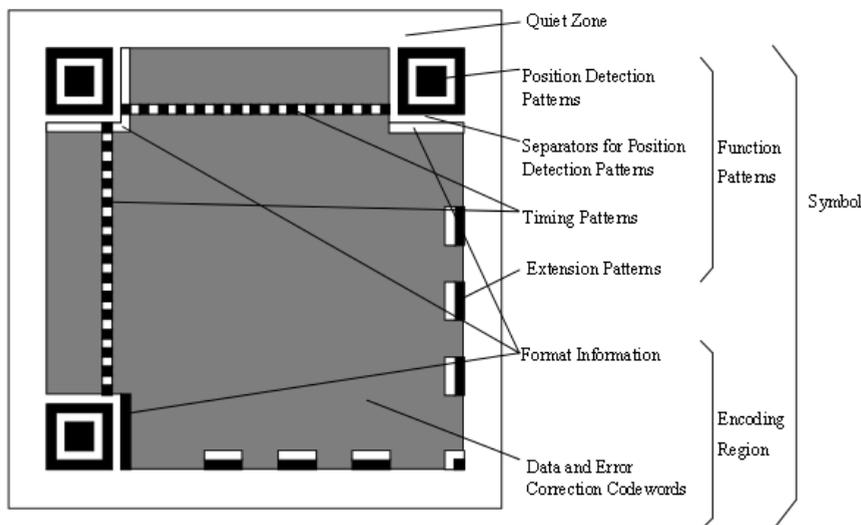


Fig. 4. Structure of a QR Code Model 1 symbol, version 7

Source: http://raidanii.net/files/datasheets/misc/qr_code.pdf, Annex M (10.08.2013).

Model 1 of the code contains Extension Patterns, which were intended for code development in the future, but are not used at present (see Fig. 4). The entire code is surrounded by an uncoded zone referred to as the Quiet Zone of four modules in width. This zone is used to record background color and compare it with the color of modules. Model 2 of the code is equipped additionally with Alignment Patterns. A single pattern is composed of a black module surrounded with separators: a white one on the inside and a black one on the outside. The number of such patterns depends on the version of the code. They are arranged symmetrically on both sides of the axis running from the upper left corner of the code to the bottom right corner. The procedure of information coding to the QR Code contains a masking mechanism. Its aim is to provide a potentially uniform arrangement of white and black modules on the code surface. In this way code image processing speed by the scanner is increased.

PRINCIPLES OF QR CODE USE

The QR Code, referred to as a photocode, has found numerous applications in the coding of information to be placed and read in public places. Most frequently in such cases the URL (Uniform Resource Locator) is coded in the QR Code, being a uniform address format for resources on the Internet, particularly websites. The address is read using mobile devices such as a mobile phone, a smartphone or tablet, with an embedded camera and a decoding app (Fig. 5).

After reading the code the application connects the mobile device with a website indicated in the address or displays other recorded information (e.g. e-mail address, phone number, tag). The displayed website presents specific information required by the user, e.g. concerning a historical monument, a cultural event or goods.



Fig. 5. The manner of information collection using the QR Code

Source: <http://www.komputerswiat.pl/jak-to-dziala/2011/06/wszystko-o-kodach> (10.08.2013).

Apps needed to read the QR Code are available free of charge on the Internet or they are installed by the manufacturer in the mobile device. Selection of the application depends on the device model. For mobile phones it may be e.g.²⁹:

- QR Droid – a code scanner for mobile devices with the Android operating system,
- i-nigma Barcode Scanner – an extended scanner for phones by LG, Mio, Motorola, Nokia, Orange SPV, Palm, QTek, Samsung, Sony Ericsson, T-Mobile, etc.,
- Kaywa Reader – working with many operating systems and phones by Motorola, Nokia, Samsung and Sony Ericsson,
- Lynkee Reader - working with iPhone, Blackberry, Sony Ericsson, HTC, Motorola and Nokia,
- Nokia leader – designed for Nokia N80, N93, N93i, N95 and E90 phones,
- UpCode – operating phones by Motorola, Nokia, Samsung, Sony Ericsson, Siemens, Panasonic, Blackberry, LG, HTC and Vodafone.

CONCLUSIONS

In Europe, including Poland, the QR Code is slowly becoming popular. In terms of the number of locations in which it is found and the number of users it may still be considered a niche product. The primary barrier is connected with the limited knowledge on the applications and potential uses for this code. This pertains both to those who could transmit information using this code and its potential users. Another barrier is related to the need to have an appropriate device and software. Not all manufacturers of mobile devices install software reading the QR Code. Moreover, there is no information how to use the code in places where it is displayed. As a consequence many potential users are not interested in the QR Code, although they see it in an increasing number of places in the public space.

Despite the indicated barriers the number of applications for the QR Code is growing. It may be found on billboards, advertisement posters, plaques with information on historical monuments in the urban areas or even public transport where timetables may be downloaded on the phone. Using the code is characterized by low costs of running and does not require much effort.

The code is willingly downloaded if the information read by the user provides additional benefits. An example of such a solution is e.g. a combination of advertisement with the possibility to download an interesting game. In South Korea the Tesco supermarket chain has used the QR Code to do shopping while commuting on the underground. Codes were placed on banners with

²⁹ <http://www.qr-online.pl/programy.html> (07.08.2013).

offered products, which delivery could be ordered using several clicks. Such a solution has raised considerable interest among very busy Koreans. In 2010 Macy's, the American chain of clothes and cosmetics stores, started an information campaign on the QR Code on television and the Internet, at the same time providing the possibility to download the code reading app by sending an SMS. Next codes were placed in stores as well as different public places throughout the country. They offer 30-second films with beauty and fashion tips and advice. As a result of increased knowledge on products customers may make more educated purchase decisions. The campaign caused a 1200% increase in QR Code scanning throughout North America³⁰.

The first barrier in the popularization of the QR Code is slowly being eliminated. According to IDC, the American International Data Corporation specializing in market research of the IT sector, in the first quarter of 2013 for the first time the sales of smartphones exceeded those of traditional mobile phones. Smartphones accounted for 51.6% (a total of 216.2 million sold items) of all devices manufactured³¹. Smartphones are the primary tools used to read the QR Code.

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³⁰<http://www.retailtouchpoints.com/cross-channel-strategies/778-macys-target-tap-qr-codes-for-extended-customer-interaction> (08.08.2013).

³¹<http://tech.wp.pl/kat,1031195,title,Sprzedaz-smartfonow-po-raz-pierwszy-wieksza-niz-telefonow-komorkowych,wid,15528918,wiadomosc.html> (13.08.2013).

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CURRENT APPROACHES TO CUSTOMER RELATIONSHIP MANAGEMENT

Abstract: This paper provides the overview on Customer Relationship Management. Different theoretical approaches to CRM are included in the first part of the paper. It describes CRM development and compares main CRM teaching leading school. Second part of the paper presents the results of research based on Delphi method, which was aimed at finding actual CRM definition and core areas that might support company's CRM, in order to build strong relationships with customers.

Keywords: Customer Relationship Management, CRM, customer, definition, characteristic.

The globalisation and new approaches in economy are affecting both sides of the market supply and demand. The information technologies development is empowering and challenging each of them. There are companies on one side, and customers on the other one. Since the customers are more informed, they can compare companies' products and services. They also can compare prices of items and share references. Their decision power is higher. Companies have to struggle to create long term relationship with customers. So The Customer Relationship Management of the companies is changing as well.

PERCEIVING CUSTOMER RELATIONSHIP MANAGEMENT THEORETICAL APPROACHES

We can find some different approaches how to build up long term relationships with customers in different resources. The common idea, which is shared among quality representatives (Čierna 2006; Mateides 2006; Nenadál 2004, 2005) marketing representatives (Ďaďo 2006; Kotler, Keller 2007) and among CRM representatives (Peelen 2005; Payne 2007; Lehtinen 2007; Buttle 2010; Greenberg 2010), is the importance of customer centricity in the company, when dealing with customer.

Concept of the CRM has been developing continuously. It is no possible to identify exactly the year when it emerged, because there always had been an interaction between customer and seller. The interaction between subjects is defined as relationship (Birkenblihova 1999; Friedman 2005; Mateides 2006). So there always had been relationship between customer and seller. What has changed is the way companies perceive customers and communicate with them. In the early 50s, company activities were aimed mainly at distribution. CRM was understood as sales supporting activity. All company CRM processes were aimed only at selling. There was no deep interest in CRM and its further development. Customer was identified as a mass, there was no communication with the customer and no relationship with customer was built (Greenberg 2010; Gordon 1998; Starzyczna 2007; Kotler 2007; Lehtinen 2007; Peelen 2005; Payne 2007). In the 80s companies aimed at stable position on the market. The aim of CRM shifted from satisfying minimal requirements of the customer in the 70s to bring quality and excellence to customer. CRM processes have changed from selling to selling and analyse. The first signs of the CRM development can be marked at that time. It is automatization of customer service. Earlier the customer was understood as group, later on as specific segment. There is the presence of the short term non personal relationship with customer. Communication with customer had shifted from one way to two-way, but there is a domination of the company in this communication (Greenberg 2010; Gordon 1998; Starzyczna

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2007; Kotler 2007; Lehtinen 2007; Peelen 2005; Payne 2007). From the 90s until now company's activities aim at customer. CRM was focused on building the loyalty based on preferences, and nowadays it is the loyalty based on emotions. CRM processes are wider, they support selling, analytics and collaboration. CRM is developing widely and deeply in its structure of customer oriented processes. Customer is understood as a consultant or community. Relationship with customer is personal intensive and long term. The communication is two – way, and targets the customer Greenberg 2010; Gordon 1998; Starzyczna 2007; Kotler 2007; Lehtinen 2007; Peelen 2005; Payne 2007)

CURRENT VIEWS ON CRM

There is no exact CRM definition, because CRM is perceived differently among companies and experts. Some authors define CRM as technology, others as data mining process. Firth (2006) and Lager (2008) consider CRM for technology. This technology should enable a company to sell more effectively (Tan 2002). Others connect CRM with data management processes (Berson 2000). Customer and marketing data collecting, leads into higher company profitability and better relationships with customers (Berson 2000; Johnston 2008). Other authors see CRM as process that helps to reach the highest possible profit on both sides (Carachová 2004; Chlebovský 2005; Kotler 2007). Meanwhile Berson (2000), Chlebovský (2005), Johnston (2008), Kotler (2007) characterise CRM as process, which is oriented at economical profit on both sides, Buttle (2010), Greenberg (2010), Payne (2007), Bokorova (2003), Croteau (2003), Lee (2003), Seybold (2002) define CRM as strategic approach to the customer, which integrates all processes in the company in order to bring value to the customer.

So the CRM is perceived as the technology connected with data, which enables higher profits, or as strategic approach that brings value.

Relationship between company and customer can be seen differently. According to Buttle (2010) and Lehtinen (2007), there are 5 main "CRM schools" which affect CRM characteristic. First of them is rooted in B2B marketing in USA, and its representatives Gadde, Ford, Shehota, Naurde, believe that relationship is built by 3 main areas: connections, sources, and human interaction. The Second - nordic school emphasizes attention on human element of the relationship. Authors Gronroos, Gummesson, Lehtinen point out at interaction, dialog and value, when building relationship with customer. The third is anglo-australian school which sees relationships as all connections, that company has with its environment. They emphasise attention on customer satisfaction and loyalty in relationships. The next one, asian school believes that good personal contacts between company's owners lead into good business, which is regulated by rules. Heide, Morgan, Sheeth, who are part of North American, believe that all relationships with customers are based on trust and open communication, that brings value to company (Buttle 2010; Lehtinen 2007).

The CRM in the company should be supported by different well run parts of the company. Berson (2002), Dohnal (2002), Peelen (2005), Torggler (2008), Buttle (2010) believe that company's CRM should be supported by 3 main parts: operational, analytical and collaborative. Operational CRM helps to improve customer processes like enterprise marketing automation, sales force automation and customer service automation (Buttle, 2010; Torggler 2008). It integrates basic "touch points" Kotler (2007), and back and front office communication channels (Berson, 2002). Analytical CRM helps to gain, proceed and use data that create value for customer and for company (Buttle, 2010). It is aimed at gaining data that was created by operational CRM and its further usage in strategic and tactical decisions (Buttle 2010; Torggler 2008; Berson, 2002). Collaborative CRM includes all communication channels with customer. It implements technology through all parts of organization, so the value brought to the customers is higher (Buttle 2010; Torggler 2008).

We have characterised the common approaches to CRM, which is seen as a technology closely connected with data and information. The second approach sees CRM as company's strategy. The relationship is built mainly by interaction and people, but there is a difference among aims of this interaction. Some authors believe relationships with customers should lead into economical profit. Others believe that relationship should lead into customer satisfaction and loyalty. This result should be supported by the 3 main parts of the CRM, and it is operational, collaborative and analytical one. There are two main questions concerning previous information. How could CRM be currently defined? Has it changed lately? What would be the areas that company should concentrate on to achieve that best-possible relationship with customers?

METHODOLOGY

Research held from 2011 – 2012 was aimed at previous questions and the expert Delphi method has been used. This method is based on collective intelligence, with the aim to find a common consensus. The anonymity of the respondents needs to be ensured. It has to be held at least in 2 separate rounds Reichel (2009), Závadský (2006), Hsua, Stanford (2007). In the beginning, forty experts were asked to participate in first round via email. 15 of them were willing to participate first round. The experts were from Europe 60% , USA 33%, Australia 7%. Some experts - 40% had previous experience in CRM management in company. 60% of experts were experienced as CRM consultants and CRM researchers. The participants from Slovakia and Czech Republic have on average 8,7 years of experience in the field of commerce, retail, marketing, CRM. The experts from other countries were experienced in the following areas: CRM, CRM strategies, CRM, analysis, customer experience, customer lifecycle, social CRM, business architecture, CRM safety, social strategies, and in average they have 20,57 years of experience in Customer Relationship Management.

CURRENT CRM CHARACTERISTIC

In the first round, the analysis was aimed at finding current definition of the CRM.

In this round the experts were asked to characterise CRM. 73% of them consider CRM for strategy or strategy of cooperation, philosophical approach to customer. "Customer Relationship management is programic approach, which creates and its build up relations with customers...", "...is strategy with aim to create value...", "...collaborative business strategy that is focused on co-creation of the value, by using any type of communication channel...". The emphasis was set on the connection between strategy and value creation. According to experts the main aim of CRM is to create value (80%), "to co-create value", "to ensure meaningful relationship between customer and company", to engage customer into cooperation (60 %) and to create bilateral relationships (53%). The experts pointed at the fact that the success of CRM depends on high quality data. "...CRM is a strategy, technology and processes, that are running in order to provide partners with data about past, current and future customers...", "...data that customer requires and creates needed to be processed and integrated...". Most of the experts haven't defined CRM as only technology, they agreed on that CRM is not technology however "...deep interconnection..." is needed. However the experts haven't defined CRM as technology, they consider technology as strong factor which affects company on one side, and the customer on the other side. "CRM absorb, and have to absorb parts of the different areas like behavioural economy, neuromarketing or psychology, and it is empowered by internet and social networks and technologies, which are connected with mentioned areas." Customer position is shifting from a passive receiver to an active influencer: "...it is active collaboration with customer based on trust and honesty..." where customer can influence communication: "...where customer chooses its own way of interaction and collaboration with company...", and can easily approach company: "... nowadays it is important that current and new customers can find company easily, when searching for the solution of their problem...". 93%



responses agreed on the idea that, due to continuous development in information technologies, it is the customer who controls communication.

To conclude the first round: CRM wasn't characterised as internal partial process, or technology. It was characterised as a philosophy, strategical approach to customer that is supported by the newest technologies, which enable both sides to communicate equally. Based on first round the first draft of CRM characteristic was made:

“CRM is a philosophy and business strategy to engage customer in collaborative conversation. It is supported by company's leadership, people, technology platform, business rules, processes, social characteristics and metrics and grounded on high quality customer-related data. It integrates internal processes and functions, and external networks for co-creating mutually beneficial value through the entire business lifecycle, from awareness till after sales, for the products and services, where customers controls channels, frequency and intensity of interactions, conversation, engagement and company's programmatic response.“ After second round some corrections have been made, and final consensus was reached, and final characteristic of CRM was made:

„CRM is a philosophy and a business strategy, which tries to engage customer in mutual collaboration when creating value. It is based on high quality customer-related data and it is supported by company's leadership, people, technology platform, business rules, processes, social characteristics and metrics. It integrates internal processes and external networks so, that it is possible to create mutually beneficial value exchange between customer and company during the entire life cycle: starting with pre-acquisition to post-acquisition activities. The value is created continuously in products, services and the customer controls: communication channels, intensity of interaction and contacts. Customer controls channels, frequency and intensity of interactions, conversation, engagement and company's programmatic response“. This characteristic supports presupposition from the theoretical part, that CRM should be perceived as a strategic approach to creating value between two parties that enter into an interaction; between a customer and a company. Results pointed at importance of customer choice in relation to the depth of the engagement, the level of collaboration and the way of communication with the company. Customer is the one who is making the choice.

Another part of the research was aimed at defining the main areas that should be performed in high quality level in order to support perfect CRM of the company. Based on theoretical approaches to CRM, there are several ways how the model can be understood. The model in this paper is seen as Amit, Massa, Zott (2010) did, who characterised the model as a collection of activities which happen in a company. The proposed CRM areas are based on research results and experts' comments, while the basic structure is inspired by Payne (2007). The research question was: “Ideally, companies would like to be able to have an optimal relationship with their customers. Realistically, what would be the four areas that you would concentrate on to achieve the best-possible relationship with those customers?” The analysis showed there were more than 4 core activities that company should focus on and they were mainly connected with following areas: to create an individual product for each customer; to communicate with the customer: to communicate the way customer chooses, and with intensity that the customer wants; to create unique and over-expected experience for customer with product, with service or with company; to cooperate with customer in product improvements, in company's improvements, with the aim to enhance value delivered to customer; Create unique company culture, which is rooted in empathic customer oriented employees; Support customer centricity of the company by customer oriented strategic and tactic decisions; Create processes that are supported by the newest technologies enabling their automatization. The experts suggested different number of activities to these areas. The percentage ratios were determined based on absolute numbers in individual areas. According to the results, 60% of all suggested processes within company should verge to customer. It follows that one of the 4 main areas defined in company's CRM - Customer was divided into 4 more sub-areas that should

be included in company's CRM. Other 3 parts, which were defined as important in order to run best possible relationship with customer, were: 1. Customer centricity 2. Technology and processes, 3. People and culture and already mentioned one – 4. Customer.

CONCLUSIONS

The latest approaches to CRM were characterised in the first part of the paper. CRM was considered as technology or data mining, some authors approach CRM as philosophy, strategy, others as partial process in the company. According to research new characteristic of CRM was profiled as philosophy and business strategy. It confirmed the idea that CRM should be approached in a wide perspective as philosophy on strategical level, and shouldn't be viewed as separate technology or separate process, on tactical level. Main aim of the CRM is not the profit, as it was defined in the theoretical part, but it is, as we found out in practical research, the value creation. It should be created on both sides on company's side and customer's side as well. The important point is also customer position. Customer position is changing from unknown segment and partner to one who controls the engagement, communication and collaboration with the company.

Limitations

Some study limitations should be acknowledged. Findings are based on the expert method, where group of experts was smaller than 100 participants. However it is recommended to put smaller group of experts, when dealing with new ideas or the topic is homogenous- the findings are based on qualitative research. However, results can serve as the theoretical basis for further researches. We invite other researches to conduct quantitative large scale follow- on explorations.

Implication

This exploratory theoretical research contributes to better understanding of current approaches of CRM characteristic. Main characteristic of CRM can serve as basis in further theoretical research. It can help researches and organisations better understand and practically implement CRM in the companies.

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The author would like to thank the Scientific Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic and the Slovak Academy of Sciences. This paper was elaborated within the frame of Grant project 1/0387/13 A comprehensive model of wood chain comparative advantages

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THE POTENTIAL OF PINE WOOD FOR BUILDING CONSTRUCTION

Abstract: The object of the research was to analyze the quality of glued elements in endurance tests. The pine wood used in the research originated from the vicinity of Sulechów.

In the research the physical properties of the wood, such as density and humidity were analyzed. Within the framework of the research the endurance of laboratory samples was also tested. The research was conducted on laboratory samples. The results of the study are presented on illustrations and in tables.

Keywords: pinewood, quality, strength tests, components

INTRODUCTION

Lumber is material that has accompanied man from the beginning of humankind. This material is readily accessible, renewable and easy to process what makes it ideal for construction. Following strength sorting (either mechanical or visual) it is graded according to specific strength classes. Knowing the construction requirements one may select strength class that will be adequate for specific purposes. There are two non-destructive methods of lumber sorting: mechanical and visual, which are based on certain rules in accordance with standards such as for example: PN-EN 336; PN-EN 338; PN-EN 384; PN-EN 408; PN-EN 1194; PN-EN 1912; PN-EN 14080; PN-EN 14081. Visual sorting is still carried out in accordance with standards set by norm PN-82/D-94021: (Krzosek et al. 2008, Krzosek i Grzeškiewicz 2008):

Research on the possibilities of using pine lumber for woodworking for dozens of years have constituted an important element in the works of numerous teams of researchers. An evaluation of the quality as well as the characteristics of wooden material used in building industry and both visual and mechanical methods of sorting processed wood are the basis of adequate selection of material for construction. (Dzbeński et al. 2000, 2005, Krzosek et al. 2008, Wieruszewski et al. 2010, 2011, 2012).

Aim and scope of the work

The aim of this work is analysis of the problem concerning the quality of construction elements possessed from glued elements presented in the light of strength research. It has been agreed that experimental tests will be carried out on a selected batch of raw material used for construction. Pine wood of the size used for construction of wooden house built using light-frame construction due to its most common usage in construction industry was selected for the research.

Research methodology and description

For the purpose of present research the following material has been prepared: 15 beams measuring 40x150x2400mm made of glued layers of timber. Pine wood 90 years of age from which material samples have been drawn came from Sulechów Forest District, region Stary Dwór, unit 255b. Raw material following processing into the primary and secondary elements underwent drying process in order to achieve target moisture content of 12% and then the material used for research was cut into battens while the possible defects were also eliminated. Material was planed all round and profiled using woodworking machine FC-10KZ6 by GOMA company in order to achieve longitudinal integration. The prepared sets of battens were glued using previously selected

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resin adhesive MUF 1247/2526 (Krystofiak et al. 2011, Wieruszewski et al. 2011) and integrated in a vertical hydraulic press.

Elasticity module was measured during static pressing in accordance with the norm PN-EN 408. The test was carried out using endurance machine DM 2214. Comparative durability tests of laboratory samples measuring 20x20x300mm were carried out using testing machine Zwick Roell Z050. 102 samples possessed from glued material were tested.

Determining physical properties.

Density is one of the basic physical properties of wood, which is directly linked to its structure and mechanical properties. Based on measuring laminated beams the obtained results were show in Figure 1.

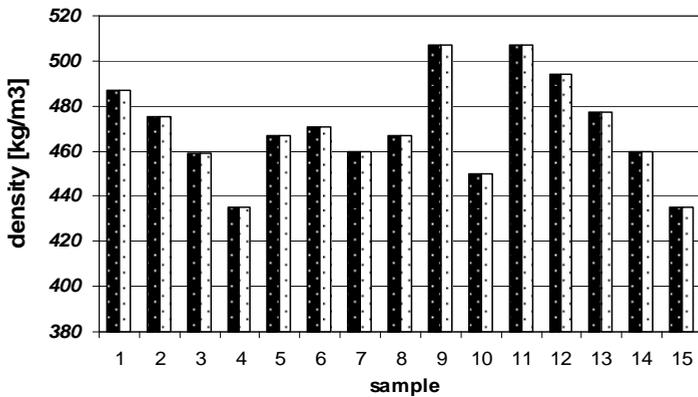


Fig.1. Density of dry glued test samples

Following Figure 1 analysis in can be concluded that absolute density of glued wood (MC – moisture content 0%) ranged from 434 kg/m³ to 508 kg/m³. Intermediate value was 470 kg/m³.

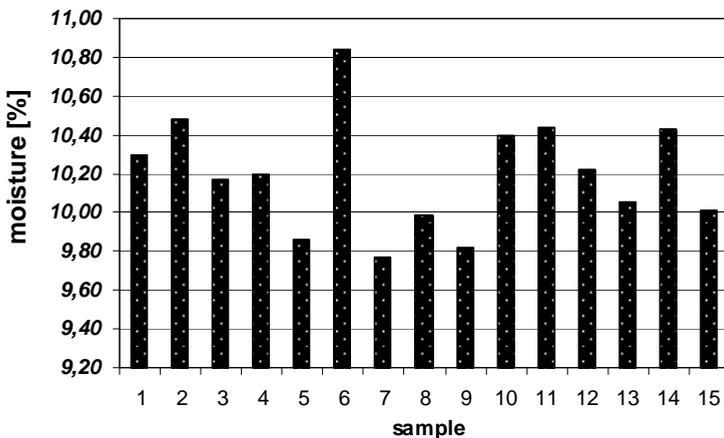


Fig.2. Mean moisture content of laminated beams

Pine wood density ranges between 410 kg/m^3 and 500 kg/m^3 (Krzysik 1975), therefore test samples fall within the range towards its higher end. It should indicate good durability parameters of used raw material.

Wood is a hygroscopic material hence its mechanical properties are moisture dependent. Its durability decreases when the moisture content grows up to saturation point of the fibers. Figure 2 shows mean results of moisture content of tested beams.

As the above figure shows mean moisture content of laminated samples assigned for testing fell within the range from 9,77% for sample 7 to 10,84% for sample 6. Average moisture content amounted to 10,2%.

SAMPLES DURABILITY TESTING

The results of tests carried out using Zwick Roell durability machine for the raw material used for the production of laminated beams were show in Figures 3 and 4.

Following calculations of compression durability and elastic module for moisture content of 12 % the following results were obtained:

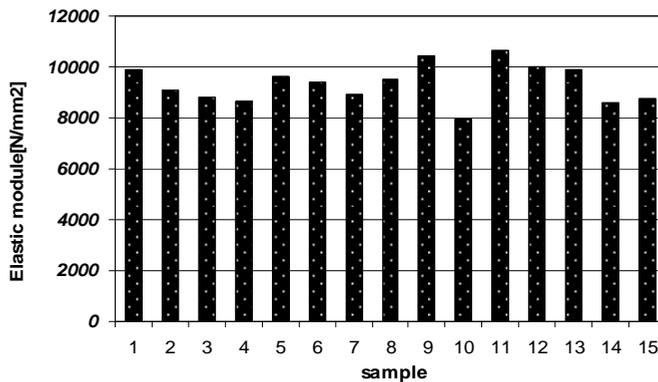


Fig.3. Elastic module for MC=12%

As it may be concluded from the data in Figure 3 elastic module ranged from 7955 N/mm^2 to 10656 N/mm^2 . Its mean value for MC = 12% amounted to 9342 N/mm^2 .

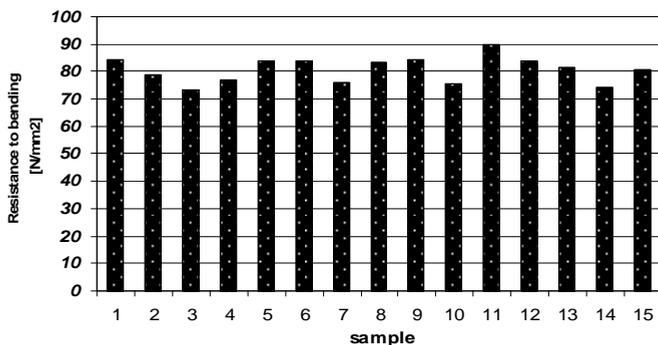


Fig.4. Resistance to bending MC=12%

As the above figure shows the resistance to bending of solid samples ranged between 73 N/mm² and 90 N/mm². Its mean value amounted to 81 N/mm².

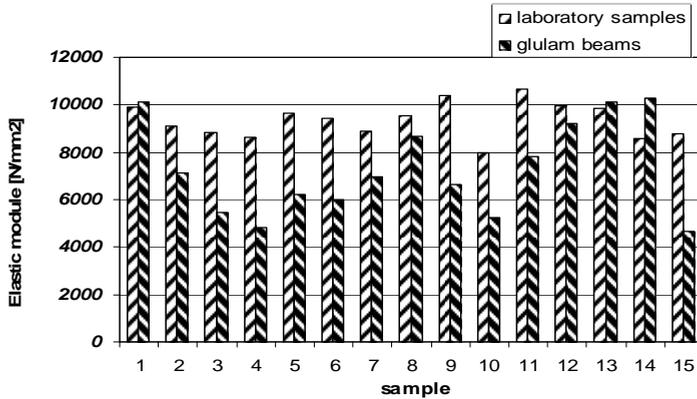


Fig.5. Comparison of elastic module of laminated beams and laboratory samples

As it can be concluded on the basis of the data presented in figure 5 it has been proved that elastic module of laboratory samples is higher than large-size samples. Greater elastic module in case of laboratory samples is the proof of better quality properties of wood deprived of defects. Control samples which showed lower elastic module than their large size counterparts are exceptions due to a random choice of location from which the raw material has been possessed.

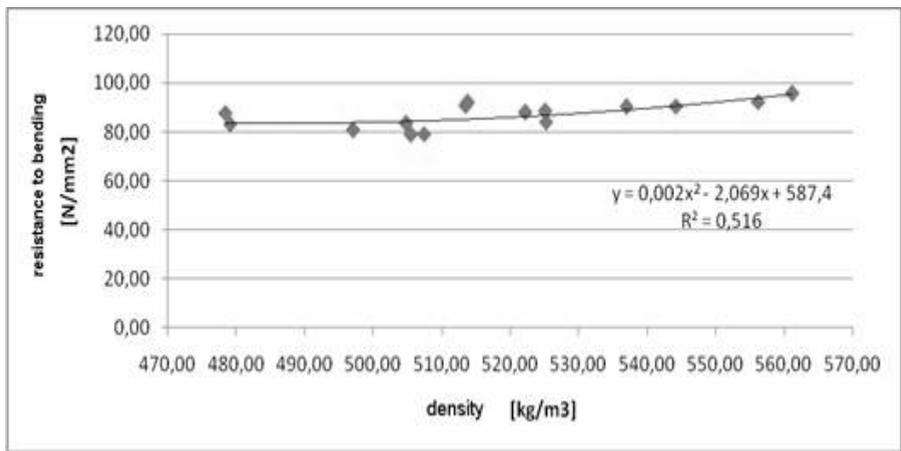


Fig.6. The relation between density and resistance to bending (moisture content MC) (Staszewski 2012)

As it can be concluded following the analysis of the data presented in figure 5 density has an impact on resistance. The relation can be shown using the following equation $y = 0,002x^2 - 2,069x + 587,4$ where the co-factor R^2 equals 0,516. The values obtained in tests confirm the fact that there is a link between density and resistance to bending.

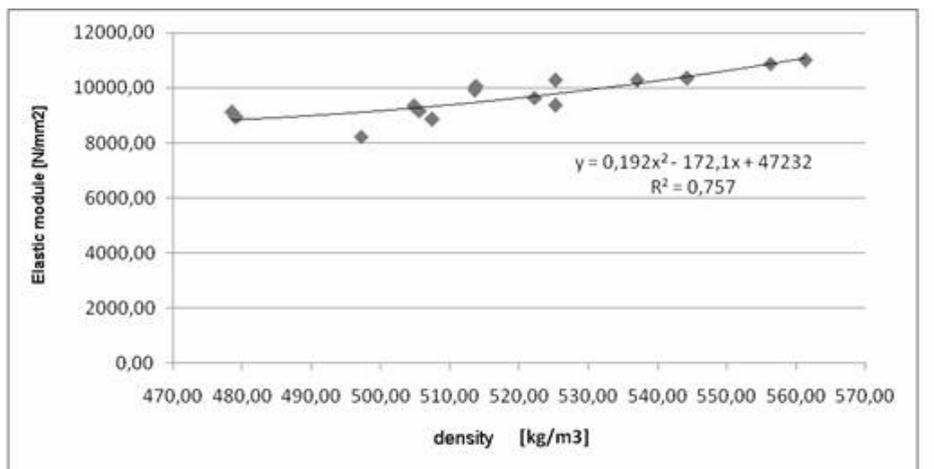


Fig.6. The impact of density on elastic module (moisture content MC) (Staszewski 2012)

As the data in figure 6 shows density has a substantial impact on elastic module. This relationship may be described using the following equation $y = 0,192x^2 - 172,1x + 47232$ where determination co-factor R^2 equals 0,757.

CONCLUSIONS

The tests carried out on the quality of construction elements of pine wood roof truss allow to draw the following conclusions:

- The results obtained during visual evaluation prove good durability properties of large-size samples.
- The value of deflection arrow of laminated samples differed slightly, in glued samples range of maximal bending was narrower. That proves a more homogenous structure of laminated beams.
- The values from durability tests carried out on the glued samples fall within the range of pine wood mean resistance to static bending.
- The value of glued samples module on average equalled 9690 N/mm² (moisture content 0%) and 9342 N/mm² (moisture content 12%) the result is lower than elastic module quoted in references amounting to 12 000 N/mm²
- As the obtained results suggest the density has an impact on resistance to bending and elastic module of glued samples. The relation between the resistance and density is shown by correlation factor $R^2 = 0,52$ and in case of the relation between elastic module and density the co-factor $R^2 = 0,76\%$.
- Moisture content of glued samples amounted to about 10 % +/- 2% what proves equal moisture content on the cross section of glued elements.

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STANDARDS

- PN-EN 14081; 2005 „Konstrukcje drewniane. Drewno konstrukcyjne o przekroju prostokątnym sortowane wytrzymałościowo”
- PN-EN 384; 2004: „Drewno konstrukcyjne. Oznaczanie wartości charakterystycznych właściwości mechanicznych i gęstości”
- PN-EN 14080; 2006: „Konstrukcje drewniane Drewno klejone warstwowo Wymagania”,
- PN-EN 408; 2003: „Konstrukcje drewniane. Drewno konstrukcyjne lite i klejone warstwowo- Oznaczanie niektórych właściwości fizycznych i mechanicznych”
- PN-EN 1194; 2000: „Drewno klejone warstwowo”
- PN-EN 336; 2001: „Drewno konstrukcyjne. Gatunki iglaste i topola. Wymiary dopuszczalne i odchyłki”
- PN-EN 338;: „Drewno konstrukcyjne. Klasy wytrzymałości”
- PN-82/D-94021: „Tarcica iglasta konstrukcyjna sortowana metodami wytrzymałościowymi”
- PN-EN 1912: - „Drewno konstrukcyjne- klasy wytrzymałości- Wizualny podział na klasy i gatunki”.

