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Wojciech Lis
Sławomir Kalinowski¹, Magdalena Kozera²

THE INCOME SITUATION OF OLD AGE PENSIONERS’ AND DISABILITY PENSIONERS’ HOUSEHOLDS IN POLAND

Abstract: The article presents selected elements of studies on factors influencing the quality of life of elderly people vs the EU-27. The focus is on the multitude and diversification of the income of old age pensioners’ and disability pensioners’ households in reference to groups with other sources of income. The article also discusses the problems of the threat of poverty and the subjective sense of poverty. It also indicates the paradoxes of the financial situation of old age pensioners’ and disability pensioners’ households in Poland, which become the source of income or improvement of the situation of entire families, especially in agriculture and in rural areas, although they have one of the lowest income levels in Europe.

Key words: aging, household income, households, pensioners, poverty

INTRODUCTION AND MATERIALS

The 21st century brings along numerous new challenges to economy, in the field of social transformations, which have a national, international or even global impact. More and more attention is paid to the analysis of megatrends, simultaneously investigating the demographic changes that result from them and their socioeconomic consequences to economy. Among many issues listed here the problems of decreasing population growth, the ageing of the population and pressure on modification of pension schemes are particularly important [Scherbov, Mamolo, Lutz 2011]. The area which is particularly afflicted by those processes is Europe, especially the countries outside the Eurozone. The income situation of old age pensioners’ households in those countries is particularly difficult. Their relatively low income combined with growing living expenses enhance the level of poverty, both in its subjective and real aspect. The article presents selected elements of studies on the income situation of old age pensioners’ and disability pensioners’ households in Poland versus the EU-27. The authors indicated income disproportions in individual countries and differences in the income level in the households with other sources of income than disability pensions and old age pensions.

The materials used for the study were above all the unpublished data of the Central Statistical Office from household budgets, the results of the authors’ own research embracing the period 2004-2011 and statistical information from Eurostat and other European institutions providing such information.

THE AGEING OF POPULATION AS A EUROPEAN PROBLEM

From the biological point of view the length of human life is diversified both in the individual and population-related aspects. The average global life expectancy is 60 years, but women live on average 6 years longer than men. The very process of ageing has its individual character. Although the pace of life and ageing depend on genetic factors, they also largely depend on one’s quality of life and living standard. The lifestyle, especially the diet and physical activity, as well as environmental factors, i.e. the climate, hygiene, pollution and other harmful conditions are particularly significant. At the time of rapid changes in civilisation the ageing process particularly

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afflicts the inhabitants of highly developed countries, including urbanised European countries. For people at the post-working age, defined as the 65+ generation, the fact of deterioration of the economic status is particularly painful, as it results in limitations in everyday life, both in consumption and social contacts [Straś-Romanowska 2001].

Eurostat’s forecast for 2008-2060 says the population of Europe will be gradually growing until 2035 (from 495 million in 2008 to 520.7 million in 2035) and then it will be systematically decreasing to about 505 million in 2060. The share of the 65+ population in the total population will rise from 17.1 to 30 per cent (in absolute values this means the growth from 84.6 million in 2008 to 151.5 million in 2060). In 2008 there were almost 20 million people aged 80 years or more in Europe. The forecast is that this number will have grown to 61.4 million people by 2060 [Socioeconomic conditions…2010]. In consequence of these changes the ratio of burdening the EU-27 population with young people will rise to 25.0 per cent in 2060, whereas the ratio of burdening with elderly people will increase from 25.4 per cent (2008) to 53.5 per cent (2060). This means that in the EU-27 in 2008 there were 4 people at the working age (15-64 years) per 1 person aged 65 or more, whereas in 2060 the ratio will be 2 per 1 [Socioeconomic conditions…2010].

Table 1. Public pension expenditures in 2007, gross in per cent of GDP

<table>
<thead>
<tr>
<th>Country</th>
<th>Old-age and early pension, gross in per cent of GDP</th>
<th>Other pension (disability, survivors), gross in per cent of GDP</th>
<th>Total pension expenditures on social security pension in per cent of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>9.2</td>
<td>0.8</td>
<td>10</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>6.8</td>
<td>1.4</td>
<td>8.3</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>7.1</td>
<td>0.7</td>
<td>7.8</td>
</tr>
<tr>
<td>Denmark</td>
<td>7.0</td>
<td>2.0</td>
<td>9.1</td>
</tr>
<tr>
<td>Germany</td>
<td>10.4</td>
<td>:</td>
<td>10.4</td>
</tr>
<tr>
<td>Estonia</td>
<td>4.9</td>
<td>0.7</td>
<td>5.6</td>
</tr>
<tr>
<td>Irlandia</td>
<td>2.6</td>
<td>1.4</td>
<td>4.0</td>
</tr>
<tr>
<td>Greece</td>
<td>8.8</td>
<td>2.9</td>
<td>11.7</td>
</tr>
<tr>
<td>Spain</td>
<td>5.6</td>
<td>2.9</td>
<td>8.4</td>
</tr>
<tr>
<td>France</td>
<td>13.0</td>
<td>:</td>
<td>13.0</td>
</tr>
<tr>
<td>Italy</td>
<td>13.5</td>
<td>0.5</td>
<td>14.0</td>
</tr>
<tr>
<td>Cyprus</td>
<td>4.8</td>
<td>1.4</td>
<td>6.3</td>
</tr>
<tr>
<td>Latvia</td>
<td>4.8</td>
<td>0.6</td>
<td>5.4</td>
</tr>
<tr>
<td>Lithuania</td>
<td>5.6</td>
<td>1.2</td>
<td>6.8</td>
</tr>
<tr>
<td>Luxemburg</td>
<td>5.8</td>
<td>2.9</td>
<td>8.7</td>
</tr>
<tr>
<td>Hungarian</td>
<td>9.0</td>
<td>1.9</td>
<td>10.9</td>
</tr>
<tr>
<td>Malta</td>
<td>4.2</td>
<td>3.0</td>
<td>7.2</td>
</tr>
<tr>
<td>Niderland</td>
<td>4.5</td>
<td>2.1</td>
<td>6.6</td>
</tr>
<tr>
<td>Austria</td>
<td>9.5</td>
<td>3.2</td>
<td>12.8</td>
</tr>
<tr>
<td>Poland</td>
<td>9.8</td>
<td>1.7</td>
<td>11.6</td>
</tr>
<tr>
<td>Portugal</td>
<td>9.1</td>
<td>2.3</td>
<td>11.4</td>
</tr>
<tr>
<td>Romania</td>
<td>5.3</td>
<td>1.3</td>
<td>6.6</td>
</tr>
<tr>
<td>Slovenia</td>
<td>7.0</td>
<td>2.8</td>
<td>9.9</td>
</tr>
<tr>
<td>Slovakia</td>
<td>4.3</td>
<td>2.5</td>
<td>6.8</td>
</tr>
<tr>
<td>Finland</td>
<td>7.5</td>
<td>2.5</td>
<td>10.0</td>
</tr>
<tr>
<td>Sweden</td>
<td>7.0</td>
<td>2.6</td>
<td>9.5</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>5.8</td>
<td>:</td>
<td>6.6</td>
</tr>
<tr>
<td>EU-27</td>
<td>9.1</td>
<td>:</td>
<td>10.1</td>
</tr>
</tbody>
</table>

Source: Eichhorst et al. 2011.
The problem of ageing of the European population is clearly visible in the geographic arrangement. The countries which are particularly afflicted by the problem are: Germany (20.7%), Italy (20.2%), Greece (18.2%) and Sweden (18%). Another group consists of the countries where the population of the 65+ generation approaches 18 per cent. The group includes Finland (17.9%), Portugal (17.9%), Austria (17.8%), Bulgaria (17.8%), Spain (16.9%), France (16.8%), the United Kingdom (16.2%). Poland belongs to the group of countries where the share of the 65+ generation in the total population is 12-14 per cent, but this does not mean that the socioeconomic problems of ageing population are less significant there.

It is predicted that the share of people aged 65+ will rise by at least 10 per cent in all European countries, but the highest growth of population in this group is forecast in Slovakia (by about 24%) and Poland (by about 23%) [Scherbov, Mamolo, Lutz 2011]. A rise in the population of the 65+ generation entails pressure on pension schemes. The income situation depends on them and in consequence - elderly people’s quality of life and living standard. The amounts of old age pensions and disability pensions are diversified around Europe, which can be seen in the share of expenses on pensions made by individual states, expressed in per cent GDP (Table 1).

The wealthiest pensioners are undoubtedly the Germans, Austrians, French and Dutch. The Swedes, Britons and Italians are less wealthy, whereas the Latvians, Bulgarians and Romanians are relatively the poorest.

THE ECONOMIC SITUATION OF THE 65+ POPULATION IN POLAND

One of the economic measures that describes the quality of life in Polish seniors’ households is their income level. Although they are not a sufficient factor which enables definite determination of one’s living conditions and standard, they significantly influence the degree and quality of satisfying one’s financial and non-financial needs. It results from the fact that the income level significantly influences the demand volume and structure. Besides, it is a key component of the financial factor in its broad sense, which is a constituent of the existence of a household. It is also significant to consider the statement that although income is more endangered by fluctuations than expenses, the results of studies indicate that the trends showing the scale of poverty and social exclusion are usually similar to each other. According to Sleznick [1993], studies on the scale of poverty in Hungary and the USA indicate that there is a considerable difference in the size of the fraction that does not satisfy its needs according to the income and expense criterion. However, these numbers only show the values of goods and services from the market division. In spite of numerous weaknesses of the assumed measure, in market economy the dependences between income and the degree of deprivation are so considerable [Golinowska 1997] that we can assume that the measure is an adequate index showing people’s quality of life.

However, from the point of view of the research, it is above all necessary to note the disposable amount of income, which comprises all current monetary and non-monetary income reduced by taxes, rather than the total amount of income. The rank of this category results from the fact that it carries particular information in the process of economic analysis. Namely, it enables better comparability of households with different demographic composition and it strongly affects the consumption level and structure.

As results from the unpublished data of the Central Statistical Office, from 2004 to 2011 the level of disposable income increased in all economic types of households in Poland. The exception was farmers’ households, which noted a decrease in income in 2011 (Table 2).

A detailed analysis of Polish old age pensioners’ living standard gives grounds for a statement that their income situation is on a higher level than in other types of households and the amount of their disposable income is higher than the average income in total society. Simultaneously it is
possible to notice that the average annual increase in the income of this group of population was 6.0 per cent (whereas the average annual increase in prices was 3 per cent).

Table 2. Average monthly disposable income per capita in households in zloty’s (2004-2011)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Grand total</th>
<th>Households of the self-employed</th>
<th>Households of the self-employed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2004</td>
<td>2005</td>
<td>2006</td>
</tr>
<tr>
<td>Total</td>
<td>706</td>
<td>732</td>
<td>802</td>
</tr>
<tr>
<td>Employees</td>
<td>719</td>
<td>746</td>
<td>803</td>
</tr>
<tr>
<td>Farmers</td>
<td>519</td>
<td>581</td>
<td>670</td>
</tr>
<tr>
<td>Retirees</td>
<td>903</td>
<td>943</td>
<td>1059</td>
</tr>
<tr>
<td>Pensioners</td>
<td>736</td>
<td>757</td>
<td>826</td>
</tr>
<tr>
<td>Societies</td>
<td>818</td>
<td>834</td>
<td>891</td>
</tr>
<tr>
<td>Total</td>
<td>585</td>
<td>594</td>
<td>655</td>
</tr>
</tbody>
</table>

Source: own calculation base on the unpublished data of CEO.

Thus, it is possible to state that the income situation in the households supported with pensions is better than in other types of households and the amount of disposable income per capita is higher than the average income in total society per capita. This is an atypical situation, because the households of people who are not professionally active have higher disposable income than the groups of working people, who actively participate in economic processes. It is difficult to find a rational explanation to these disproportions [Pena-Casas, Latta 2004]. However, it is necessary to note the fact that pensions in this group are relatively low when compared with the pensions in the EU countries. The relatively better income situation of old age pensioners’ households does not correspond to their consumption expenses (Table 3).

Table 3. Average expenses on consumer goods and services depending on the household type

<table>
<thead>
<tr>
<th>Specification</th>
<th>Average expenditure</th>
<th>Total</th>
<th>on consumer goods and services</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2006</td>
<td>2011</td>
<td>dynamics</td>
</tr>
<tr>
<td>Employees</td>
<td>2455.71</td>
<td>3328.32</td>
<td>135.5</td>
</tr>
<tr>
<td>Farmers</td>
<td>2501.14</td>
<td>3089.58</td>
<td>123.5</td>
</tr>
<tr>
<td>Self-employed</td>
<td>3172.58</td>
<td>4080.42</td>
<td>128.6</td>
</tr>
<tr>
<td>Retirees</td>
<td>1777.61</td>
<td>2245.38</td>
<td>126.3</td>
</tr>
<tr>
<td>Pensioners</td>
<td>1406.77</td>
<td>1687.87</td>
<td>120.0</td>
</tr>
<tr>
<td>Living on unearned sources</td>
<td>1422.25</td>
<td>1863.16</td>
<td>131.0</td>
</tr>
</tbody>
</table>

Source: own calculation base on the unpublished data of CEO.

Old age pensioners’ average expenses on consumer goods and services are only higher than the expenses of disability pensioners, who are supported with social benefits. Their expenses are lower than their income and this reflects not only their lower needs but also the fact that old age pensioners’ households often use some of their income to help their families. Very often they are a protective umbrella for the households supported from other sources. In view of the fact that pensions provide a regular inflow of cash they also give relative certainty of existence. Seniors’ support and aid have become a specific strategy of the living standard that enables families to satisfy their needs increase the amount of expenses in other economic groups. This imposes the need to be particularly careful when drawing conclusions about this group only on the basis of their
expenses [Daras et al. 2006, Fioro 2009, Bargain et al. 2007]. The lower share of expenses in those households does not have to mean a higher living standard and vice versa. Due to the family’s life cycle the expenses in those households are usually lower, but this does not mean they can satisfy all their needs. It is worth noting that the share undergoes transformations in the long term and it is mainly conditioned by social and economic changes.

It turned out that the 65+ generation usually answered they had enough money for everyday needs, but they needed to save cash to do bigger shopping. Moreover, among disability pensioners and those who support themselves from unearned income there are the fewest people who say they can afford luxuries (Table 4). If this method is used to calculate the level of deprivation of one’s needs, it may suggest that seniors are forced to live thriftily. This situation makes the households purchase only the cheapest products and they usually limit their amount. It is worth noting that some Polish seniors are unaware of the fact they cannot satisfy higher-order needs. These groups poorly satisfy their cultural and tourist needs, which are so common among the citizens of the western EU countries. Sometimes these needs are substituted with participation in religious communities or senior groups.

Table 4. The self-assessment of satisfying one’s needs depending on the household type

<table>
<thead>
<tr>
<th>Specification</th>
<th>we can afford some luxury</th>
<th>we have enough without special saving</th>
<th>we have enough for everyday living, but we have to save for greater purchases</th>
<th>we have to live economically everyday</th>
<th>we do not have enough even for basic needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees</td>
<td>1.2</td>
<td>12.8</td>
<td>55.1</td>
<td>28.4</td>
<td>2.5</td>
</tr>
<tr>
<td>Farmers</td>
<td>1.0</td>
<td>9.3</td>
<td>58.4</td>
<td>29.3</td>
<td>2.0</td>
</tr>
<tr>
<td>Self-employed</td>
<td>4.7</td>
<td>25.2</td>
<td>55.2</td>
<td>14.3</td>
<td>0.6</td>
</tr>
<tr>
<td>Retirees</td>
<td>0.7</td>
<td>9.0</td>
<td>49.2</td>
<td>37.7</td>
<td>3.5</td>
</tr>
<tr>
<td>Pensioners</td>
<td>0.2</td>
<td>3.5</td>
<td>29.7</td>
<td>54.4</td>
<td>12.3</td>
</tr>
<tr>
<td>Living on unearned sources</td>
<td>0.7</td>
<td>4.8</td>
<td>19.6</td>
<td>45.8</td>
<td>29.1</td>
</tr>
<tr>
<td>Total</td>
<td>1.2</td>
<td>11.5</td>
<td>50.5</td>
<td>32.5</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Source: own calculation based on the unpublished data of CEO.

The answer to the question how people find their income situation in comparison with other respondents carries important information concerning the economic position of individuals. The answers to those questions enable determination of the degree of subjective poverty. According to Veit-Wilson [1987], such a question is the most democratic method of determination of deprivation of one’s needs. In recent years this method has been particularly appreciated by experts [P. Townsend, B. Abel-Smith, L. Rainwater]. The received answers enable determination of one’s sense of inability to satisfy one’s needs in comparison with other households. It is noteworthy that these assessments are an important signal to trigger such instruments of the social policy that will be the most effective for a particular group. They also give a possibility to provide aid (both financial and non-pecuniary) to those people who feel that they are unable to satisfy their needs but simultaneously they exhibit proactive activities. Among the old age pensioners’ households under investigation in almost every fourth of them there is a sense of being in a third of the poorest households (Table 5). Also in this case both the people who support themselves from unearned income and disability pensioners tend to assess their own financial position as worse. However, it is necessary to remember that the use of the methods based on respondents’ opinions does not always classify really poor people as being poor and vice versa [Kahneman, Kruger 2006, Schwarze 2008].
One of the measures that enables determination of the potential area of deprivation of one’s needs is the range of poverty. This index provides information about the number of poor people, whose income is lower than the value assumed in advance. The subsistence wage is the most important limit. The right to this minimum is very often treated as the right to freedom as it designates the consumption level below which health and life are threatened and participation in social life is actually impossible.

Table 5. Subjective sense of poverty

<table>
<thead>
<tr>
<th>Specification</th>
<th>one third of households with the highest standard of living</th>
<th>one third of households with the lowest level of life</th>
<th>between</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees</td>
<td>2.6</td>
<td>16.3</td>
<td>81.1</td>
</tr>
<tr>
<td>Farmers</td>
<td>1.2</td>
<td>18.3</td>
<td>80.6</td>
</tr>
<tr>
<td>Self-employed</td>
<td>6.9</td>
<td>6.7</td>
<td>86.4</td>
</tr>
<tr>
<td>Retirees</td>
<td>1.8</td>
<td>23.6</td>
<td>74.6</td>
</tr>
<tr>
<td>Pensioners</td>
<td>2.1</td>
<td>42.8</td>
<td>55.0</td>
</tr>
<tr>
<td>Living on unearned sources</td>
<td>2.5</td>
<td>55.7</td>
<td>41.8</td>
</tr>
</tbody>
</table>

Source: own calculation base on the unpublished data of CEO.

Table 6. Risk-of-poverty index

<table>
<thead>
<tr>
<th>Specification</th>
<th>At-risk-of-poverty in years</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>relative poverty threshold</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td></td>
<td>17.6</td>
<td>17.3</td>
<td>17.1</td>
<td>16.7</td>
</tr>
<tr>
<td>employees</td>
<td></td>
<td>17.2</td>
<td>16.5</td>
<td>16.3</td>
<td>15.3</td>
</tr>
<tr>
<td>farmers</td>
<td></td>
<td>26.8</td>
<td>28.5</td>
<td>25.9</td>
<td>28.7</td>
</tr>
<tr>
<td>self-employed</td>
<td></td>
<td>8.5</td>
<td>8.2</td>
<td>9.3</td>
<td>9.9</td>
</tr>
<tr>
<td>retirees</td>
<td></td>
<td>13</td>
<td>13</td>
<td>13.3</td>
<td>12.6</td>
</tr>
<tr>
<td>pensioners</td>
<td></td>
<td>28.7</td>
<td>27.7</td>
<td>25.4</td>
<td>26.4</td>
</tr>
<tr>
<td></td>
<td>legal poverty threshold</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td></td>
<td>10.6</td>
<td>8.3</td>
<td>7.3</td>
<td>6.5</td>
</tr>
<tr>
<td>employees</td>
<td></td>
<td>10.5</td>
<td>7.9</td>
<td>6.9</td>
<td>5.8</td>
</tr>
<tr>
<td>farmers</td>
<td></td>
<td>17.6</td>
<td>14.2</td>
<td>12.1</td>
<td>13.4</td>
</tr>
<tr>
<td>self-employed</td>
<td></td>
<td>5</td>
<td>3.5</td>
<td>3.3</td>
<td>3.4</td>
</tr>
<tr>
<td>retirees</td>
<td></td>
<td>6.2</td>
<td>4.9</td>
<td>4.1</td>
<td>3.7</td>
</tr>
<tr>
<td>pensioners</td>
<td></td>
<td>16.4</td>
<td>14.1</td>
<td>10.1</td>
<td>10.7</td>
</tr>
<tr>
<td></td>
<td>subsistence minimum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td></td>
<td>5.6</td>
<td>5.7</td>
<td>5.7</td>
<td>6.7</td>
</tr>
<tr>
<td>employees</td>
<td></td>
<td>5.2</td>
<td>5.2</td>
<td>5.1</td>
<td>5.7</td>
</tr>
<tr>
<td>farmers</td>
<td></td>
<td>9.4</td>
<td>9.3</td>
<td>8.9</td>
<td>13.1</td>
</tr>
<tr>
<td>self-employed</td>
<td></td>
<td>2</td>
<td>1.8</td>
<td>2.2</td>
<td>3.4</td>
</tr>
<tr>
<td>retirees</td>
<td></td>
<td>3.9</td>
<td>3.8</td>
<td>3.9</td>
<td>4.6</td>
</tr>
<tr>
<td>pensioners</td>
<td></td>
<td>9.8</td>
<td>11.2</td>
<td>9.6</td>
<td>13</td>
</tr>
</tbody>
</table>

Source: own calculation base on the unpublished data of CEO.

According to this definition of poverty, the endangerment in the group under investigation must be interpreted as rather low in comparison with other household types, including the households of professionally active people. However, it must be remembered that the scale of poverty in professionally active groups may be slightly falsified due to their tendency to conceal
some of their income (Table 6). Nevertheless, upon the research results it is possible to state that seniors’ pecuniary income has significant influence on the functioning of rural households because they guarantee constant inflow of cash, which is necessary for the functioning of those households [Brandt et al. 2009].

There is low diversification of income both in old age pensioners’ and disability pensioners’ households. This fact is proved by the results of statistical analyses (Table 7).

### Table 7. Living standard positioning measures

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposable income</td>
<td>Total</td>
<td>3371.31</td>
<td>2846.15</td>
<td>1818.57</td>
<td>4212.60</td>
<td>1165.00</td>
<td>6001.68</td>
</tr>
<tr>
<td>Employees</td>
<td>3973.02</td>
<td>3465.70</td>
<td>2469.00</td>
<td>4851.51</td>
<td>1771.80</td>
<td>6619.54</td>
<td>2382.51</td>
</tr>
<tr>
<td>Farmers</td>
<td>3965.12</td>
<td>2791.50</td>
<td>1427.91</td>
<td>4979.25</td>
<td>29.00</td>
<td>9280.55</td>
<td>3551.34</td>
</tr>
<tr>
<td>Self-employed</td>
<td>4804.04</td>
<td>4000.00</td>
<td>2857.84</td>
<td>5800.00</td>
<td>2000.00</td>
<td>8128.00</td>
<td>2942.16</td>
</tr>
<tr>
<td>Retirees</td>
<td>2459.67</td>
<td>2197.60</td>
<td>1461.24</td>
<td>3116.90</td>
<td>1050.00</td>
<td>4200.00</td>
<td>1655.66</td>
</tr>
<tr>
<td>Pensioners</td>
<td>1741.03</td>
<td>1490.21</td>
<td>1073.07</td>
<td>2087.54</td>
<td>798.10</td>
<td>2949.07</td>
<td>1014.47</td>
</tr>
<tr>
<td>Living on unearned sources</td>
<td>1783.93</td>
<td>1419.98</td>
<td>846.15</td>
<td>2246.83</td>
<td>497.50</td>
<td>3337.00</td>
<td>1400.68</td>
</tr>
</tbody>
</table>

Source: own calculation base on the unpublished data of CEO.

Low divergence between the upper and lower quartile is the effect of generally low income received by the entire community as well as the effect of great flattening of income as compared with other professionally active groups. High diversification is noticeable especially in farmers’ households. In spite of the fact that in recent years differences in income have been decreasing they are still considerable. The quartile range of income in old age pensioners’ households is higher than 1.6 thousand zlotys, which is nearly 1.5 times as much as the minimum net salary in Poland. When analysing the percentile range of the amount of income it is possible to notice that the distance between 10 per cent of old age pensioners with the lowest income and 10 per cent of pensioners with the highest income amounts to nearly as much as the triple lowest net salary in Poland. However, it is necessary to note the fact that this amount is relatively low in comparison with most of the EU countries.

**CONCLUSIONS**

The problem of ageing society in the EU countries has been a major challenge for explorers in recent years. Therefore, there are more and more studies on the social and economic exclusion of elderly people as well as recipes and guidelines on how to prevent marginalisation of this group. As results from analyses, seniors’ households are in a relatively better situation than other types of households, especially those belonging to people active on the market. The income from pensions on its own often becomes the basic maintenance strategy for many households. It is a matter of concern that social exclusion in Poland does not pertain to old age pensioners as much as to productive groups, which is irrational and difficult to explain from the point of view of the latter. Furthermore, the analyses give grounds to the statement that the concept that in recent years the 65+ generation has transformed from aid recipients into aid providers is absolutely justified in Poland.

However, it is necessary to bear in my mind the fact that the relatively more favourable financial situation of the 65+ generation, as compared with other groups, may become worse in the near future. The danger of excessive increase in the share of this group in total society may lead to
the collapse of the pension scheme in the nearest years, which in consequence may cause old age pensioners to become aid recipients again.

It is noteworthy that in spite of relatively good economic conditions Polish old age pensioners are in a worse situation than in the EU countries and their living conditions are more difficult. In this aspect the optimistic conclusions concerning their favourable living situation encounter the obstacle of the rationality of explanation. Thus, the question arises about the present-day challenges aimed at successful ageing and prevention of both economic and social degradation of this community. The lack of simple solutions combined with the current global economic situation gives good reasons to presume that the tools which would enable solution of the unfavourable situation can be found both in the hands of the authorities and in the group of concern itself.

REFERENCES
Capital Market of the Slovak Republic

Abstract: The aim of the article is to analyse the conditions of capital market in Slovak Republic from the view of its functionality as a tool providing redistribution of capital in economic system. We focused mainly on functionality of stock exchange as market and execution of individual theoretically determinate functions. We analysed functionality and execution of these functions in individual points, mainly on the basis of last year stock market statistics. In addition to the analysis, there was also our comparison with relevant countries. The aim of the work was to point out some defects of Slovak capital market in the course of current global difficult times in financial sector and present possible perspectives.

Keywords: stock market, securities, market function, market price, trading

Introduction

Last year set very difficult conditions in financial sector globally, especially the competition among individual national economic systems in EU became very tough. Any regional or national economic system is in need of proper functionality of all its subsystems which determine its succession. In the article we will focus on the analysis of Slovak capital market and its components, which should be the tool in economic system to provide financing for prospective and also well settled business projects. Shortage in any component of national financial system can result in various defects in development of the whole economic system, which are probably unpredictable and possibly harmful. Focus of the article is to analyse the capital market in Slovak Republic with its components and to point out some defects reducing its competitiveness in comparison to comparable countries. For better understanding of all the specialities of evolution of Slovak capital market our analysis is enriched by comments on various social aspects associated with its establishment.

History

Process of establishment of capital market in SR was accompanied by lots of changes mainly of legislative character. Almost all spheres of life were affected by necessity of legislation implementation essential for fulfilment of criteria to enter the EU. For Slovak capital market those changes brought revolutionary change of game’s rules. A new collection of legislation of capital market that was being formed from the year 2000 relates to all subjects of capital market (stock exchange, stockbrokers, banks, regulatory institutions, clients, and securities themselves) and also newly adjusts interactions (i.e. relations) among those subjects. Present legislative state characterises Financial Markets Office (ÚFT, i.e. institution supervising capital market) as follows: Our legal regulations have been entirely correlated with European Community law [www.uft.sk].

Harmonization of law of capital market gave good presumption of functionality of the market for the future.

However, a long process of transformation of economics and capital market as the process’s integral part was affected by lots of negative factors that have changed Slovak capital market giving it its present state.

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BRATISLAVA STOCK EXCHANGE (BCPB)

Nowadays Bratislava Stock Exchange (hereinafter referred as “BCPB”) is the only organizer of stock market in Slovakia which share on Slovak capital market, based on data on the volume of transactions is approaching 100%. So problems of BCPB may be identified with problems of the whole Slovak capital market. Roots of these problems go back to the beginning of the market in the early nineties of last century. The market was not formed on economic subjects´ demand and requirements for its formation, but was, so-called, artificially established. In spite of an effort of those who wanted to establish a fully functional capital market and an effort to incorporate experiences of many foreign developed countries when establishing the market, the result is inconsistent. In our opinion, it is so, mainly because of, a so-called province particularities of Slovakia among which we can include typical problems of transforming economics and that is non-transparency, corruption and with it relating strong influence of power and political groups, and mainly deformation of ethical and moral values of some of the market’s participants. Developed markets had disproportionally longer period of time to deal with similar maladies of market economics (and the process will never come to an end), what together with improperly selected form of transition of state property to private sector (the first wave of voucher privatisation, cancellation of the second wave of voucher privatisation and subsequent privatisation in a form of direct sales) has come to contemporary unflattering state of both capital market in Slovakia and stock exchange. Selected form of privatisation rather stimulated formation of technical infrastructure necessary for effectiveness of stock markets, but there was neglected institutional and legislative framework, including legal and ethical consciousness that would have guaranteed the fact that capital market and stock exchange would fulfil their functions that are being fulfilled in the developed market economics.

FUNCTIONALITY OF BCPB

Understanding, according to which stock market means a certain place, determines only one aspect of stock market as a market, namely spatial aspect because every market is performed in certain space. The principle of understanding stock market as special market simply lies in the fact that stock market is considered a market for changeable goods on a large scale [EWALD, B., SCHÄRF, W.G. 1990]. So stock markets are places where concentrated offer of capital meets demand on it.

We consider functionality of stock market as market, especially in Slovakia, where it can be identified with capital market, to be crucial, mainly because of the fact that in a society it should represent (together with financial market) a mechanism for transformation of public savings to such investments that enable economic development, establishing of new job opportunities, and raising of standard of living. In a form of shares, obligations, and other securities the functionality should create credit for both keeping the range of public expenses and standard of living and for maintaining purchasing power in the future [ROSE, P. S, 1997]. There is less important role of stock market to mediate financing of extensive long-term investments, accumulate available capital and direct the capital where its application could be, from economic point of view, specified as the most efficient (allocation effectiveness)[2, p. 563].

Functionality of BCPB will be judged in regard with fulfilment of basic function of the stock market, i.e. market function. Economic literature presents lots of functions of stock market; however, all functions consider market function to be one of the basic functions, and the market function lies mainly [CHOVANCOVÁ, B. a etc. 1997]:

a) in providing wholesale turnover of trade in securities
b) in fixing objective security rate (market price)
c) in providing liquidity of securities
So the most important function of stock market is fixing of market price. Actual rate is shown at concentrated offer and demand on securities, and on its basis security rate is established. Rates’ movement reflects not only the present and expected development of economic situation of the issuers but also existing relations and expectations on financial and capital market, development of macroeconomic indicators, influence of relations of home politics and foreign policy. Especially from the reason of a wide spectrum of factors expressed in rates established on capital market and also stock market, we can brand it as “barometer of economics” [CHOVANCOVÁ, B., a etc., 2002], so credibility of output of process of interaction of all these rate-making factors in a form of information about market price should be the highest. Providing of wholesale turnover is important so that information expressed in market price could be of the best objectivity because it reflects expectations and evaluations of a group of investors and participants (the group of divergences of opinion) in the market, and also liquidity gives possibility for this divergence to show in practice in a form of possibility of performance of required transactions as soon as possible and with low expenses. The following parts of article will analyse the functionality of BCPB according to its individual components as a market. So like on each market the result (market price – rate) is established on basis of mutual interaction of an offer and demand. That is why these entities will represent main points of our analysis. However, since all individual decisions of subjects on sides of both offer and demand are fully determined by available information, this factor will be analysed individually.

Offer

For functionality of any stock market there is adequate offer essential on this market, which in case of stock market means sufficient number of issues and also adequate height of total market capitalization of these issues. For comparison let us mention surrounding V4 countries (Poland, Czech Republic and Hungary) where even if privatisation was not carried out in a significantly different way in all its phases but probably with greater efficiency, what developed radically more active trading of shares of privatized companies, and subsequently led in greater number of commonly traded issues and also greater market capitalisation. Situation is illustrated better in a table of market capitalisation of quoted shares in the markets of developed and other selected countries in comparison with GDP from the end of the year 2012.

Table 1. Market capitalisation of quoted shares in the markets of selected countries in comparison with GDP from the end of the year 2012:

<table>
<thead>
<tr>
<th>State</th>
<th>MC/ GDP</th>
<th>State</th>
<th>MC/ GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>119,02%</td>
<td>Austria</td>
<td>26,53%</td>
</tr>
<tr>
<td>Great Britain</td>
<td>123,99%</td>
<td>Slovenia</td>
<td>18,99%</td>
</tr>
<tr>
<td>Germany</td>
<td>43,72%</td>
<td>Czech R.</td>
<td>18,99%</td>
</tr>
<tr>
<td>Japan</td>
<td>61,76%</td>
<td>Hungary</td>
<td>16,8%</td>
</tr>
<tr>
<td>Canada</td>
<td>110,69%</td>
<td>Poland</td>
<td>36,29%</td>
</tr>
<tr>
<td>Turkey</td>
<td>39,12%</td>
<td>SLOVAKIA</td>
<td>5,03%</td>
</tr>
</tbody>
</table>

Source: World Bank (www.worldbank.org)
The table shows very low relative portion of capitalization of quoted shares to GDP also in comparison with V4 countries. Comparing of this indicator with developed countries indicates serious deformations in structure of capitalization of BCPB market.

However, such considerable difference is not only a short-term phenomenon but, as shown in the table No. 2, it has been accompanying the stock market since its establishing. Growth of last years is only minimal and present level of the indicator does not even reach values from the year 2001.

Table No. 2: Market capitalization of quoted shares in comparison with GDP:

<table>
<thead>
<tr>
<th>Year</th>
<th>MC/GDP</th>
<th>Year</th>
<th>MC/GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>5.14%</td>
<td>2007</td>
<td>8.29%</td>
</tr>
<tr>
<td>2002</td>
<td>5.5%</td>
<td>2008</td>
<td>5.19%</td>
</tr>
<tr>
<td>2003</td>
<td>6.06%</td>
<td>2009</td>
<td>5.36%</td>
</tr>
<tr>
<td>2004</td>
<td>7.87%</td>
<td>2010</td>
<td>4.77%</td>
</tr>
<tr>
<td>2005</td>
<td>7.16%</td>
<td>2011</td>
<td>4.93%</td>
</tr>
<tr>
<td>2006</td>
<td>8.08%</td>
<td>2012</td>
<td>5.03%</td>
</tr>
</tbody>
</table>

Source: ÚFT (Financial Market Office), World Bank (www.worldbank.org)

Also an offer in the Slovak capital market is not very variable. Portion of capitalization of government bonds on total market capitalization reaches 72% at the end of the year 2003 and is still slightly growing. Such a high portion of one kind of assets (especially government bonds) is at least non-standard. Last years’ development of this portion is probably demonstration of “crowding-out effect” which is mostly considered as negative phenomenon in capital markets.

Structure of trade

Statistics of trade structure reflects structure of market capitalization of BCPB. Its results only reflect possibilities that such a structure of market capitalization offers to subjects acting in stock market. BCPB is characterized by the fact that trading in bonds have crucial portion in total trades. In 2003 nearly 98 % of all trades in Bratislava stock market were closed by bonds. Up to 98,3 % from total trades in bonds were the trades in government bonds. So the portion of trades in government bonds in total turnover of stock market was 96,12% in the year 2003. Such kind a structure with small variance is on the market up to now. Also in other stock markets of V4 countries the portion of trades in bonds is high but not that much. However, it is obvious that such a high relative portion of trades in government bonds proves low rate of variability of traded asset, especially looking on theoretical knowledge stated in introductory about flexible trade in wholesale turnover. Also, as we have already mentioned before, such portion demonstrates “crowding-out effect”. In addition to this, trade in government bonds is probably a condition of existence of stock market in general.

New issues

Number and value of new issues indicate how stock market fulfils other of its essential functions, namely regulating and selecting. If BCPB is the only organizer of market in Slovakia, the number of new issues should reflect the development in particular economic branches, increase of
perspective companies, and also real capital demand of already existing subjects performing in Slovakia. Total volume of new debenture capital received in BCPB market in last years is minimal, since it is mostly dealt with emissions of government bonds. Minimal rate of increase of share capital, in our opinion, does not correspond with transforming country such as Slovakia, especially if GDP was mostly growing during last 20 years.

**Demand**

There is inseparable adverse party to an offer, and that is demand which in the course of the whole development of capital market and stock market in Slovakia also was a significant factor which contributed to decline of stock exchange. It is necessary to mention a number of cases emerging at the very beginning of market economy in Slovakia which reduced credibility of this system among the population in relation with cessation of some investment funds after the first wave of voucher privatization. After those events common population lost interest in investment of their savings into capital market which brought decrease of total demand in particular market, delimited further development of infrastructure formed by subjects providing services in this market. This is also pointed out by the fact that market capitalization of BCPB at the end of 2003 was 441,8 bln. Sk [www.uft.sk] of which shares represented one forth. On the other hand, in the same time volume of bank products was considerably greater – total volume was worth 658,9 bln. Sk, and total volume of granted credits worth 701,1 bln. Sk. Situation stayed nearly similar in relative meaning up to now. These data prove bank-centric character of Slovak financial market. And that is why number of subjects acting in both stock market and capital market, and who chose wrong orientation of their activities for providing services to general public, came into an end.

**Brokers**

Net of brokers is a presumption of small and medium-sized investors´ entry in capital market. Harmonized legislation dramatically reduced the number of subjects acting in capital market. Institution supervising capital market (ÚFT) characterises the situation in its official 2003 (when most of legal changes become effective) annual report as follows: Rapid reduction of number of active stock traders is a result of over licensing. While there were about 130 traders with valid licence in Slovak market in summer 2002, at the end of 2003 there were only 38 stock traders owning license for providing investment services and other 6 stock traders owning valid license according to law No. 600/1992 Coll. Up to 93 % of volume of all client trades in investment instruments were carried out via stock traders that are banks in fact [www.uft.sk]. However, stock traders who are banks do not provide their services to small and medium-sized investors in direct form at all, mainly through specialized products with very low possibilities of control. Conditions in this field leads to even smaller possibilities of access to capital market till today.

**Market Price**

Very low relative portion of price-setting transactions presents defect of trading in stock market, and it probably states non-functionality of market function of stock market in view of price setting. This state is caused mainly by various manipulations at the beginning of trading, what caused considering decrease of volumes of price-setting transactions, and also by various purpose transactions of large blocks of securities for markedly non-market prices. Stock market statistics from last years give the best evidence of it: portion of price-setting transactions is minimal (less than 10%). For better understanding of difference between price-setting transaction and negotiated trade we shall state definitions from BCPB’s official yearbook: “A price-setting transaction is closed when an order to buy and an order to sell are matched. If a price-setting transaction is closed
in the module of auction trading or in the module of continuous trading, the parties to the trade are completely anonymous.” On the other hand, “In a negotiated deal, the price and volume are set beforehand through an agreement of the buying and selling member, with both parties knowing each other.[www.bcpb.sk]” so the price cannot be considered market price in today’s unclear network of proprietary relationships and number of purpose transactions. Price’s stating and informational function of such transaction is very small what proves the presumption about a serious defect in functionality of stock market in this essential function.

**Liquidity**

Low liquidity of market is caused by small number of active traded issues because the companies which are in a view of trading in stock market attractive, mostly already have a majority owner. This evidently restricts opportunities for trading in remaining shares of these companies. Generally low liquidity is shown in a table comparing total volume of transactions in proportion to market capitalization in developed countries (considerable differences can be also seen in comparison with countries of development similar to Slovak Republic):

<table>
<thead>
<tr>
<th>Market</th>
<th>Volume of transactions with shares on MC</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>124,6%</td>
</tr>
<tr>
<td>Great Britain</td>
<td>84,04%</td>
</tr>
<tr>
<td>Germany</td>
<td>91,77%</td>
</tr>
<tr>
<td>Japan</td>
<td>99,85%</td>
</tr>
<tr>
<td>Canada</td>
<td>61,58%</td>
</tr>
<tr>
<td>Turkey</td>
<td>136,51%</td>
</tr>
<tr>
<td>Austria</td>
<td>50,12%</td>
</tr>
<tr>
<td>Slovenia</td>
<td>6,24%</td>
</tr>
<tr>
<td>Czech R.</td>
<td>27,04%</td>
</tr>
<tr>
<td>Hungary</td>
<td>54,59%</td>
</tr>
<tr>
<td>Poland</td>
<td>42,56%</td>
</tr>
<tr>
<td>SLOVAKIA</td>
<td>3,57%</td>
</tr>
</tbody>
</table>


As we see the table shows minimal activity of trading with shares on Slovak capital market, which probably reduces potential liquidity on this market.

**Information**

In today’s market economies and in a modern society lately marked as informational, opportunity of receiving relevant information of high credibility is in Slovak capital market very difficult. Current rules of providing information for all participating subjects and also stock market are on a satisfactory level, but sanctions for non-fulfilment of the duties are inconsiderable. We suppose that there is also no will to change this state.

**PERSPECTIVE**

Stated information reflects, in our opinion, defects in functionality of stock market in comparison with the effective functionality’s delimitation by economic theory of which
consequences can be identified in lots of fields of Slovak economics nowadays, and also in
deformations of the economic development. However, there will be no possibility to accomplish
more successful functioning of stock market and capital market when applying actual stereotypes
and benevolence of control and competent institutions. Slovak capital market in actual form can
exist even without stock market which, in this particular state, presents expensive luxury, let us
mention expenses for regulation, monitoring and supervision, and last but not least implicit
expenses from overpricing of other ways of obtaining capital. For making stock market, to all
intents and purposes and of its full functionality, capable of operation in Slovakia, it is vital to make
several crucial changes and steps being able to support such a state. In this point we are going to
describe most real and (in a view of urgency) fastest feasible proposals of so-called take off of stock
market and capital market to effective functionality.

During their formation we abstracted from a number of side influence of which intensity
cannot be judged without implementation in real economics. However, we abstract especially from
possibility or impossibility to implement particular proposals in the eye of the law which is not the
subject-matter of our work.

Information Technologies

Primarily we would propose improvement of legislation relating to electronic signature which
should be formed in such a way so as to provide access to e-signature use to the largest group of
users with high repeatability without above-standard call on time and technologic facilities. This
step would considerably contribute to speeding of the whole cycle of operations connected with
transactions of securities in stock market and also among individual clients and members of stock
market.

In developed capital markets and stock markets using modern information technologies for
making trading accessible to clients of individual members of stock market is natural. They
themselves develop and provide mostly on-line terminals or software platforms to their clients, or
other way of on-line connection with stock market immediately through their informational central
office. This whole process has in a high quality elaborated legislative and contractual basis which
sets clear rules for all participating parties. Great advantage of this system is creating a wide
customer network for stock market members, and gradually the network spreads further in both
vertical and horizontal directions. Realization of implementation of similar systems with more
levels calls for interest of members in their creation because of high input expenses. However, when
strictly following legal regulations, possibilities of formation of profit for completion subjects in
stock market in the field of questioning speculative transactions will reduce and will lead to
necessity of searching for new source of profit formation, and it gives good chances to this proposal
to realization in practice in near future. Such accessing of trading for wide groups of investors and
also speculators would considerably contribute to increase of price-setting transactions; with gradual
increase of client networks it would lead to reduction of charges what would even more evidently
contribute to engagement of these groups with trading in stock market, and thus also to increase
volumes of trading, liquidity, and making market prices.

Fusion of Stock Markets

We propose to initiate negotiations on fusion of BCPB with stock markets of V4, e.g. also
individually. Slovak capital market and stock market have, as we know, very difficult problems; however, other stock markets of V4 were not able to avoid the problems. Such fusion is nowadays a
trend in the world, and joint stock market of countries V4 could also play a role in European scope.
They would cover large economic space which is very well integrated also in other spheres of
economics and economy and which is also culturally close. Such stock market would not only be
simple sum of its individual components, but in a long-term interval, considerable synergy would appear. The stock market would become more independent on state and political power of individual countries, such a stock market’s ability of being monitored would improve markedly, and scope for all illegal practice would be reduced. By means of possibility to gain and locate a great volume of capital the stock market’s attractiveness for foreign subjects would also increase significantly. In stock market of such significance also expectations of progress of development of financial derivations segment would markedly improve. Such connection would together with integration of capital flows contribute to considerable development of the region also in other economic fields and to the increase of its significance within the European Union. In the future such fusion could be extended to other dimension which would be engagement with Wiener Börse, eventually fusion with one of the greatest world’s exchanges Deutsche Börse.

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**Igor Liberko**, Barbara Ciecińska, Karolina Samborska-Kłeczek

**THE USE OF 5S METHOD IN MACHINE PARK MANAGEMENT**

**Abstract:** The paper present results from use of 5S method. Maintaining a good market position is the key issue for companies. It depends on many factors, but mainly on the quality of products, its availability for the customers and the ability of adapting to variable surrounding conditions. The execution of the production tasks is directly connected with the organization of the company, especially with the organization of the machine park.

**Key words:** 5S method, organization, optimization, production

**INTRODUCTION**

The key problems may be: lack of task allocation for employers in particular workplaces, no instructions for service, difficulties in excluding the machine from production, unclear or complicated procedures of service activities. Sometimes, owing to the application of costly software the coordination of the work of production line and maintenance services is possible. However, many companies search for simpler and cheaper ways to achieve more satisfying flexibility and efficiency.

Increasingly popular assumptions of reliability centered maintenance (RCM) and total productive maintenance (TPM) offer some guidance. Servicing activity is combined with planning and task systematization for the benefit of maintaining machines in operation, without the necessity of stoppages. The proactive maintenance idea is especially helpful, as it propagates the monitoring of the state of machines, preventive inspections, use of 5S method on the workplaces and including the operators in the general process of productivity creation within the company [Antosz K., Ciecińska B, 2011, Legutko S. 2007].

**THE USE OF 5S METHOD AT A MILLING WORKPLACE**

The prerequisites of the 5S method use may be different: the necessity of identification and elimination of the main sources of losses – the failures, the regulations, a reduction of machines performance level, slowing down of the production, decreasing quality (more and more defective products), an implementation of autonomous operator’s work for the benefit of production maintenance, allocating responsibility for smooth flow of production, an optimization of the operator’s work or of machines and others [Samborska-Kłeczek 2012, 5S dla operatorów 2010].

In this paper the means of implementation of a new course of conduct at a milling workplace was analyzed.

**a) the results of the initial audit before 5S implementation**

Before proceeding with the appropriate organizational work the previous practices at workplaces were identified:

- the documentation, tools, workplace equipment scattered in disarray;
- unclear or lack of designations on the shelves, tables and drawers;
- long time spent on finding the right tool or metering equipment;
- dusty or dirty parts of machines, no equipment for order maintenance
- waste on the platform, no container for garbage;

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lack of work safety instructions and no symbols with required personnel protective equipment, no fire extinguisher;
no marks required on the transportation route and on moving parts of the machine;
unknown procedures for order maintenance in the workplace.

b) the start of the reorganization – the first S – Selection/Sorting

A typical activity at this stage is an action called “the red label”. All unnecessary things or things without allocation were marked with small red labels. The closets, drawers and shelves underwent selection. The use of red labels made it possible to discover the actual scale of negligence: unnecessary or outdated oils and lubricants, uncompleted tools, a lot of unused raw-materials, the storage of finished products in the place, where they were exposed to damage or dirt, were discovered.

Additionally, the green labels were used, which contained: the description of the thing, its right place and necessary number of the items. [Pacana, A., Bednárová, L 2009]. The selection with green labels was time-efficient. On the label (“holding the item”) the decision about its destination was written (fig. 1). In this way the place for tools, fixing equipment, keys, handles and documentation was defined.

![Figure 1. The labels: a) red, b) green; used in the selection](source: own study)

c) next stages: systematics, cleaning and standardization

Each thing with green label was put away. The groups of things were isolated: tools, garage equipment, documents, etc. Typical organization guidelines were used: labels – painting – color
marks – contours or shapes – maps of the state „before” and „after”. Things were arranged according to the frequency of use, size and number (fig. 2). The workplace, platforms, the containers for cooler and the floor were cleaned. The waste and the useless liquids were disposed of. The area of dangerous zone was marked on the floor. The operator was equipped with clothes and personal protective equipment, documentation, work safety instructions and a fire extinguisher.

Figure 2. The view on the state „before” and „after” during third S: a) „before” – the red and green labels, b) „after” – arranged tools, equipment; signed closet

Source :own study

To keep the workplace clear the schedule of cleaning activities was prepared and now it is part of workplace documentation (tab. 1).

Table 1. The schedule of cleaning action [based on 4]

<table>
<thead>
<tr>
<th>No.</th>
<th>Object</th>
<th>The frequency of cleaning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>After each use</td>
</tr>
<tr>
<td>1</td>
<td>Tables and work-surfaces</td>
<td>X</td>
</tr>
<tr>
<td>2</td>
<td>Floor</td>
<td>X</td>
</tr>
<tr>
<td>3</td>
<td>Machine platform</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>Machine body</td>
<td>X</td>
</tr>
<tr>
<td>5</td>
<td>Waste container</td>
<td>X</td>
</tr>
<tr>
<td>6</td>
<td>Tools and equipment</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Lamps</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Radiators</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Windows</td>
<td></td>
</tr>
</tbody>
</table>

Source :own study

**d) the last S - self-discipline**

To maintain the state of workplace achieved by the use of the first four S training and preparation of procedures are necessary for the future. To make service activity easy for the staff the
A check list was prepared (tab. 2). It enables selecting the areas for further improvement, the goal of which is to maintain an efficient and flexible machine park.

Table 2. The check list for audit of work-place [based on 4]

<table>
<thead>
<tr>
<th>Do?</th>
<th>Analyze?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Attention: if necessary – underline correct one</td>
</tr>
</tbody>
</table>

**MAIN BODY OF MACHINE**
1. Is the dirt, dust, excess of lubricant, fragments of rubber, shavings visible?
   (a) on the moving or revolving parts
   (b) on the stop or block equipment
   (c) on the gauges, devices
   (d) on the frame or on the surface of bed of a machine tool
   (e) the others ..............
2. There are no nuts, screws, etc. or they are loose, twisted, damaged?
3. Is there any play in the moving parts, fastening devices, etc.?
4. Are there unnecessary objects in the machine body?
5. Is the machine stable?

**DIFFERENT PARTS OF MACHINE**
1. Is the dirt, dust, excess of lubricant, fragments of rubber, shavings, damaged elements visible?
   (a) check the cylinders, electromagnetic valves
   (b) check the limit switch-keys
   (c) check the engines, reduction gears, drive shafts, couplings
   (d) check the gauges, monitors, switches, control panel
   (e) check the others.................................................................
2. Are there enough nuts, screws, etc.? Are they loose or twisted?
3. Are the effluents of lubricant, oil, water, gas, vapor?
4. Are there enough lamps?
5. Are there any defects of preservation, covers?

**LUBRICATION**
1. Does the oil lubricate moving parts?
2. Is there enough oil in the container (1) for lubricant, (2) for oil?
3. Do the fillers have covers?
4. Are the oil pipes clean, without leaks?

**AROUND THE MACHINE**
1. Are all plates with marking or labels clean and clear?
2. Are the covers and protective shelters clean, without dust or mist?
3. Are the pipes and lines clean and visible?
4. Is there any dust around the machine?
5. Is there any waste or are there any unnecessary things on the floor?
6. Are the working parts separated from the defective ones?

With many devices needing a day-to-day maintenance the activities include: cleanliness tests, the raw-materials use tests, the functioning of moving parts, quality and frequency of lubrication of joints, mechanisms and their regulation; presence and place of protective covers and work safety.
There are plans of inspecting technical readiness and the assessment of the need for changing used-up parts, lubricants, lids, covers, preservation against corrosion, etc. on seasonal basis [Samborska-Kleczek 2012, Żółtowski M., Żółtowski B 2013].

CONCLUSIONS
The maintenance of machines and equipment in operation, ensuring specified productivity and flexibility, is not an easy task. Machine tools wear and require periodical inspections but, above all, surveying their condition on a daily basis. Simple 5S method, which was used in the described case, not only improved ordering, but also revealed the weak points in the workplace organization. Every kind of equipment means specific mechanisms, constructional elements and materials. The prepared inspection schedule gives possibility of planning a lot of different activities – reviews, overhauls, buying of spare parts, regulation, preservation, etc., whereas the check list (of questions) is a simple tool for improving the internal management system of a machine park.

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Wojciech Lis

THE COMMUNE OF KOSTRZYN – THE POOREST AMONG THE RICHEST

Abstract: This study assessed the wealth of the Commune of Kostrzyn, which represents the average tax revenue per capita in Poland, and compared it with other countries and regions in the European Union. The commune was presented and compared with the county, voivodeship and country. Its economic situation was compared with that of the neighbouring communes.

Key words: commune, tax per capita, economic situation

INTRODUCTION

The language of finance and accountancy uses the term ‘assets’ to describe property. The colloquial language uses such terms as: wealth, richness, possessions, property or even fortune (to describe extensive amounts of material possessions).

The Gross Domestic Product (GDP) per capita is regarded as the most reliable index of the wealth of the citizens in a particular country. The tax revenue per capita is considered to be the most significant index in Poland. Every year the Ministry of Finance announces the value of that index.

THE WEALTH OF COUNTRIES, REGIONS AND COMMUNES

According to the data published by Eurostat in 2012 the GDP per capita in Poland amounted to 67% of the average value calculated for the 28 EU member states. As results from the data, the following EU countries have the poorest economies: Bulgaria (47% of the EU average), Romania (50%), Croatia (62%), Latvia (64%), Poland and Hungary (67%). Some of the countries neighbouring Poland are slightly wealthier, but not much: Lithuania (72%), Slovakia (76%), the Czech Republic (81%). The richest countries in the EU are: Luxembourg 263% (the highest GDP in Europe), Austria (130%), Ireland (129%), Holland (128%), Denmark and Sweden (126%). Those countries are followed by Germany (123% of the EU average), Belgium (120%), France (109%) and the United Kingdom (106%). By comparison, the GDP per capita in Norway is 195%, in Switzerland – 158%, in the USA – 152%, in Japan - 105%, in Turkey - 54%, in Albania – 30%, in Bosnia and Herzegovina – 29% (the lowest GDP in Europe).

According to Eurostat, Mazovian Voivodeship was ranked the highest of the 16 regions of Poland. It was the only region of Poland to reach a higher GDP than the EU average (i.e. over 100%). The GDP per capita in Mazovia was 107%. The other voivodeships did not exceed 75% of the average value of all the EU regions. The indexes of Lower Silesian Voivodeship (74%) and Silesian Voivodeship (70%) are relatively good. Eurostat included five voivodeships located in the east of Poland into the twenty poorest regions of the commonwealth. The indexes of the following voivodeships were lower than 50%: Lublin Voivodeship (44%), Subcarpathian Voivodeship (44%), Podlaskie Voivodeship (47%), Warmian-Masurian Voivodeship (47%) and Świętokrzyskie Voivodeship (49%).

The GDP index is less useful for the assessment of the parts of the country which are smaller than regions. In Poland the wealth of communes is assessed on the basis of their tax revenue per capita, i.e. on the basis of the G index.

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Every year the Ministry of Finance calculates the value of that index. In 2014 the average tax revenue per capita for all the communes in Poland, i.e. the Gg commune index, reached 1,358.98 zlotys. The calculations of the Ministry of Finance are based on the data about the tax revenue in communes in 2012, including future amendments.

The Gg index is calculated by dividing the total tax revenue in all the communes in Poland by the population of Poland. The G index, which is calculated for each commune, is worked out by dividing the total tax revenue in a given commune (the local taxes and the share in personal income tax and corporate income tax) by the population of the commune. The G index makes the basis for the calculation of the compensatory grant and the amount to be paid by communes to the state budget.

The Commune of Kondratowice, Strzelin County, Lower Silesian Voivodeship, was the closest to the Gg value. It is ranked in the 454th place on the list of communes with the highest tax revenue. The tax revenue per capita in the Commune of Kondratowice is 1,358.80 zlotys.

As results from the analysis of the Gg index, 453 (18.27%) Polish communes are relatively rich – their tax revenue is greater than the Gg index for Poland, whereas 2026 communes (81.73%) are relatively poor – their G index is lower than the Gg for Poland.

The wealth of the urban and rural Commune of Kostrzyn, Poznań County, Greater Poland Voivodeship, which is analysed in detail in further sections of this article, is ranked one place higher (453). This commune is the last one that belongs to the richer group of Polish communes, which are differentiated by the Gg index. Kondratowice belongs to the poorer group.

The arithmetic mean of the G index for Poland (1101.54 zlotys) is lower than the Gg index. The revenue of the urban and rural Commune of Kožuchów (1101.14 zlotys), Nowa Sól County, Lubusz Voivodeship, is the closest to the arithmetic mean. The Commune of Kožuchów is ranked in the 908th position with its G index, in the 750th place with its general subsidy (population potential) and in the 625th place (tax potential) as far as its planned share in the personal income tax in Poland is concerned. The tax potential of the Commune of Kožuchów is greater than its population potential, which means that the inhabitants of Kožuchów pay relatively high taxes. The Commune of Kožuchów belongs to the poorer group in the set of communes separated by the arithmetic mean of the G index.

907 communes (36.59%) are richer than the arithmetic mean of the G index, whereas 1572 communes (63.41%) are poorer. The urban Commune of Nowa Sól, Lubusz Voivodeship, with its revenue of 1102.10 zlotys per capita (the 907th place) is the poorest of the rich communes separated according to the G index. The population potential (the 130th position) is greater than its tax potential (the 198th position), which means that the inhabitants of the commune pay relatively low taxes.

To sum up, the arithmetic mean of the G index can definitely be seen in the communes of Nowa Sól County (the Communes of Kožuchów and Nowa Sól).

The Gg value and the arithmetic mean of the G index are noticeably higher than the median value for the communes, which amounts to 961.18 zlotys. The median divides the set of communes into two equal parts. The value of the G index for the Commune of Walim is the closest to the median - the commune is ranked at the 1240th place with its G index. It is a rural commune in Wałbrzych County, Lower Silesian Voivodeship. The commune occupies the 2058th place with its general subsidy and the 1280th place with its planned share in the personal income tax in Poland. The inhabitants of Walim pay relatively high taxes.

As results from the analysis of the G indexes, there are much fewer rich communes than poor ones in Poland. This observation is proved by the references to the Gg index and the arithmetic mean of the G index, which were discussed above.
Another piece of evidence that proves the thesis that there are more poor communes than rich ones in Poland is the communes’ contribution to the compensatory part of the general subsidy to the state budget, which is the ‘soak-the-rich’ tax. 106 (4.28%) out of 2479 communes in Poland pay the tax. Warsaw pays the highest tax – 219,160,728 zlotys (Table 1), whereas Suraż pays the lowest tax – 7,102 zlotys (the 102nd highest G index). Pawłowice is the poorest commune that pays the ‘soak-the-rich’ tax (the 106th highest G index). Pawłowice pays slightly more than Suraż, i.e. 8,647 zlotys.

Warsaw is not the richest commune, because it is ranked in the 43rd position with its G index. However, it is the largest commune – it tops the list with the general subsidy it receives (it has the greatest population potential) and with its planned share in the personal income tax in Poland (it has the greatest tax potential).

1447 communes (58.37%) receive the compensatory part of the subsidy. Chorzów receives the greatest subsidies, i.e. 13,821,517 zlotys. It is the greatest urban commune in Silesian Voivodeship. The commune is in the 387th place with its G index value, in the 31st place with its population potential and in the 36th place with its tax potential. The inhabitants of Chorzów pay minimally lower taxes than their population potential.

Katowice receives the second largest compensatory subsidy, i.e. 7,032,563 zlotys. The last and lowest compensatory subsidy of 94 zlotys goes to the Commune of Wyszki, Bielsk County, Podlaskie Voivodeship. Wyski is in the 1447th position on the list of the communes that receive the ‘soak-the-rich’ tax. Wyski is the 2102nd commune with the value of its G index. It is in the 1712th place with its population potential and in the 2234th place with its tax potential. The inhabitants of Wyski pay relatively low taxes, as compared with the mean value in Poland.

Four large agglomerations receive the ‘soak-the-rich’ tax. They are: Katowice, Łódź, Gdańsk and Poznań.

30 communes pay and receive the compensatory subsidy at the same time. Among those communes Płock receives the greatest amount, i.e. 3,194,522 zlotys, but it pays 8.57 times more, i.e. 27,390,798 zlotys (the fourth highest contribution to the compensatory subsidy). Five communes, i.e. Głogów, Tolkmicko, Frombork, Kolbaskowo and Suraż, receive more money from the ‘soak-the-rich’ tax than they actually pay.

The rural Commune of Kleszczów, Belchatów County, Łódź Voivodeship, is the richest in Poland. The tax revenue per capita in that commune amounts to 33,560.89 zlotys per capita. Simultaneously, it is the second largest contribution to the compensatory part of the general subsidy in Poland, i.e. 46,688,012 zlotys. It is in the 1757th place with the value of the general subsidy it receives and it is in the 998th place with its planned share in the personal income tax. The inhabitants of Kleszczów pay high taxes. The tax revenue per capita in Kleszczów is 27.7 times greater than the Gg index. About 70% of the revenue in Kleszczów comes from taxes and maintenance fees from the lignite mine and power station in Belchatów.

Krynica Morska is the second richest commune with its G index of 21,301.10 zlotys. It is an urban commune in Nowy Dwór Gdański County, Pomeranian Voivodeship. It is at the 10th place with its contribution to the compensatory part of the general subsidy in Poland and it is in the last, 2479th position with the value of the general subsidy it receives. It is a commune with the smallest population in Poland, but it occupies the 998th position with its planned share in the personal income tax. The inhabitants of Krynica Morska pay very high taxes in comparison with the population potential in the commune.

Nowe Warpno is ranked in the third position. The revenue per capita amounts to 12,672.57 zlotys. It is an urban and rural commune in Police County, West Pomeranian Voivodeship. It pays the 13th largest contribution to the compensatory part of the general subsidy in Poland, i.e.
5,167,925 zlotys. It holds the 2478th (penultimate) place with its planned share in the personal income tax. The inhabitants of the commune pay higher taxes than their population potential.

Only in those three communes (Kleszczów, Krynica Morska, Nowe Warpno) the tax revenue per capita is greater than 10,000 zlotys (the first commune, i.e. Kleszczów, pays more than 30,000 zlotys, the second commune, i.e. Krynica Morska, pays more than 20,000 zlotys, and the third commune, i.e. Nowe Warpno, pays more than 10,000 zlotys). Polkowice is the fourth richest commune in Poland with its G index of 7,754.07 zlotys per capita.

Łukowica is the poorest commune. It is a rural commune in Limanowa County, Lesser Poland Voivodeship. The tax revenue in the commune is 343.59 zlotys per capita. It is 97.68 times less than in the richest commune of Kleszczów. Łukowica is in the 265th place with the general subsidy it receives and it holds the 1459th place with its planned share in the personal income tax. The inhabitants of Łukowica pay relatively very low taxes in comparison with their population potential.

The rural Commune of Przytuły (historically the Commune of Kubra), Łomża County, Podlaskie Voivodeship, is in the penultimate position among the poor communes. The G index in Przytuły is 345.91 zlotys. Przytuły is in the prepenultimate (second to last) position with the general subsidy it receives and it holds the last 2479th place with its planned share in the personal income tax. The tax potential of the Commune of Przytuły is slightly lower than its population potential.

The rural Commune of Radgoszcz, Dąbrowa County, Lesser Poland Voivodeship is the second to last with its G index value. The tax revenue per capita is 348.07 zlotys. The commune is in the 608th place with the general subsidy it receives and it holds the 2037th place with its planned share in the personal income tax. The inhabitants of Radgoszcz pay relatively very low taxes in comparison with their population potential.

The largest Polish agglomerations have the highest population and tax potential (Table 1): Warsaw (1/1), Kraków (2/2), Łódź (3/4), Wrocław (4/3), Poznań (5/5), Gdańsk (6/6), Katowice (11/7). Apart from Warsaw none of the agglomerations pays contributions to the compensatory part of the budget. The population potential in Katowice is noticeably lower than the tax potential. Four big cities, i.e. Szczecin, Białystok, Lublin and Bydgoszcz, receive greater general subsidies than Katowice.

THE COMMUNE OF KOSTRZYN

The Commune of Kostrzyn is situated in the east central part of Greater Poland Voivodeship, in the northern part of Września Plain, which is part of Greater Poland (Wielkopolska) Lowland. The area of the commune is 154 km², with the urban area of 8 km² and the rural area of 146 km². The area of the county is 1899.61 km², where the Commune of Kostrzyn occupies 8.11% of the area of the rural county of Poznań.

Kostrzyn is situated near five major towns in central Greater Poland, i.e. 21 km away from Poznań, 20 km away from Środa Wlkp., 27 km away from Września, 32 km away from Gniezno, 11 km away from Swarzędz. It shares borders with 6 communes: Kleszczewo, Swarzędz, Pobiedziska (Poznań County), Nekla (Września County), Dominowo and Środa Wlkp. (Środa County).

The Commune of Kostrzyn is part of the rural county of Poznań, with the capital in Poznań. The city of Poznań is a separate urban county. The population of the rural county of Poznań is 1.86 times lower than the population of Poznań itself, where the population of the Commune of Kostrzyn makes 4.92% of the population of the county. There are comparable conditions concerning the town of Kostrzyn – with 60.48% of the commune inhabitants and 2.97% of the inhabitants of the rural county of Poznań.

Poznań is the main labour market for Kostrzyn inhabitants and it is the place where they can find health care, education and culture. On the other hand, for Poznań Kostrzyn is one of several residential areas, which are commonly known as dormitory towns. There have been noticeable
changes recently. Shopping and logistics centres have moved to dortitory towns. In 2005 a Jeronimo Martins Distribution centre was opened in Kostrzyn. It is one of the most modern distribution centres in Poland and Europe. Jeronimo Martins Distribution owns Biedronka, the largest chain of retail outlets – more than 1500 outlets and 9 modern distribution centres. Jeronimo Martins Group is the largest food concern in Portugal, the owner of Feira Nova and Pingo Doce - chains of hypermarkets and supermarkets, and the owner of Recheio - a chain of ‘cash & carry’ wholesale outlets.

Swarzędz is the most populated commune (the 143rd place in Poland) in Poznań County, whereas Puszczykowo is the least populated commune (the 2139th place in Poland) in the county. Other small communes (with the population under 10,000) in the county include Rokietnica (the 1295th place in Poland), Kleszczewo (the 1291st place in Poland) and Buk (the 1179th place in Poland). The Commune of Tarnowo Podgórne is relatively big (more than 20,000 inhabitants). Its population potential is ranked in the 212th place in Poland. The other communes in the county are comparable to Kostrzyn – they are ranked from the 332nd place (Mosina) to the 929th place in Poland (Murowana Goślina). The population potential of the Commune of Kostrzyn is ranked in the 795th place in Poland.

The tax potential of all the communes in Poznań County is greater than their population potential. In other words, they pay relatively high taxes. The greatest disproportion can be observed in Puszczykowo (the 2139th place in the population potential, the 281st place in the tax potential, which makes the difference of 1858 positions). Kostrzyn is ranked in the 389th place with its tax potential, which makes the difference of 406 positions.

Five communes in Poznań County pay the ‘soak-the-rich’ tax, i.e. Suchy Las, Tarnowo Podgórne, Kórnik, Komorniki and Puszczykowo. Six communes in the county receive subsidies, i.e. Kórnik, Swarzędz, Czerwonak, Pobiedziska, Murowana Goślina and Kostrzyn. Kostrzyn receives 84,507 zlotys (the 967th place in Poland). Only the Commune of Kórnik pays (nearly 35 times more) and receives some of the compensatory grant.

Luboń is the poorest commune in Poznań County. The G index in Luboń is 1268.67 zlotys, which ranks the commune in the 565th place in Poland, the 67th place in Greater Poland Voivodeship and in the 17th place in Poznań County. The value of tax revenue per capita ranks Kostrzyn in the penultimate (16th) place in the county, in the 52nd place in the voivodeship and in the 453rd place in Poland.

The following communes neighbouring the Commune of Kostrzyn and situated outside Poznań County are richer: Środa Wlkp. (the 276th/23rd places), Nekla (the 298th/26th places), the rural Commune of Gniezno (the 419th/48th places). The following communes are poorer: Września (the 555th/65th places), Dominowo (the 785th/88th places), Łubowo (the 992nd/105th places), the urban Commune of Gniezno (the 1010th/108th places), Czerniejewo (the 1266th/137th places).

CONCLUSIONS

Poland is not a rich country of the European Union and Greater Poland (Wielkopolska) is neither rich nor poor region (voivodeship) in the European Union. The urban and rural Commune of Kostrzyn belongs to the group of richer communes in Poland. However, when its wealth is measured with its position in the ranking related to the Gg index for communes, it turns out that Kostrzyn is the poorest in the group of rich communes in Poland and in Greater Poland (Wielkopolska). Among the rich communes the position of Kostrzyn in Greater Poland Voivodeship is ranked slightly worse than in Poland, when we measure it using the arithmetic mean of the tax revenue index. In the list ordered from the best (0%) to the worst (100%) communes it is ranked as 49.89% among the communes in Poland and as 57.14% among the communes in Greater Poland (Wielkopolska).
In brief the Commune of Kostrzyn can be assessed as a commune with a well-established position in the middle of the ranking.

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**FUEL EFFICIENCY OF WASTE WOOD**

**Abstract:** Wood has been considered as a source of biomass and valuable technological material of beneficial ecological properties.

**Key words:** wood, waste wood, biomass

**ENERGY-RELATED PROPERTIES OF WOOD**

A decisive factor for using wood for energy purposes is its calorific value. It is defined in Polish Norm as the heat of burning, diminished by the heat of water evaporation, generated from the fuel in the process of burning and hygroscopic moisture (PN - 81/G - 04513). Briefly speaking – calorific value of wood depends directly on its moisture content.

Indirectly wood calorific value is determined by its density, hardness, health condition, age, and the place of origin in relation to the trunk. An increase in its moisture content decreases calorific value on average from 18 MJ/kg for dry wood to:

a) 15.5 MJ/kg – for air-dry wood (of moisture content 15%-18%), that is by 2.5 MJ/kg (which constitutes almost 14% of calorific value of dry wood) and

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<th>Kind of wood</th>
<th>Fuel value [MJ/kg] at humidity:</th>
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<td>Elm</td>
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<td><strong>Deciduous wood average</strong></td>
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<td><strong>Coniferous wood average</strong></td>
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<td><strong>WOOD AVERAGE</strong></td>
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b) 12.4 MJ/kg – for moisture content equal to saturation point of wood fibres (28%), that is by 5.6 MJ/kg (over 31% of calorific value of dry wood).

Following its cutting wood gradually loses its moisture – it dries naturally. First, it loses free water. This process does not entail the changes in the wood shape and size. Along with the loss of free water also mineral substances essential for tree development as a plant are lost. Gradually, life processes in wood die out. This process lasts till a total desorption of water from wood to the atmosphere. Total free water evaporation is described as reaching the level of fibres saturation. It ranges from 25–30% of moisture content – depending on the type of wood; average moisture content is 28% (MC - moisture content) – as the level of fibres saturation. The process of losing free water progresses relatively fast.

It is assumed that wood moisture content of 88% does not bring positive energy effect from burning it.

Significant wood elements which increase its calorific value are lignin and resin, and its content in wood depends on the species and type of wood. Large resin content in wood may increase its average calorific value even by 20% (Szczuka, Żurowski 1994). Table 1 shows the impact of wood species and its moisture content on wood calorific value.

From table 1 it can be concluded that higher calorific value is the property of softwood. The reason for it is high content of resin in softwood species.

Among solid fuels wood has the highest share of volatile substances about 85% in air-dry state. Wood is classified as long-flame fuel and as such for efficient burning it needs large furnace space.

Solid fuels: coal and wood are chief air pollutants. As the result of burning them there are emitted and cumulated in atmosphere carcinogenic - benzoapyrenes and ashes (Lis 2011).

CHARACTERISTICS OF WOODY RESIDUE

The type and main features of woody residue generated by industries using wood materials, created following wood processing and following wood based production are determined by the character and the type of industrial process during which they are generated. Its big variety is the result of applying numerous techniques and technologies of production and its organization. Woody biomass is characterizes by regularity of its formation, mass scale and usually large homogeneity.

The basic properties of post industrial woody residue or wooden by-products facilitate its systematization in accordance with the following criteria of which the most significant are:

- type groups (wood residue, wood based material residue),
- form (pulpwood, pole-wood, cuttings, sawmill residue – wings and edgings, ends of panels, pellet, briquettes, chips, shavings, sawdust, pieces of veneer),
- the place of its formation (furniture industry, pulp industry, sawmills, laminated panels industry).

Assortment variety requires individual approach using assortment adequate for specific burning conditions (Szostak, Ratajczak, Bidzińska, Galecka 2004).

Woody residue and firewood should be treated as source of energy of local reach – it is most efficiently used when applied in the vicinity of the place of its formation. Local heating plants using woody biomass may be categorized as dispersed renewable energy sources. Development of such local sources of RES has the highest economic sense and should be intensely developed.

BALANCE OF WOODY RESIDUE

The residue from wood industry is a substantial source of woody biomass. It is estimated that from 100 m$^3$ of wood possessed from forest, following its processing at a sawmill up to 60% of residue is generated (depending on the type of conversion). Average results of conversion of 100 m$^3$ of wood at traditional sawmill may come to: 10 m$^3$ bark, 15 m$^3$ of wigs, 20 m$^3$ of wood residue in
pieces, 19 m$^3$ of sawdust and chips, 36 m$^3$ of lumber and 20-25 m$^3$ of final products. (Szostak, Ratajczak, Bidzińska, Gałecka 2004). Of course the deeper the conversion of round wood the bigger the share of post processing residue in it. In the production process of for example very quality demanding furniture panels made of round wood of 1m$^3$ in volume only 0.22 - 0.25 m$^3$ of a ready-made panel is obtained. The rest, 75% – 78%, is residue in its various forms.

When we assume that 30 million m$^3$ of wood per year is allocated to furniture industry (National Forests offer for entrepreneurs for 2014), it may be estimated that the level of residue will reach about 18 million m$^3$ (60%). All of it is of course used. It is used both at the place of its formation, mainly for generating heat and technological steam at large wood industry plants, and their surplus is sold mainly for the production of wood-based panels and pulp and paper masses. Ever more often they are used for side production of briquettes and pellet for heating. From the beginning of 2013 significantly less of the total biomass, including woody biomass is used by energy sector.

The majority of woody residue is generated by sawmills, and their share here reaches 60%. The source of over 14% of woody biomass is furniture industry and 15% is generated by the producers of wood-based panels. The residue from pulp industry constitutes 8%, wood joinery 1.5%, packaging industry – 1.2% and match industry – 0.1% (Szostak, Ratajczak, Bidzińska, Gałecka 2004).

**USAGE OF POLISH ROUND WOOD**

In usage chain – the proper hierarchy of meeting the needs for round wood and its residue regardless of the state of economy goes from veneered lumber, through large size material of specific features, then selected sawmill logs, material for constructing wooden houses and elements of buildings constructed using other technologies (roof framing, construction elements, facade coating), sawmill wood of general usage (later during secondary processing used for manufacturing furniture, wood-working, interior design), wood for packaging (including pallets and packaging boxes) as well as for the production of elements of small garden architecture, wood used for production of panels, wood for pulp and paper industry, households and further wood used to produce briquettes and pellet, yet not necessarily for commercial energy sector. Among bio-ecological energy components there is only that part of woody biomass that is generated from wood residue from wood industry (mainly, yet not exclusively at sawmills, by the producers of pallets and wood packaging and the manufacturers of elements of garden architecture and so on) as well as from post felling residue (arbomass) and round wood that is no longer technologically usable.

Only at the end of the chain of supply of wood of various types there should be the aims of commercial energy sector. To satisfy its needs only the low-value rest could be used that is the residue from mechanical and chemical processing, elements left in forests following felling, as well as branch wood, wood from field and road cuttings and orchards pruning. Currently undervalued and insufficiently used source of biomass are twigs and stumps and other wood residue from forest, especially that left following clear felling called arbomass. On average from 1 ha of clearing area one may obtain approximately 18 600 kg of arbomass.

However, arbomass is also a valuable element of soil humification and an element of natural forest fertilization (especially the source of biogenic elements: phosphor, potassium, calcium, nitrogen and magnesium) but just like wood itself it has a high energy value. Wood energy value does not depend on its structure or form – in all forms (sawdust, wood shavings, chips, briquettes and pellet) it remains the same, however naturally not in all forms it can be used for specific purposes.

Brash assigned for burning may in a way be a specific compensation for the inequality in the demand for wood by commercial energy sector and wood industry. At the time of economic
prosperity and high demand for round wood – it should be grounded and intensively sold for energy purposes. In case of a less stable economic situation and a significant decrease in orders – arbomass may be treated as natural element of forest fertilization. Undeniably, various intensity of commercial sales of arbomass will diminish the impact of economic cycles on forest economy.

Aspect of using wood in Polish economy was regulated in 2013. One should hope that its results will be effective and long-lasting. Still numerous suggestions require ultra-national that is EU level. And that is still ahead of us (commercial wood purchased in Poland for 60 €/m³ may be currently with no obstacles sold to German energy sector as biomass for double the price). To stop such activities adequate legal regulations at the level of European Union are inevitable. Legislative activities concerning that should be one of the task of members of European Parliament, who will be elected still this year.

Following a long-term negative commercial and price policy concerning wood export – Polish wood industry may become uncompetitive in the UE, in Europe and the world. Furniture production in 2012 and 2013 recorded a significant slump by over 8%, mainly due to recession in the EU and world-wide economy, reducing export constituting the main market for Polish furniture industry.

CONCLUSIONS

Assigning wood for the production of goods which give the companies large added value, that is for manufacturing products of high degree of conversion and a long period of usage will guarantee both economic effects in rolling costs as well as ecological benefits that will be effective for environment protection. Not just for wood industry or for forestry but for the whole Polish economy.

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THE IMPACT OF ENTERPRISE’S SAFETY CLIMATE ON NATIONAL HEALTH AND SAFETY CULTURE

Abstract: In the article different data and studies have been analyzed, that were conducted to diagnose the state of safety climate in enterprises and subsequently to find out the extent of its impact on national safety culture. The analysis of the results indicates the consequences of lack of the correlation between the imposed occupational health and safety standards and the system of safety principles acquired in the process of socialization of the enterprises’ stakeholders (especially employees). The paper is based on the assumption, that in order to create national safety culture, it is essential to build safety climate in enterprises.

Key words: safety climate, safety culture, risk-awareness, safety systems, value system

INTRODUCTION

Formation of the desired safety culture in society is a continuous process. It is carried out in the area of values and attitudes, at every stage of the process of socialization, including the longest stage - work. Conducting the cultural change takes time and change orientated programs. The thesis of this work is, that the safety climate created and promoted in enterprises, affects the safety culture of a society – national safety culture. In order to clarify this relationship, one should start with defining the concept of safety climate and safety culture.

Safety climate can be regarded as the surface features of the safety culture discerned from the employees’ attitudes and perceptions at a certain point in time [Cox, Flin, 1998]. It is a specific form of organisational climate, which describes individual perceptions of the value of safety in the work environment. A range of factors has been identified as being important components of safety climate. These factors include:

- management values (management concern for the employees’ well-being),
- management and organisational practices (adequacy of training, provision of safety equipment, quality of safety management systems, etc.),
- communication, and employee involvement in workplace health and safety [Neal et al., 2000].

In order to explain the phenomenon of national safety culture, the phenomenon of culture per se must be defined first. Multi-dimensional and multi-faceted definition of culture was offered by Edgar Schein [1992]. The phenomenon of culture is perceived as observed behavioral regularities, group norms, espoused values, formal philosophy, rules of the game, climate, embedded skills, habits of thinking, shared meanings, root metaphors. Some of these usages focus on values.

Safety culture according to Pidgeon [1991] is a system of meanings by which a social group perceives danger. This system contains explanations of accidents - why and how they arise. National safety culture is an expression of society relation to risk, threat and security, and the value system in this area. High safety culture is a reflection of the high esteem of human health and life. It also means maintaining the balance between necessary risk, which is inherent to life and development, and ensuring the security and protection against security threats. Safety culture

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provides an overall categorization of some of the common behavioral preconditions to disasters and accidents in high-risk systems. It might also become an effective tool to build the risk management strategies, in order to complement current risk assessment practice.

The difference between safety culture and safety climate is, that culture embodies values, beliefs and underlying assumptions, and climate is a descriptive measure reflecting the workforce's perceptions of the organisational atmosphere [Gonzalez-Roma et al., 1999]. Despite the fact, that the safety begin to be formed long before the beginning of work, it is in the work environment where comes to the full formation of difficult to change attitudes towards safety and risk-taking. Since the socialization process runs for the longest time in the work environment.

The article is based on a derivative analysis of research, because only a summary of the studies carried out on large samples will be useful to verify the thesis, and such a wide range of own research is beyond the reach of the author. The selection of studies for derivative analysis, conducted in Taiwan and the United States, is not inadvertent. Research initiated by the government of Taiwan, as one of the few, has been directed at the correlation between safety climate in the enterprise and national safety culture. The unique character of the American research is the safety climate affiliation with the value system of employees. The results of both studies are in direct connection with the hypothesis of the article.

So far, no studies on the correlation of safety climate, value system and national safety culture, have been conducted in Polish enterprises. References to those areas are lacking in the publications of the Central Institute for Labour Protection - National Research Institute, the primary research facility in Poland dealing with complex issues shaping working conditions. Upcoming research area of this article are publications on the implementation of principles of social responsibility in health and safety management systems [Pawłowska 2011; Pawłowska 2009; Pęciłło 2011] and on the direct participation of employees [Pawłowska 2009; Warszewska i Widerszal-Bazyl 2003].

INTERNATIONAL INITIATIVES FOR SAFETY CLIMATE AND CULTURE

A healthy workplace is one in which workers and managers collaborate in order to ensure continual improvement process, designed to protect and promote health and safety, as well as, the sustainability of the workplace. The whole process is reflected in the dominant in the enterprise safety climate. To achieve this aims, following needs have been indicated:

- health and safety concerns in the physical work environment;
- health, safety and well-being concerns in the psychosocial work environment, including organisation of work and workplace culture;
- personal health resources in the workplace;
- ways of participating in the local community to improve the health of workers, their families and other members of the community [WHO, 2010]

The last point, which indicates the WHO, refers to the broader phenomenon, which is the safety culture of a society. The standards of behave, to which we are socialized in work environment, affect also personal life of the employees. Safety culture of a society consists of several components: the value placed on human life and health, social approval of risks, promotion of safety and health on the state level. All of this is reflected in the number of accidents and in the overall health of the inhabitants.

In 2007 the World Health Assembly of the World Health Organisation established the Global Plan of Action (GPA) to provide new impetus for action of the member states in the area of health and safety of the employees. The Global Plan of Action sets out five objectives:

- to devise and implement policy instruments on workers’ health;
- to protect and promote health at the workplace;
• to promote the performance and access to occupational health services;
• to provide and communicate evidence for action and practice;
• to incorporate workers’ health into other policies [WHO, 2007].

The Global Plan of Action seems to be an attempt to establish some kind of a global health and safety culture. The author of the work is rather skeptical about the concept. Although the recommendations are general and refer to shared values, the question is: what are the control mechanisms, especially as far as the workers’ health condition is concerned? Such a plan needs close cooperation of different national health departments, which, taking into consideration the differences in socio-economic development, would be difficult to achieve. The skepticism is the greater, if one takes into account the regional, transnational organisations like the European Union. In spite of common Judeo-Christian heritage of the member states, the organisation has not, so far, managed to establish common, enforceable health and safety standards. Such solution would be treated as an excessive intervention in national social policies. Social policy remains in economic and political supranational organisations outside the common rules. It is mostly due to the already mentioned differences in socio-economic development. If it is so difficult to establish common rules concerning one of the most important aspects of economic activity within a coherent economic entity, we cannot expect, that conducting the process at the international level will be easier. That is why, the author of the article prefers focusing on implementing improvements and the process of control at national levels.

As the research show, the most commonly measured dimensions of safety climate within an enterprise are related to management, safety systems, risk, work pressure and competence [Flin et al., 2000]. National Research Centre for the Working Environment designed in 2011 a survey by the method of questionnaire, in order to know the opinion of the employees of the prevailing safety climate in their companies - Nordic Occupational Safety Climate Questionnaire - NOSACQ-50 [National Research Centre for the Working Environment, 2011]. The questionnaire proved to be a versatile, effective tool and is available for use free of charge for all interested. It contains questions related to the proceeding’s assessment of the managers and employees in workplace regarding the safety issues:

• managers group: safety priority, safety empowerment, safety justice;
• employees group: safety commitment, risk non-acceptance, trust in the efficacy of safety systems.

In 2013, the questionnaire was used to carry out an exploratory study in three European countries - Denmark, United Kingdom and the Netherlands - concerning the safety of migrant workers, especially those coming from Eastern European countries. Special attention was given to the relationship between safety and the national background of migrant workers. Such a profile of research points to the fact how important is the safety culture acquired in the process of socialization. It is usually derivative to an enterprise’s safety climate, but in the case of emigrants, national safety culture is primary in relation to climate.

SAFETY CLIMATE AND CULTURE: TAIWAN

The International Labor Organization (ILO) considers the national preventive safety and health culture to be the basis of any safety culture. The members of the organisation also believe, that the most efficient way to promote such safety and health management at work, is to organise global activities. Such activities cause better understanding at both national and company level. The ILO therefore encourages national governments to promote OSH programs at national level in order to strengthen and maintain a preventive safety culture [ILO, 2003, 2005].
The government of Taiwan has appointed a special body, which task is to monitor the situation of the state in the field of occupational health and safety, custody of the proper implementation of the suggestions and programs of ILO. The Taiwan Council of Labor Affair (CLA) developed national and enterprise’s occupational safety and health management system (OSHMS), following the recommendations of ILO-OSH 2001. In order to carry out the national policy of building a safety work environment, the CLA combines the efforts of the inspectors, the related government agencies, industry and academia. The safety strategy of the ILO also calls for countries to incorporate specific OSH issues into national policy, in order to provide a national system for the implementation of OSH. It is recommended to set a national agenda for accomplishing all of the defined OSH goals. These tasks should be accomplished within a set timeframe, in a given order, through a range of initiatives proposed by the organisation. The plan is based on conviction, that only by establishing a comprehensive OSH system, the OSH culture can be realized at grassroots level. That is why, the study conducted by the Council of Labor Affair was meant to identify the appropriate vision, strategy and goals for labor policy in Taiwan. The Council provides the government with data, which is helpful in decision making process, as far as Taiwan labor policy is concerned. The primary aim of the research was to investigate the views of industry OSH personnel. The secondary aim was the assessment of Taiwan’s OSH policy formulation system [Kuen-Yuan Chuang et al., 2009].

The questionnaire was mailed to 199 experts from industry, government agencies, and the academic fields. Comments from 102 experts were received. Two subgroups with 199 experts and 373 industrial personnel were surveyed with the same questionnaire. The Delphi method with Likert scale was used in expert survey to investigate the importance and feasibility of Taiwan’s occupational OSH strategy formulation system. The study was divided into two parts: the employees’ and the experts’ one. Findings from the first round survey, have been verified and completed by the data based upon feedback from the experts. According to Taiwanese experts and industry personnel, the annual reductions of 10% was considered to be the most appropriate level for “occupational injury disability rate”, “occupational injury rate” and “occupational diseases”. For the overall vision of reduction in the number of accidents in Taiwan, “promoting OSH awareness and enhancing the overall safety culture” was the primary consideration for both the experts (13.4%) and the industry personnel (10.6%). As far as the current OSH policy focus is concerned, 11.2% of the experts claimed, that the most important factor was “improving OSH legislation, standards and systems”. The industry personnel considered the most important factor to be “recognizing work stress and overworking and emerging OSH issues” (8.9%). There was general agreement among both the experts and the industry personnel with regard to their OSH ideals. For the safety status indicators, with the weighting indicators, experts gave “disability rate” the highest score. The industry personnel scored “fatal occupational accidents” and “fatal occupational accident rate” the highest. For the health status indicators, experts and industry personnel both agreed, that the most important factor was to “improve ergonomic environment and productivity”. Due to the Council of Labor Affairs’ expert database with a high proportion coming from academic institute and government agencies, the results of expert survey may provide more academic and governmental views [Kuen-Yuan Chuang et al., 2009].

The study showed, that both the experts and the employed in enterprises, recognize the correlation between the process of promoting awareness and safety culture and the reduction of occupational accidents and diseases related to performed work. Both groups of respondents also pointed to improving standards and safety systems. These indicators also result from a culture of safety. The questionnaire did not, however, include questions, answers to which could suggest solutions to the problems. For instance: How to improve the ergonomic environment and productivity? What does it really mean for the workers? How do the employees define ergonomics?
How to reduce fatal occupational accident rate? If the issues connected with dealing with risk were established and written down at the organisational level, analytical value of the studies would be greater. Since the safety climate need to have also its material dimension – artifacts and written down, enforceable rules.

SAFETY CLIMATE AND CULTURE: THE UNITED STATES

Studies conducted in the United States focused on safety climate, do not refer to the parent category - safety culture. The reason for this lack of correlation was the extent and nature of the measurements. The study was conducted by the academics, without the involvement of public institutions. It was not directly related to safety systems in specific enterprises (although indirect ratio of the studies on these systems is evident), but to the ethical dimension of safety climate. K. Praveen Parboteeah and Edward A. Kapp [2008] in their research indicated the link between workplace safety-enhancing behavior and ethics. Using data from 237 employees from five manufacturing plants in the Midwest, the authors investigated how specific local ethical climate types are linked to incidences of injuries. The interdependence concerned also the local ethical climate and two types of safety-enhancing behaviors: safety compliance and safety participation. The study confirmed, that there is a positive relationship between safety motivation and the corresponding safety-enhancing behaviors. Linkages between safety motivation and safety-compliance (safety activities carried out to maintain workplace safety) and safety participation (behaviors that help to develop an environment, which supports safety) have been also considered. The authors noticed, that employees who were motivated to comply with safety requirements, were also more likely to engage in safety compliance behaviors. Furthermore, employees who are motivated to involve themselves in safety participatory activities are also more likely to be motivated to participate in safety activities. The results of Parboteeoh and Kapp indicates, that those companies with defined safety climate are more likely to have employees who are engaged in self-protective behaviors and safety promotion. Interpretation of the results of the study showed that, a significant part of the responsibility for creating a climate of security was delegated to managers. Managers were thus encouraged to focus on establishing and maintaining a principled safety climate and fostering the execution of the company rules and procedures, as well as, to support creating the safety policies.

The research confirmed the previous findings - close relationship between properly designed and implemented safety climate and employee morale. Employee morale is defined as a degree to which an employee feels good about his/her work and work environment. The term is used to encompass constructs such as intrinsic motivation, job satisfaction, work meaningfulness, organisational commitment and work pride [McKnight et al., 2001]. On the other hand, poor safety programs could negatively influence company morale and make the recruiting process difficult, especially in high-risk industries [Rechenthin 2004].

In another type of American research different effects of safety climate has been analyzed. Safety climate was defined as “a summary of molar perceptions, that employees share about their work environments” [Zohar, 1980] and as “not separate entities but rather different approaches towards the same goal of determining the importance of safety within an organization” [Guldenmund, 2007]. Although, in the study appeared the typology of safety climates (egoist climates, principled climates), the typology consists only of the achievements of researchers in this area, ranging from the 50s. The research does not refer to the internal perception and definition of safety climate of respective organisations. In the questionnaire, of filling which 237 workers were requested, also lacked references to the value system, that is referenced to the area of health and safety. Without such a reference, even declarations such as: “I use all the necessary safety equipment to do my job”, “I carry out my working a safe manner” or “I believe, that it is important
to always use safe/standard procedure”, do not indicate risk-awareness of employees. What is more, the analytical study has been weakened by a small sample and the fact, that the researchers did not indicate, whether the study included employees in various positions or whether respondents were only production workers. It must not be forgotten, that reflexivity and risk-awareness are equally valid for the office workers. On the other hand, the advantage of this study was to link the phenomenon of safety climate with the attitudes of employees, which often result from the values and are their exemplification. The results of this study show how the employees behave (at least declaratively), the reference to values would allow for an explanation of why employees prefer such behaviour.

The author of this paper also recognizes the untapped potential of the study in another area. The study included employees of U.S. transnational corporations in its branches in Europe, Asia, the North and South America, including five locations. A survey carried out in such a multinational work environment could demonstrate, whether the system of values and attitudes towards safety is local or whether we are dealing with imported, American system of health and safety standards. Nevertheless, the interest in the relation of climate and safety culture, as well as in its consequences, can be seen in explorations of American researchers.

**CONCLUSIONS**

Building safety culture within an enterprise is a long and complex process, particularly difficult in multicultural work environment, as happens in the case of transnational corporations. Due to the ongoing process of globalization, there is recently a rise of such transnational safety cultures. It is quite understandable, that the transnational corporation wants to implement the same standards of health and safety in all its branches in the world. It is crucial, however to keep in mind also the national safety culture based on the local values.

As noted in the introduction, studies of the described area have not been previously conducted in Polish enterprises. Research on the impact of safety climate on national safety culture would require close cooperation of Central Institute for Labour Protection (CIOP-PIB) and the Ministry of Labour and Social Policy. The current achievements of CIOP-PIB researchers could be used, if enriched with measurements of national safety culture as the basic unit of analysis. Research profile fit in CIOP-PIB tasks defined as important for reaching the goals of the state’s socio-economic policy [CIOP-PIB, 2014].

Studies quoted in this article show, that organisations analyzed in the context of safety culture do not engage in the area of health and safety to a greater extent than is required by the applicable national legal norms. Companies do not try to look for a common denominator in the value system of the organisation's members, which would not only help to perpetuate the desired behaviour, but also tend to reflect on the current state of the security system and suggest improvements to its condition. Safety climate exerts a strong impact on individual motivation to achieve work outcomes, but also firmly affects the employees behaviours in the social sphere, which form the national safety culture. Therefore, it is a great pity, that the process of building safety climate happens to be neglected in enterprises.

The research also show, that the burden of responsibility for health and safety is ceded primarily on the managers and health and safety services. Such action makes the specialists feel overworked, they are not able to truly fulfil the growing number of responsibilities. The reference to the system of values - the internal sense of responsibility, would facilitate the enforcement of obligations under the working rules. The examples of two countries have shown weak correlation between the national standards of health and safety at work, and what is revealed by research carried out in enterprises. Therefore, the number of accidents at work and outside work, remains significant. This is because there is a disturbed relationship between safety climate and national safety culture.
Where one dimension is not apparent from the other, they are often in conflict. There cannot be then a question of safety climate of an enterprise or safety culture of a society.

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APPRAISAL OF EMPLOYEE'S WORK HISTORY BY USE OF CLUSTER ANALYSIS

Abstract: This article focuses on pointing out the possibility of using cluster analysis of the questionnaire survey. The survey is aimed at the working history of employees of several companies. The result of clustering is dendrogram, which graphically illustrates the clusters at different levels of aggregation. The output of process is cumulative assessment of cluster analysis work history.

Key words: cluster analysis, ward method, dendrogram, employee's work history

INTRODUCTION

Cluster analysis is among the statistical methods and includes calculation procedures designed to decomposition of the data set into several relatively homogeneous clusters. The essence of cluster analysis is to create clusters of objects whose relative similarity is the smallest and also the similarity of objects within a cluster as large as possible. Theoretical knowledge of the cluster analysis were practically applied to the assessment of the working history of employees of selected companies based on the results of the questionnaire. The aim of the analysis is to create clusters of working history of employees who may have general utility in assessing the work history of employees, for example in the selection process into employment.

THE QUESTIONNAIRE SURVEY OF EMPLOYEE'S WORK HISTORY

The questionnaire survey was conducted within the sample for the three companies, which has been designated randomly. Employees have provide answers to the questions about their work history choice using: 1-yes, 2-no, ie. used combined scaling.

Information from employment history clarifies the position of the client to work and method of social responsiveness in touch with other people. They allow us to assess the degree of frustration tolerance, suitability of professional orientation and personality traits that are necessary for the exercise of certain professions. [6]

In the segment of the working history there are the following: [6]:

- **The working flexibility** - this area examines first job, its duration, type of work tasks and allocation of working time.
- **Frustration tolerance** - assess the equivalence of employment and education, skills and interest level of responsibility in each occupation, ability to concentrate on the job despite the adverse working conditions, willingness to perform mundane work and response to rewards and punishments.
- **The social adaptability** - monitors the character and amount of contact with people in the workplace, ie. relationship with superiors, friendly relations in the workplace and beyond, participation in management and political bodies.
- **The working initiative** - observes the administering rationalization proposals and implementation of work.
- **Reliability** - includes attendance of work, activity without control, performance at work, causes of fluctuations.
- **Degree of the useful guidelines the working power** - considers the problems in decision-making, involvement in completing work tasks, frequency or criticality of receiving the
amount of work, suitability of work plans and systems and adaptability to changes in working conditions.

**CLUSTER ANALYSIS OF RESULTS OF THE QUESTIONNAIRE**

The results of the questionnaire survey were then processed in the program STATISTICA9. From clustering methods was used Ward's method and the similarity of objects (similarity of results of the questionnaire) was measured using the Euclidean distance. Outputs are tree diagrams (dendrograms) which are a graphic representation of the clusters.

To determine the number of significant clusters from tree diagrams was then used heuristic approach, i.e. that based on the subjective judgment of the evaluator was elected a significant number of clusters.

Graphical representation of cluster analysis of work history of all companies clearly and describes in detail dendrogram shown in Figure 1.

![Figure 1. Dendrograph of employee's work history](image)

The graph shows that a significant decrease of the link distance of dendrograph occurs at the second level of clustering, at other levels there is a small decrease what is characteristic is that the similarity of objects increases.

In terms of obtaining interpreted and logical solution of cluster analysis of employees working history it is considerable to create five clusters of similar constituents, which are illustrated in Tab.1.

By similarity resp. significance of objects can be sorted clusters formed in the following order: first cluster, second cluster, fourth cluster, third cluster and fifth cluster.

The first cluster consists of length the employment relationship in excess of three years, and suggestions for improvements. On the basis that it can be a cluster described as the impact of initiatives by the employees working on the length of the employment relationship.

The second cluster is formed by changing jobs over three years, causes of leaving the job for personal reasons, financial evaluation and better job offers. This cluster is acceptable to designate as a cause of change of employment or working adaptability.

The fourth cluster consists of the ability to concentrate staff to work, willingness to perform uninteresting work, furthermore there are adequate responses to rewards and punishments, positive attitude to superior and engagement in finishing the work. This cluster can be named as frustration tolerance.
The third cluster includes elements as disagreements with co-workers, employee participation in political and governing bodies and the feasibility of the proposals submitted by the employee. Cluster can be described as social adaptability of workers and their valuation.

<table>
<thead>
<tr>
<th>Number of clusters</th>
<th>Content of clusters</th>
<th>Name of clusters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.cluster</td>
<td>length employment relationship for more than three years, suggestions for improvements.</td>
<td>Effect of working initiatives on length employment relationship</td>
</tr>
<tr>
<td>2.cluster</td>
<td>changing jobs over 3 years causes of leaving the service: o personal reasons, o salary, o better job offer.</td>
<td>Causes of changes in employment</td>
</tr>
<tr>
<td>3.cluster</td>
<td>ability to concentrate at work willingness to perform the mundane work adequate response to rewards and punishments, positive attitude towards superiors, commitment to finishing work.</td>
<td>Frustration tolerance</td>
</tr>
<tr>
<td>4.cluster</td>
<td>disagreements with co-workers, participation in political and governing bodies, implementation of the proposals.</td>
<td>Social adaptability of workers and their valuation</td>
</tr>
<tr>
<td>5.cluster</td>
<td>responsibility for the work, reliability, self-control, regular attendance, quick decisions, adaptability to change, appropriateness of tasks</td>
<td>Reliability and degree of useful guidelines working power</td>
</tr>
</tbody>
</table>

The fifth cluster consists of responsibility for work performed and reliability, self-control employees, frequency of attendance of employees to work, quick decisions, the ability to adapt and appropriateness of workload, education and skills of employees. On the basis of the elements that make up this cluster it is appropriate to mark it as reliable employees and the degree of useful guidelines of working energy.

CONCLUSION

Cluster analysis is widely used and one of the possibilities of its use is the analysis results of the questionnaire, which is briefly described in the paper. The questionnaire survey was focused on the area of the history of employees and was implemented in three companies with different production focus. The output of the cluster analysis are dendrograms of employees working history of individual companies and the total dendrogram, which graphically illustrate clusters. Significant clusters ie. clusters with the highest rate similarity are also verbally interpreted. On the results of cluster analysis, we can perform further analysis from the group multivariate statistical methods.
REFERENCES


PLM SYSTEMS AND REPRESENTATION METHODS IN PLANT SIMULATION OF MATERIAL FLOW IN THE PRODUCTION UNIT

Abstract. The paper deals with a brief description of the development of PLM systems, description of their activities, usability and ways of handling materials in the production unit. There are many ways of material handling. We will focus on sample transport simulations using carts in the production, handling robots for transshipment and the use of conveyors. Samples are shown in 2D and 3D form in Plant Simulation software module.

Key words: PLM systems, simulation, modeling, material handling.

INTRODUCTION

An essential process of every production process is factory material handling. This process does not add or is involved in any way in the added value of the product, but without it the production could not take place. Too few products may be produced on the same machine, or by using only one operation. Each movement of the material in the production consider for handling it. To facilitate this operation we use in today's modern manufacturing various kinds of devices, conveyors, trucks, handling robots and etc. When planning, and optimizing production we use various modern systems. In this paper we present ways of dealing visualized by a software module Tecnomatix Plant Simulation.

WHAT IS PLM (PRODUCT LIFECYCLE MANAGEMENT?)

Around 1980 engineers in manufacturing industries and construction industry recognized the need to keep track of the growing volumes of project files. These were generated by CAD systems. They began to manage data using first EDM (Engineering Data Management) and later PLM systems. These systems include PDM, which permits standardized items to store and manage product data and their publication. Subsequent check in items in bills of material and perform review of individual items. They are seen relationships between parts in assemblies. This feature allows quick access to the structures of these assemblies. It also allows to reuse individual parts and to derive new sets of products and innovations. It also reduces the risk of creating new versions of incorrect assembly and also this version of the report allows for further use. This will facilitate the publication of information about the product which they have created, verified information is used several times in a row.

Benefits of using PLM systems several times outweigh the costs of its implementation. Behind increase in yields not worth only fully setting performance and technology tools occurs mainly at radical change in business processes, the procedures for exercising control. These steps significantly affecting the well established corporate values but ways to increase profitability and market share and streamline business processes. Help speed up the process of product innovation. These products improve the quality and brand image. This will allow faster penetration of new or innovative products on the market. This will allow the manufacturer to obtain more evidence-based
information directly from market perform and objective decisions on the way forward in the life
cycle of all products in its portfolio.

PLM is a holistic business concept developed for data management and product lifecycle. It
includes not only entry, documents, bills of materials, but also analyzes the results of the test
specifications of the product, information on the environmental impact, quality standards, technical
requirements, statements based on changes in production, manufacturing techniques, information
about suppliers, customers, supply sizes, locations where the goods supplied under etc. It also
manages the functions of the workflow. Includes the functions of design and modeling and
standardizing these activities for their automatic use in the future.

The processes in which they engage, and accelerate development of new projects. In the PLM
systems there is also included WEB database. This allows companies to easily connect their devices
globally dispersed staff each other. Manage their activities as needed throughout the organization.
Allows you to engage suppliers, partners, or customers directly to production and product
development. PLM forms the backbone for effective cooperation, planning, management and
control of all organs related to the manufacturing organizations as well as individual products it
produces. The use is not currently no longer only in large manufacturing companies, but also for
smaller manufacturers producing their products in different markets. Also in various service
providers. Progressively expanding PLM trends raises its necessity for successful business and its
planning, management and control of the results.

HANDLING AND TRANSPORT OF MATERIALS IN THE PRODUCTION PROCESS

Handle the material in the manufacturing process represents the most extensive area of
logistics operations. All operations associated with transferring and manipulation of materials, raw
materials, supplies in the production inside the factory or warehouse are cost items. These, but do
not deliver the goods and products have added value, whether in quality or product features. Each
production unit must therefore most optimal plan and to design methods and material handling
options. That the material handling, materials, and finished products as efficiently as possible, it is
necessary to observe the following principles:

- Handling should be kept to a minimum,
Distances material transfer should be as short as possible,

Require the constant flow of material with minimal interruptions

Handling equipment must be standardized, its design should be economical, efficient and multi-purpose.

Handling should be run by a group of facilities and equipment (transport, lifting, etc.). Forming units, thus handling systems.

Every workplace and the type of production has its own individual character. Therefore, it also requires specific solutions for material handling following manufacturing process. In addressing the optimization of existing sites, or when designing and planning new workplaces, it is necessary to consider factors such as:

- Material handling
- The variety of materials moving in transition
- Dimensions and other properties of materials (size, weight, surface, etc.).
- Spatial production possibilities
- Handling zone
- The degree of automation in material handling
- Timing of material handling
- And so on.

Selection and setting optimal parameters for these and any other properties in handling the manufacturing process, we can use several options such as:

1. Modeling of physical models, development of workplace layout, layout of machinery in the real reduced scale project planning and handling areas. This method is relatively expensive and the disadvantage is that we not find time individual disposition, whether handling or manufacturing operations.

2. Simulation model workplace or production. We take into account the dimensions of machinery, handling equipment, real space constraints. We can develop a layout and after running a simulation run, we can schedule a time variant, the layout of production and handling practices.

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• Spatial production possibilities
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• The degree of automation in material handling
• Timing of material handling

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METHODS DESIGN OF HANDLING OPTIONS IN TECNOMATIX PLANT SIMULATION

Plant Simulation is a software tool for modeling, simulation and optimization of logistic systems (e.g., manufacturing, assembly, supply, transportation, etc.). Plant Simulation creates a dynamic computer model, which can be used to explore the properties and behavior of the real processes in a variety of situations and optimize the performance, while it does not matter whether it is a functioning process or new preparation process. Plant Simulation is a clear, object-oriented software with hierarchical structure using inheritance properties of objects. Plant Simulation provides relevant information, based on reality and allows the user to carry out experiments without physical intervention into existing production.

Planning and designing handling operations in Plant Simulation can depending on the requirements divided into:

• Handling the help of the conveyor line or conveyor (Line)
• Submission of automatic material transfer station (transfer station),
• Submission of material by manipulating robot (pick and place)
• Material transport via transport trucks (Transporter)

CONVEYOR

![Figure 2. Conveyor belt 2D and 3D model of the Plant Simulation](image-url)
One way of handling and transport is conveyor. These conveyor belts can be direct, or as in Fig. 2 bent at different angles, or corners. For more complex manufacturing requirements can also create them through various high-rise bridge lines in the halls and the like. Material at the conveyor belt can move independently in pieces, or stored in containers or pallets. The attributes can define parameters such as: the length of the strip, the strip bends angle or radius, belt speed, number of units permissible on one strip at a time and under.

**HANDLING ROBOT**

![Figure 3. Handling robot 2D and 3D model](image)

Another way of handling simulations help of Plant Simulation is the use of a handling robot (PickAndPlace). This robot is used to illustrate the automatic landings and transhipments of materials in production processes. His handling priority depends on the length of his arm and the size of the translated material. Material, can translate individually by the piece or on pallets. The basic attributes we can set parameters such as: length interleaver cycle, possible angle of rotation in space and etc.

**TRANSPORTER AND TRANSFER STATION**

![Figure 4. Transportation via transport truck 2D and 3D model](image)
Frequently used form of transport between the object mainly in larger operations operations is the use of forklifts or pallet trucks. Plant Simulation shows this mode of transport assistance for small transport trucks. Truck, is similarly necessary for people to create a first path along which they move. The roads we define the length, radius bends and width of roads. The transporters can set the number of attributes in trucks, their speed, slowing cornering, acceleration, also the size of the loading area, the number of containers or entities that able to conduct etc. .

Plant Simulation in changing the movement and transport of materials or products after manufacture uses this element (Transfer Station) as a transfer station for example transport truck on a conveyor belt and so on. The attributes Transfer Station is set whether the unloading or loading of items, enter the place where they should be handled in a place where it is to be interpreted, or vice versa, and duration of translation. When carried out translation of trasportného truck is necessary to set the place where the truck during loading and unloading on the road to stop. These items are also often in the simulations as invisible, visible is only the transfer of material from one place to another, for example off the truck onto the conveyor belt and so on.

THE COMBINATION OF ALL KINDS OF MANIPULATIONS IN PLANT SIMULATION

The planning and design of production and movement after manufacture can combine several or all of these types of material handling equipment (Fig. 6) and the product after manufacture.

![Image](image)

Figure 5. The simulation of material movement, a combination of several methods said

CONCLUSION

Depending on the size and priorities of the company in terms of production and one can choose several types of handling and transport of materials in production. In more complex production, it should be combined with various other modes of transport, whether the use of trucks or conveyor belts. In automated production and use of appropriate handling robots. Rethinking handling equipment is also an important parameter in optimizing production, or planning new workplaces and their design. Application of simulation software is an indispensable tool for optimum project planning production lines. Simulations are the preferred way to test the possibility of multiple variants without investing funds for physical verification of these variants.

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Elżbieta Mikołajczak, Piotr Marciniak

ANALYSIS OF THE VOLUME AND MEANS OF UTILIZING POST CONSUMER RECOVERED WOOD ON THE SELECTED LANDFILLS IN WIELKOPOLSKA

Abstract: An inherent element of human existence is the generation of various types of waste linked to our everyday activities. Among the currently generated waste, post consumer recovered wood constitutes an ever bigger share that is waste which is the result of the end of life cycle of various wooden products. The aim of the study was to determine the size and type of post consumer wood discarded on the landfills, such as furniture, window frames, doors, logs and boards, pallets and so on, as well as paper and cardboard. Also the means of utilizing that post consumer wood have been analyzed. The study embraced municipal waste landfills in selected administrative districts of Wielkopolskie Voivodeship.

Key words: waste management, post consumer wood, recycling

INTRODUCTION

Wood waste, similarly to general waste, may be categorized in respect to the place where it was generated:

- Pre consumer wood waste, generated during large scale production process;
- Post consumer waste generated due to the end date of the utilization of products or their parts, due to their natural, material and ethical exploitation (Ratajczak 2008).

Post consumer wood is disparate from pre consumer wood generated by industrial sector. It significantly conditions its further usage. Pre consumer wood waste generated by industry, of familiar quality composition, is collected in the place of raw material conversion. While post consumer wood is scattered. It is of low density and diversified both in respect to quality and quantity (Danecki 2007).

Issues related to post consumer wood are relatively new and there is no unified and widely accepted and referred to definition related to what should be understood by the term post consumer wood.

For the use of this study a definition proposed by Ratajczak, Szostak and Bidzińska (2003) has been accepted. Post consumer wood was defined here as wood contained in products which life cycle has ended. In terms of material management it is net usage of wooden material in goods of complete product’s life cycle. A given volume of wood may be related to the average wooden material density of a given moisture content (for example 15% for air-dry wood). Cubic meter was adopted as measurement unit used for expressing the volume of post consumer recovered wood. While post consumer wood should be understood as wooden products with a finished life cycle, or used wooden products, which where, at least during their primary utilization used as final product. That type of waste is usually measured in tonnes (Ratajczak 2008). Wood waste is the source of post consumer recovered wood. Post consumer wood is also called “old used” wood or “scrap wood”. (Danecki 2007).

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Post consumer recovered wood is usually wooden goods which life cycle, has finished and which come from households and various types of institutions. While the term post consumer wood that is wood waste following wooden goods usage should be used in relation to material management and technical and technological potential for the utilization of such wood. Wood from post consumer waste constitutes an additional resource base, which following adequate interventions, among them segregation respectful to its origin as well as physical and chemical properties, may be efficiently used in various branches of wooden industry as a material for the generation of new products of standard value as well as energy. (Szostak 2004).

METHODOLOGY
The study embraced municipal waste landfills located in selected administrative districts of Wielkopolskie Voivodeship. The selected districts were classified into one of the three large groups, created based on the number of residents (table 1). In each group three districts along with their landfills were appointed. A research carried out at the appointed landfills aimed at determining the size and type of post consumer wood waste such as furniture, window frames, doors, logs, boards, pellet as well as paper and cardboard.

Table 1. The list of landfills representing selected districts comprising larger groups created based on the number of residents.

<table>
<thead>
<tr>
<th>Group</th>
<th>Population in the districts comprising the group</th>
<th>Districts included in the group</th>
<th>Selected districts</th>
<th>Landfills</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>&gt; 8 000</td>
<td>poznański, ostrowski, gnieźnieński, pilski, koniński, kolski, szamotulski, czarnkowsko-trzcianek, turecki, kaliski</td>
<td>poznański, szamotulski czarnkowsko- trzcianek</td>
<td>Poznań Suchy Las Piotrkówek Zofiowo</td>
</tr>
<tr>
<td>II</td>
<td>6 000 – 8 000</td>
<td>kościański, krotoszyński gostyński, wrzesiński, nowotomyski, jarociński, złotowski, wągrowiecki, pleszewski</td>
<td>kościański, wrzesiński, wągrowiecki</td>
<td>Kopaszyn Bonikowo Bardo</td>
</tr>
<tr>
<td>III</td>
<td>&lt; 6 000</td>
<td>rawicki, śremski, słupceki, obornicki, kępiński, wolszyński, średzki, ostrzeszowski, leszczyński, grodziski, chodziezki, międzyzychodzki</td>
<td>średzki, obornicki, kępiński</td>
<td>Nadziejewo Uścikowiec Mianowice</td>
</tr>
</tbody>
</table>

RESULTS AND ANALYSIS
The largest landfill was the one in Suchy Las (52 ha). Its substantial area corresponds to the size of waste disposed there, the largest among all analysed landfills – 104 000 tonnes. The smallest in terms of area is the landfill in Kopaszyn. Its area equals only 2,2 ha. Only slightly bigger, 2,5 ha is the landfill in Uścikowiec. The areas of all landfills which took part in the study and the volume of waste deposited there in 2011 were presented in table 2.

The presence of at least one of the types of waste mentioned above including paper and cardboard was confirmed by the administrators of seven landfills. Unfortunately only three of them (Suchy Las, Bardo, Nadziejewo) were able to roughly determine the volume of waste of that type deposited in 2011. Some post consumer wood also is rarely brought to the landfill in Zofiowo. All landfill administrators who declared the presence of that type of waste at their landfills stated that those are mainly tables, chairs, sofas or wardrobes, namely furniture of finished life cycle.
Table 2. The areas of all landfills under study and the volume of waste deposited there.

<table>
<thead>
<tr>
<th>Landfill location</th>
<th>District</th>
<th>Area [ha]</th>
<th>Volume of waste [Mg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suchy Las</td>
<td>poznański,</td>
<td>52,0</td>
<td>104 000</td>
</tr>
<tr>
<td>Piotrkówko</td>
<td>szamotulski</td>
<td>6,5</td>
<td>10 000</td>
</tr>
<tr>
<td>Zofiowo</td>
<td>czarnkowsko-trzcianeksi</td>
<td>3,2</td>
<td>4 100</td>
</tr>
<tr>
<td>Bonikowo</td>
<td>kościański</td>
<td>6,5</td>
<td>9 000</td>
</tr>
<tr>
<td>Bardo</td>
<td>wrzesiński</td>
<td>4,4</td>
<td>15 500</td>
</tr>
<tr>
<td>Kopaszyn</td>
<td>wągrowiecki</td>
<td>2,2</td>
<td>3 700</td>
</tr>
<tr>
<td>Nadziejewo</td>
<td>średniki</td>
<td>11,0</td>
<td>14 100</td>
</tr>
<tr>
<td>Uścikowice</td>
<td>obornicki</td>
<td>2,5</td>
<td>9 800</td>
</tr>
<tr>
<td>Mianowice</td>
<td>kępiński</td>
<td>7,6</td>
<td>7 800</td>
</tr>
</tbody>
</table>

Administrators of landfills in Bonikowo and Kopaszyn informed about the lack of presence of post customer wood waste, as well as paper and cardboard at their landfills. Detailed information regarding that was shown in table 3.

Table 3. Management of post consumer wood waste at the landfills participating in the study including the information on the presence of paper and cardboard.

<table>
<thead>
<tr>
<th>Landfill location</th>
<th>District</th>
<th>Solid waste segregation</th>
<th>Presence of post consumer wood waste</th>
<th>Volume of post consumer wood waste [Mg]</th>
<th>Presence of paper and cardboard</th>
<th>Volume of paper and cardboard [Mg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suchy Las</td>
<td>poznański,</td>
<td>yes</td>
<td>yes</td>
<td>2 359</td>
<td>no</td>
<td>-</td>
</tr>
<tr>
<td>Piotrkówko</td>
<td>szamotulski</td>
<td>no</td>
<td>yes</td>
<td>lack of data</td>
<td>yes</td>
<td>lack of data</td>
</tr>
<tr>
<td>Zofiowo</td>
<td>czarnkowsko-trzcianeksi</td>
<td>no</td>
<td>yes</td>
<td>lack of data</td>
<td>no</td>
<td>-</td>
</tr>
<tr>
<td>Bonikowo</td>
<td>kościański</td>
<td>no</td>
<td>no</td>
<td>-</td>
<td>no</td>
<td>-</td>
</tr>
<tr>
<td>Bardo</td>
<td>wrzesiński</td>
<td>yes</td>
<td>yes</td>
<td>15</td>
<td>yes</td>
<td>11</td>
</tr>
<tr>
<td>Kopaszyn</td>
<td>wągrowiecki</td>
<td>yes</td>
<td>no</td>
<td>-</td>
<td>no</td>
<td>-</td>
</tr>
<tr>
<td>Nadziejewo</td>
<td>średniki</td>
<td>yes</td>
<td>yes</td>
<td>200</td>
<td>yes</td>
<td>10</td>
</tr>
<tr>
<td>Uścikowice</td>
<td>obornicki</td>
<td>no</td>
<td>no</td>
<td>-</td>
<td>yes</td>
<td>lack of data</td>
</tr>
<tr>
<td>Mianowice</td>
<td>kępiński</td>
<td>yes</td>
<td>lack of data</td>
<td>yes</td>
<td>lack of data</td>
<td></td>
</tr>
</tbody>
</table>

Segregation of solid waste is present on five landfills out of the nine selected for the study. Those are landfills in: Bardo (wrzesiński district), Nadziejewo (średzki district), Suchy Las (poznański district), Kopaszyn (wągrowiecki district) and Mianowice.

Pre consumer wood waste is collected by only one landfill – in Piotrkówko, representing szamotulski district. Those are mainly pieces of wood such as sawn timber, boards and battens. In 2011 at that landfill approximately 0,740 Mg of that type of waste was deposited.

Machinery facilitating waste segregation as well as that used for grinding the segregated waste is in possession of just one landfill located in Suchy Las. Two landfills in Nadziejewo (średzki district) and in Zofiowo (czarnkowsko-trzcianeksi district) use compactors – machines designed
for waste raking up, grinding and concentrating. They allow for reducing the size of municipal waste by approximately 350 kg/m³ up to 1200 kg/m³, or even 2500 kg/m³.

Among the nine landfills, included in the study only the one in Suchy Las sells the post consumer waste. Only up to 30% of the total volume of post consumer wood waste deposited at that landfill is sold. It is purchased solely by individuals. Most often those are the employees of the landfill, who purchase that waste at a symbolic price.

In case of the landfills in Nadziejewo (średzki district) and Bardo (wrzesiński district) post consumer wood is given to the employees free of charge. They usually burn them in home heating installations. The remaining landfills assign the waste for storage.

CONCLUSION
1. Wooden products past their life cycle due to material usage (loss of primary properties and features) or economic usage become post consumer wood waste.
2. Post consumer wood waste, which was not used at the place of its generation (burning, sales) is collected at local municipal waste landfills, where it is stored in its original form or following concentration using compactors in case they are available at a particular landfill.
3. Only at three out of nine landfills the wood waste is used by the employees in private household heating installations. Post consumer wood waste is distributed among them free of charge or at a symbolic price.
4. Problems related to managing post consumer wood in Wielkopolskie Voivodeship is currently not identified. There is lack of implemented solutions in respect to determining the potential possibilities for post consumer wood waste management.
5. Post consumer wood waste constitutes a large and versatile resource base, which should be effectively managed. Its utilization for generating energy or material (wooden materials) will have an impact on lowering the cost of production, as well as forest protection against excessive exploitation.

LITERATURE:
SOCIO-ECONOMIC CONDITIONS OF DEVELOPMENT IN BORDERLAND NATURAL PROTECTED AREAS: A COMPARISON STUDY OF EUROREGION POMERANIA AND EUROREGION PUSZCZA BIALOWIESKA

Abstract: This paper presents the socio–economic conditions of development in two selected Polish borderland natural protected areas: Euroregion Puszcza Bialowieska and Euroregion Pomerania. The former consists of states at the East European Union border, while the latter only involves European Union members. There are analysed foreign tourists’ activities in the protected natural areas. It’s aimed at the research of the potential provided by cross–border relationships resulted from socio–economic situation of the regions and political regulations on the European Union inner and outer borders. Research has been conducted in Wolinski National Park in West Pomerania, which has been placed about 30 km from the German border; and Puszcza Bialowieska - a protected area at the Polish–Belarusian border. The latter experience low interest of Belarusian tourists in visiting Polish natural protection areas. The Puszcza Bialowieska Euroregion should focus marketing on the creation of the touristic infrastructure for the European Union visitors utilizing the socio-economic conditions of the Euroregion development.

Key words: Euroregions, socio–economic situation in Euroregions, natural protected areas, Wolinski National Park, Puszcza Bialowieska, Pomerania Euroregion, Puszcza Bialowieska Euroregion.

INTRODUCTION

In Europe, as early as in the 1950s, representatives of regions undertook initiatives to overcome the limitations of national borders [Europäische Kommission 2000, pp. 5]. In Poland, the intensification of cross-border cooperation was made possible due to the political changes in the late 80s and 90s, the development of the civil society, the integration with the European Union, and, since 2007, the elimination of the checks at the internal EU borders. Euroregions are a specific form of cross-border cooperation, unique among other kinds of cooperation in their extent of institutionalisation of the structures of cross-border cooperation. There are 16 Euroregions in Poland: 4 on the western border, 7 on the southern border, 3 on the eastern border and 2 on the northern border.

The development of Euroregions depends not only on the socio-economic conditions specific to the country, but also, and perhaps above all, on the situation in the borderland area. The aim of this study is to assess the socio-economic conditions for the development in the two selected Polish borderland natural protected areas. The study shows the activity of foreign, predominantly German, tourists in the Euroregion Pomerania in terms of excursions to the Wolin National Park. The study also provides an analysis of the Puszcza Bialowieska Euroregion in terms of the eco-tourism development opportunities created by the Bialowieski National Park and the Polish-Belarusian Euroregion at the external border of the European Union.

In spite of the socio-economic development conditions created by Euroregions to the benefit of their member regions, the socio-economic disparities between both sides of the border, as well as political and administrative barriers in crossing borders may largely limit the extent to which the
potential of an established Euroregion is harnessed as intended. Therefore, the development of recreational tourism in the area of the Polish western border to a greater extent involves tourists from cross-border regions, whereas on the eastern border, the development of recreational tourism is hampered by both unfavourable financial conditions of Belarusians and the political and administrative barriers arising out of the nature of these areas as an external border of the European Union.

The evolution of Euroregions does not only involve the changes in their policy by also in their composition. For this reason and due to the limitations in the availability of statistical data the following composition was adopted for the purposes of the analysis presented in this study: 1) the Polish part of the Euroregion Pomerania - Zachodniopomorskie Voivodeship, 2) the German part – the districts: Greifswald, Stralsund, Rügen, Uckermark and Barnin, and 3) the Swedish part – 33 communities of Skania region. For the purposes of the analyses of the Puszcza Białowieska Euroregion was assumed that its Polish part includes the municipalities of Hajnowski District and two municipalities of Bielski District (Bielsk Podlaski and Orla). All municipalities of this Euroregion are a part of the Lomzynski subregion (Podlaskie Voivodeship). In Belarus, the Puszcza Białowieska Euroregion comprises three administrative areas: Svisloch District, Pruzhany District and Kamenets District.

SELECTED NATURAL PROTECTION AREAS IN POMERANIA AND PUSZCZA BIAŁOWIESKA EUROREGIONS: WOLIN NATIONAL PARK AND PUSZCZA BIAŁOWIESKA

Due to the expanding industrialisation, urbanisation and the intensification of agriculture, protected areas play increasingly important role in maintaining biodiversity. At the same time also the importance of protected areas as tourist destinations continues to increase. National parks are the most important legally protected areas in the Euroregions. These parks include, for the Euroregion Pomerania – the Wolinski National Park (WNP) in the Zachodniopomorskie Voivodeship and, for the Puszcza Białowieska Euroregion – the Białowieski National Park (BNP) in Podlaskie Voivodeship.

The WNP was established in 1960 and covers the central part of the Wolin island, part of the Szczecin Lagoon and a 1-mile wide Baltic coastal belt. It also includes the Świną Inverted Delta – a wetland with many frequently flooded islands. The WNP is Poland's first land-and-sea national park. The area of the WNP is 8134.5 ha (without the coastal waters of the Baltic Sea, whose area amounts to 2713.5 ha). Forested areas cover 4,643.6 ha and water areas cover 1,977.5 ha [GUS 2013, pp. 284]. The park hosts 1,300 species of vascular plants, approximately 400 of which dwell on and in vicinity of cliffs [Simonides 2008, pp. 440]. In the park area between the hills covered with beech, pine and oak forests there are numerous glacial lakes (Warnowskie, Rabiąż, Czajcze, Grodno). The beech orchid with nine species of orchids is particularly unique [Simonides 2008, pp. 438-440]. WNP is a safe harbour for birds, including the white-tailed eagle, whose silhouette is a symbol of the park. A main bird migration route crosses the Wolin island, and the delta of the Świną river was decreed to be a safe harbour for 230 species of birds that live there [Simonides 2008, pp. 440]. The park also hosts a Bison Show Pen.

For a long time Puszcza Białowieska has been one of the most interesting natural areas in Europe. It consists of the Polish part, the BNP with the area. 62,500 ha and the Belarusian part with the area of 87,500 ha. The BNP as a part of Puszcza Białowieska was established in 1932 as a National Park in Białowieza. After World War II the status of the park was confirmed in 1947 making it one of the first national parks in Poland [GUS 2013, pp. 284]. The BNP also covers the most valuable part of Puszcza Białowieska, the last primary lowland forest in Europe [Symonides 2008, pp. 415]. In confirmation of this fact, in 1979 UNESCO recognised the BNP as a World
Heritage Site [UNESCO, 05.01.2014]. In 1992, the BNP also became a part a Europe's third and world's seventh cross-border World Heritage Site [Simonides 2008, pp. 415]. Puszcza Białowieska is a relic of the primeval forests on flat plains of clayey ground moraine, in which deciduous forests prevail, mainly hornbeam-oak forests, but also riparian forests and bogs. As evidenced by the data of the General Directorate for Environmental Protection [GDOŚ, http://natura2000.gdos.gov.pl/05.01.2014] Puszcza Białowieska hosts rich and original flora, with vascular plants being most thoroughly explored (1020 species). Additionally, 325 species of lichens, about 260 species of mosses and 1,200 species of macrofungi were found. The area of Puszcza Białowieska is a bird safe harbour of European importance, with around 240 species of birds, including 12 species of the Polish Red Book. The fauna of Puszcza Białowieska comprises 11,000 species, representing 40% of the country's total. Mammals are represented by 58 species, which is 72% of Polish lowland fauna. Additionally, this is an area of key importance for the preservation of bison and large carnivores – wolf and lynx.

In protected areas the relationship between environmental conservation and tourism development opportunities is particularly evident. Nevertheless, the importance of these areas for the development of tourist services is determined by socio-economic conditions in the respective Euroregions and the border-related limitation of the inhabitants of the Euroregions.

SOCIO-ECONOMIC CONDITIONS OF DEVELOPMENT IN POMERANIA AND PUSZCZA BIAŁOWIESKA EUROREGIONS

There is a characteristic economic disparity between western and eastern regions of Poland, which has been reflected in the socio-economic performance of Pomerania and Puszcza Białowieska Euroregions. Moreover, the western Euroregions became an internal border of the European Union, which further has been facilitating economic development and social integration in the regions since 2004. On the other hand, the disparity enables European Union funds attainment by the eastern regions of Poland.

The eastern borderland is perceived as economic and geographic periphery with unfavourable social and economic conditions; although, there are factors potentially beneficial for the development of the regions. Bański and Janicki [2011, pp. 12] noticed the negative conditions on the example of Lublin Voivodeship as follows: depopulation, economic monofunctionality, low level of investments, and poor transportation infrastructure. On contrary, they indicated two following strengths: 1) natural environment, which can facilitate tourism development and 2) potential for commercial exchange. Thus, the development of the eastern regions particularly should be aimed at the increase of eco-touristic services.

However, there may be noticed two interdependent factors, which have a major impact on economic development of cross-border regions: 1) economic disparities between the regions and 2) permeability of the border [Bański, Janicki 2011; Olejniczak, Bienias, Kozak 2012, pp. 209]. The former usually facilitates cross-border economic exchange of goods, services and labour as the latter can significantly reduce the exchange according to the degree of permeability.

The Euroregions differ in the terms of border permeability since the eastern regions have become the EU’s external border; it substantially decreased the eastern border openness to cross-border economic and social exchange, although the the economic disparities in the eastern borderlands facilitate such exchange.

The demographic structures in the cross-border regions reveal positive trends in the terms of socio-economic performance as they move east (Figure 1). Thus, the Belarusian areas have the major share of working age population in the Puszcza Białowieska Euroregion. It is a potential supply of competitive labour force in the region, which experience depopulation and population
ageing. However, the Polish part of Pomerania Euroregion performs a similar positive demographic structure in compare to the Swedish and German members of the Euroregion.

![Figure 1. Demographic structures in Pomerania Euroregion (on the right) and Puszcza Bialowieska Euroregion (on the left) in 2009.](source)


Similarly to the demographic outlook can be seen the economic situation in the Euroregions. Figure 2 shows gross domestic product per inhabitant at current market prices in 2010 in Pomerania Euroregion and Puszcza Bialowieska Euroregion (the comparative data were available only for Belarus). The economic performance of all members in both Euroregions is weaker than the average in the members’ respective countries. Both Euroregions characterize significant share of natural areas\(^{15}\) and relatively low share of industry in their economies\(^{16}\). The service sectors are the major parts of the economies, particularly in Pomerania Euroregion, which have commercial tradition and become the most popular holiday destination for citizen in their respective countries (especially in Germany and Poland); the Lomzynski subregion differs significantly in the function of agriculture in its economy (Figure 2).

The economic performance of all members in both Euroregions is weaker than the average in the members’ respective countries. Both Euroregions characterize significant share of natural areas\(^{17}\)

\(^{15}\) The forest cover in Poland was 29,3% in 2012. There was 35,4% in Zachodniopomorskie voivodeship (ranked at 4th place among 16 Polish voivodeships) and 29,6% in Lomzynski subregion; however, in Hajnowka district, which is the major member of the Polish part of Puszcza Bialowieska Euroregion the forest cover was considerably higher than the Polish average - 53,2% [GUS, http://www.stat.gov.pl, 06/01/2014].

\(^{16}\) The average share of industry sector in Poland was 38%. There was 29% in Zachodniopomorskie voivodeship (ranked at the 15\(^{th}\) place among 16 Polish voivodeships) and 33% in Lomzynski subregion (the part of the Podlaskie voivodeship ranked at 13\(^{th}\) place among 16 Polish voivodeships) [GUS, http://www.stat.gov.pl, 06/01/2014].
and relatively low share of industry in their economies\textsuperscript{18}. The service sectors are the major parts of the economies, particularly in Pomerania Euroregion, which have commercial tradition and become the most popular holiday destination for citizen in their respective countries (especially in Germany and Poland); the Lomzynski subregion differs significantly in the function of agriculture in its economy (Figure 2).

![Figure 2. Gross domestic product per inhabitant at current market prices in 2010 in Pomerania Euroregion and Puszcza Bialowieska Euroregion (in the latter the data available only for Belarus and the Lomzynski subregion, which includes the most of the Polish part of the Puszcza Bialowieska Euroregion) – on the left. Structure of gross value added by kind of activity in 2010 in Zachodniopomorskie voivodeship (the Polish part of Pomerania Euroregion) and Lomzynski subregion (the Polish part of Puszcza Bialowieska Euroregion) – on the right.](image)


Protected areas, as the name suggests, are covered by a number of legal restrictions which often preclude traditional forms of land use [Nature Conservation Act, Art. 15, 17, 24, 33]. The restrictions of protected areas i.e. in the land use may be a cause of conflicts between local communities and nature preservation institutions [Hibszer 2013, pp. 176-213]. However, the existence of protected areas allows the development of tourism. This is especially true for eco-tourism, defined by R. Denman as “travelling to study, admire and enjoy beautiful landscapes, wild animals and plants, as well as the local customs and culture” [Kamieniecka 1995, pp. 20]. Eco-tourism bridges the gap between the restrictions of protected areas and the needs of local communities, and can be one of the forces driving development. Moreover, eco-tourism in protected areas provides opportunities for economic growth at the local level, which translates into improved standards for tourists and lower unemployment, and in turn activates the local community to protect the nature.
TOURISM DEVELOPMENT IN WOLIN NATIONAL PARK AND PUSZCZA BIAŁOWIESKA

The borderlands, euroregions included, are attractive sites particularly due to their natural areas which appeal to eco-tourists. This is due to the relative ease of crossing of the border via the so-called small border crossings for pedestrians or cyclists, which allows tourists to explore the other side of the border and significantly increases the attractiveness of the visit. This is confirmed by numerous cross-border projects involving the establishment of tourist trails and joint tourist offers for euroregions. Increased interest in recreation in protected areas can be also observed. This can be attributed to the changes in public awareness and lifestyle. For these purposes, the preservation of natural richness and the development tourism in environmentally valuable areas have been acknowledged as priority actions both for Euroregion Pomerania [ARGE 2006, pp. 102-183] and Puszcza Białowieska Euroregion [Agreement 2002]. The purposes of national parks includes making them available for tourists [Nature Conservation Act, Art. 8b]. Every year Polish national parks are visited by approximately 11 million tourists. In the analysed period, the least number of tourists (10.44 million) visited parks in 2004 [GUS 2005, pp. 272], and the most (11.68 million) in 2012 [GUS 2013, pp. 286].

Tourism infrastructure is similar in both parks under analysis – it consists mostly of tourist trails and, in the case of the WNP, 9 rain shelters. The most attractive sites usually require an entry fee. Such sites include, in the BNP: the Nature and Forest Museum in Białowieża, the Bison Show Reserve, the Strict Protection Area, and in the WNP they include: a natural the museum of nature, the Bison Show Pen and overlooks. The funds obtained from the sale of tickets are used, among others, for current maintenance and, in some cases development, of park infrastructure. Using the tourist trails in both parks is free. The length of the trails in the WNP was 50.1 km, and 44.3 km in the BNP (data for 2012), which is relatively low compared to other Polish national parks. Between 2007 and 2012, the length of tourist trails increased by 3.1 km in the WNP and by 6.3 km in the BNP, which is respectively 6% and 16% over 5 years. These values are lower than the calculated average for 23 Polish national parks, which amounted to 11% and resulted in the total length of tourist trails reaching 3,609.8 km in 2012 [GUS, 2008, pp. 290, GUS 2013a, pp. 286]. As far as other elements of tourist infrastructure are concerned, both national parks, as compared to other Polish parks, miss shelters, camping and bivouacking sites [GUS 2013, pp. 286].

For years the number of tourists in the WNP has remained unchanged, and in 2007-2012 amounted to 1.5 million tourists annually. The number of tourists in the BNP in the analysed period varied greatly between years: 141 thousand in 2007, 82.3 thousand in 2008, 190 thousand in 2009 and 120.6 thousand tourists in 2012 [GUS 2008, pp. 290; GUS 2009, pp. 288; GUS 2010, pp. 284; GUS 2011, pp. 284, GUS 2012, pp. 281; GUS 2013, pp. 286]. It should be noted, however, that these data – particularly in the case of the WNP – were for informational purposes only. The quoted number of tourists in national parks (excluding paid sites) is usually an estimate, due to the difficulties in data collection. In the case of the WNP it was more difficult to provide the accurate number of tourists. It is mainly due to the factors such as: the location of the park in close proximity to the popular and frequently visited seaside resorts (Miedzyzdroje, Wiselka), unlimited access to the seaside and the existence within the park area of public roads with heavy traffic. The unique location of the BNP (proximity of guarded external EU border, lack of transit routes within the park, no urban centres) allows to provide a more accurate estimate the number of tourists in this park. Due to inaccuracies in the numbers of tourists visiting the WNP and the BNP (according to the authors) further comparative analyses are based on the primary data derived paid sites in these national parks (Figure 1).
The number of Polish tourists visiting paid sites within the WNP shows a decreasing trend satisfactorily ($R^2=0.7306$) described by the equation $\hat{y}=-4421.6t + 214143$. As far as the number of foreign tourists visiting the WNP is concerned there is a noticeable upward trend – in the analysed period there was a nearly six-fold increase in the number of foreign tourists, from 1.9 thousand tourists in 1999 to 11.3 thousand tourists in 2012, the trend was described by the equation $\hat{y}=827.61t - 1366.9$ ($R^2=0.8075$). Tourism trends for the BNP are different. The number of foreign tourist visits in the BNP during the analysed period (2003-2012) was at a rather constant level of about 32 thousand tourists a year. As in the case of the WNP, the exception was 2010, in which there was a noticeable drop in the number of tourists visiting the park. This can be attributed to the rainy and cool summer of 2010. Unlike the case for the WNP, the amount of tourist visits in the BNP shows an increasing trend. However, since the financial crisis in 2008, the interest in this park has been declining by about 20 thousand visits per year.

In the analysed period, the key factor determining the cross-border traffic was Poland's accession to the EU (01.05.2004), in particular the inclusion of Poland into the Schengen Area (21.12.2007), which resulted in discontinuing the border checks at the internal borders of the EU. As follows from the presented data, the latter event substantially contributed to the increase of cross-border tourism in the WNP. In the case of the WNP the number of foreign tourists in 2008 increased by as much as 93% compared to 2007. In the subsequent years, except 2010, the number of foreign tourists in the paid sites within the WNP amounted to between 8.9 and 12.8 thousand. The dominant group of foreign tourists in both analysed parks were German tourists. The percentage of foreign tourists in the total number of tourists visiting the WNP in 1998-2004 was about 1%, and after Poland's accession to the EU increased to 2.1-2.8%, to eventually reach 7% after discontinuing the border checks. The percentage of foreign tourists in the total number of tourists visiting the BNP, even though it was at an overall much higher level (11%-15.8%), was not substantially affected by the events related to Poland's accession to the EU. This was due to a number barriers such as: the suspension in 1995 and eventual shutdown of rail connections to

![Graph showing Polish and foreign tourists in paid sites within the WNP and BNP in 1998-2012.](image-url)

*Figure 1. Polish and foreign tourists in paid sites within the WNP and BNP in 1998-2012.*

*Source: Own compilation based on the data from the WNP and the BNP.*
Bialowieza, long distance from Western Europe, considerable distance of the BNP from larger urban centres, poor access to transport – no transit routes, small number of border crossing points in the vicinity of the BNP, a considerable share of shopping tourism among tourists from the other side of Polish eastern border.

The fractional share of Belarusian tourists in the total number of foreign tourists in the Polish attractive natural areas can be also attributed to the fact that tourists on the Belarusian side of the euroregion have access to much larger areas with attractive natural assets, as well as to the economic situation in Belarus, which drives shopping and business Belarusian tourism. Economic disparities characteristic for the internal western border, in this case in favour of Polish tourists, coupled with substantially greater administrative restrictions of crossing the border, largely limit the tourist activity of Belarusians from the Euroregion interested in visiting attractive natural areas. Furthermore, the development of eco-tourism is characteristic for societies at a high level of income – it is connected with the expansion of environmental awareness and the advancing environmental degradation typical for the industrial development of developed countries [Kowalczyk 2010].

German tourists are the largest group of foreign tourists – in 2012 they accounted for 19% of the total foreign tourists accommodated in the districts of the Puszcza Bialowieska Euroregion (Hajnowski and Bielski districts). Belarusians were the second most numerous group – 11% share in 2012 [GUS, http://www.stat.gov.pl, 01/06/2014]. At this point it should be noted that the statistics are based on accommodation and Belarusian tourists might more often decide not to stay overnight in Poland or find accommodation on the Belarusian side of the Euroregion. Nevertheless, Belarusian tourism largely involves business and purchasing. A study commissioned by the Ministry of Sport and Recreation shows that in 2012 only 7% of Belarusian tourists visited Poland only for recreational purposes, while more than 70% of the tourists (out of a total of 1.62 million Belarusian tourists) visited Poland for shopping or for professional reasons. As a contrast, in the same period nearly 25% (out of 4.8 million) of German tourists visited Poland for recreational purposes [Bartosiewicz, Skalska 2012, pp. 60-62].

The seasonality of tourism is clearly evident for both national parks under analysis, as shown by the data on the numbers of visitors to park museums (Figure 2). The highest tourist traffic in the WNP – approximately 68% of the total annual number of visits to the WNP museum – occurs between May and August. The tourist traffic in the BNP is distributed more evenly compared to the WNP museum. This is manifested by an extended period of the highest tourist traffic, which lasts for 6 months (from May to October) – versus 4 months for the WNP museum. It is also manifested by the ratio between the intensity of tourist traffic in peak and non-peak periods being lower for the BNP than for the WNP – for the BNP this ratio exceeds 20% of the annual number only in June, whereas for the WNP it continues to be greater than 20% for 3 months (June to August).

Intense tourist traffic in national parks can cause many problems, in particular relating to the conflicts between the protection and tourism needs. Intense tourism results in exceeding the allowed traffic for the trails and the consequent adverse changes in the nature, as it is the case i.e. in the Tatra National Park. However, as shown by this analysis, the development of tourism-related features of the BNP seems substantiated and can be one of the development opportunities for the region. This situation is more favourable considering the more even distribution of tourist activity in this park, which allows to better secure the income of the local communities serving tourist needs and does not result in excessive short-term traffic in the Park.

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19 The next groups in terms of size are French and Dutch tourists with the joint percentage of 7% in 2012. It should also be noted that in recent years the share of Belarusians visiting Poland has been increasing as a result of, among others, waiving visa fees for Belarusians in 2011 (4% increase in Belarusian tourism in Poland Polish in 2012 compared to 2010) [GUS, http://www.stat.gov.pl, 06/01/2014].
CONCLUSIONS

The purpose of Euroregions is to create areas that foster the socio-economic development of the areas divided by national borders. However, the socio-economic and political divisions of a Euroregion should also be considered. The Polish socio-economic conditions that foster the visits of German tourists to the attractive natural areas at the same time hinder tourism of our neighbours from behind the eastern border, for whom it is also the border of the European Union. Moreover, similar natural conditions coupled with substantial disparity in the economic development between Poland and Belarus make it difficult for Polish areas of the Euroregion to be attractive for tourists from Belarus. It seems justified that the Puszcza Białowieska Euroregion should be more focused on creating an offer for the tourists from behind the eastern and southern border on the basis of the socio-economic conditions of the entire Euroregion. It also seems desirable to re-establish the status of BNP as a destination for Polish tourists by improving the transport infrastructure. It is particularly important for this Euroregion considering that, unlike it is the case for the Polish part of the Euroregion Pomerania, attractive natural areas constitute a substantial part of this Euroregion. As of now, their economic use is largely limited. It should be more closely connected with the development of the tourist sector. The development of eco-tourism can be the opportunity and the driving force for the development of this Euroregion, provided that the respective activities are focused on making the region more attractive to German tourists, using the human resources available in the Euroregion.

REFERENCES


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Gabriela Bidzińska\textsuperscript{23}

POTENTIAL SUPPLY OF WOOD BIOMASS FOR ENERGY PURPOSES IN POLAND BY 2015

Abstract: In Poland the market in wood biomass for energy purposes is characterised by large cognitive gap concerning wood biomass supply, despite the growing importance of this subsection of the wood and energy markets. The article presents the results of research on the supply of wood biomass for energy purposes in Poland in 2010 and forecasted supply by 2015. The research process utilised model approach, relating to supply of wood biomass by the main sources of its production.

Keywords: bioenergy, wood biomass, supply of wood biomass, sources of wood biomass.

INTRODUCTION

The development of renewable energy sources and the increase in the level of their use is one of strategic ways of assuring energy safety in the European Union states and also in Poland. In the case of Poland this task is so much more difficult, because hitherto Polish power industry mainly has used hard coal and brown coal, and renewable energy has been treated as an alternative to fossil fuels. In 2010 consumption of energy produced from such natural resources as hard coal, brown coal, crude oil and natural gas amounted to 92\% of total consumption of primary energy [CSO 2011]. At the same time, due to Poland’s international commitments and also rising social awareness as regards the importance of rational and effective use of alternative energy sources, the share of renewable energy within total energy generation has been growing constantly. Due to the location of Poland and hence limited possibilities of using solar and water energy and wind power, biomass is of special importance. For instance, gross electric energy produced from biomass in 2010 in Poland amounted to 6028 GWh, which was approximately 57\% of gross electric energy produced from renewable energy sources, while as much as 95\% of this amount (i.e. 5700 GWh) was the energy produced from solid biomass. On the other hand, the share of gross electric energy produced from solid biomass within total energy production from renewable sources was almost 54\% [Krajowy plan … 2010]. Fragmentary reports [Gajewski 2010; Flakowicz 2011], suggest that in Poland solid biomass is dominated by wood biomass. However the amount of its supply has not been determined yet. The large cognitive gap concerning many aspects of wood biomass supply for energy purposes stems from, among others, a relatively short presence in economic practice of the issue of public use (i.e. in so-called public power plants – power plants, heat-generating plants, and combined heat and power plants) of the energy from wood biomass.

In Poland wood biomass is created in several fields of economy and these are: forestry, industries of the wood sector (according to the Classification of Economic Activities in the European Community Revision 2 [European Communities 2008]: Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials – Section C Division 16, Manufacture of furniture – C31, Manufacture of paper and paper products – C17), municipal utility management, and agriculture.

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\textsuperscript{23} Gabriela Bidzińska, M.Sc., Wood Technology Institute, Winiarska 1, 60-654 Poznań, Poland, g_bidzinska@itd.poznan.pl
In forestry fuel wood may be a source of wood raw material used for energy purposes. The fuel wood base may be supplemented with post-felling residues. For a few years it has been the economic practice in Poland that sometimes assortments of merchantable bole (e.g. medium-size wood) are used as raw material for the production of wood biomass. However, this practice has been questioned due to the principle of wood raw material management rationality, the idea of cascade wood use, and shortages in supply of this raw material to industry (especially the wood-based panel industry).

Wood biomass from the wood sector and consumed for energy purposes mainly encompasses:
- residues of solid wood which are by-products of wood raw material processing,
- residues of wood materials and wood-based materials which are by-products in the production of final wood products,
- bark,
- rejects and residues from the processes of purification and sorting of wood pulp and bleaching of waste paper,
- residues of waste paper which are created in the process of conversion of waste paper into paper pulp,
- compacted wood products, i.e. briquettes, pellets.

On the other hand, in municipal utility management a source of wood biomass for energy purposes is post-consumer wood waste (i.e. wood products which finished their life cycle or in other words worn out wood products which were used as final products at least in their first use). The post-consumer wood waste includes mainly worn out furniture, windows and doors, flooring materials, indoor equipment elements, wooden garden products, various types of wooden buildings and structures, elements of building structures, building shores, shuttering, building fences, poles, stakes, pickets, sleepers, bridge sleepers, packaging (mostly pallets), and elements of the equipment found in means of transport. In general, post-consumer waste comes from households and infrastructural objects within different fields of economy such as, for example, commerce, stock management, education, culture, tourism etc. It is also created when various building structures and infrastructural objects are built, taken down or refurbished, which may be observed in such fields of economy as construction, mining, telecommunications, power industry, and agriculture [Ratajczak et al. 2003a].

Agriculture, which is other potential source of wood biomass, is a field of economy where there are significant possibilities of increasing or supplementing the potential of wood biomass utilized for energy purposes. For a few years within farming in Poland there have been undertaken actions consisting in launching plantations of fast-growing trees, which are conventionally called energy crops or energy plantations. In agriculture, orchards are also considered resources of wood biomass used for energy purposes.

It should be stressed that in all the above-mentioned economic fields it is possible to obtain wood biomass:
- of various types (e.g. assortments of roundwood, by-products from forest, by-products from processing of wood and materials and from the production of wood products, post-consumer wood waste),
- of various forms and sizes:
  - unprocessed – in the form of fragments (e.g. billets, split logs, edgings, slabs) and in the form of small pieces (e.g. particles, sawdust, bark),
  - processed (e.g. chips),
  - compacted (e.g. pellets, briquettes),
of different chemical composition, contamination content (mineral, chemical, metal etc.), moisture content, and calorific value.

This causes specific logistic, technical and technological, as well as economic problems in the stage of harvesting and use.

METHODS

Determination of wood biomass supply which may be used for energy purposes is very difficult. In subject literature there is large cognitive gap in this respect. Only fragmentary, inaccurate and often discrepant data on the actual volume of biomass supply is available. In Poland this state of affairs is a result of:

- firstly, large diversity and dispersion of potential producers of wood biomass,
- secondly, a relatively short existence of the wood biomass market and its immaturity, especially as regards the use of wood biomass for energy purposes by public power plants,
- thirdly, a relatively short existence of the wood biomass issue as a subject of research and lack of systematic approaches to this relatively new issue.

The aim of the research was to determine, in a systemic way, the volume of wood biomass supply for energy purposes by its sources in Poland and to draw up a forecast by 2015. Spatially the research concerned Poland. The time span in the case of diagnosis was the year 2010, and in the case of forecast the year 2015.

The subject of the research was wood biomass created in the following processes:

- harvesting of wood raw material in forests and plantations of fast-growing trees (assortments of roundwood, post-felling residues, chips etc.),
- processing of wood raw material into wood materials (wood by-products created in the primary conversion of wood into sawnwood, wood-based materials and wood pulp),
- production of final wood products (wood by-products created in the secondary processing of sawnwood and wood-based materials into flooring materials, packaging, builder’s carpentry and joinery products, furniture and matches, and the secondary processing of wood pulp into paper, paperboard and paper products),
- collection and processing of wood products which finished their life cycle (post-consumer wood).

The subjects of the research were main creators of wood biomass supply, i.e. forestry, the wood sector (including the following industries: sawmilling, wood-based panel, wooden windows and doors, furniture, and wood pulp), municipal utility management, and agriculture.

METHODOLOGY OF A DIAGNOSIS OF WOOD BIOMASS SUPPLY FOR ENERGY PURPOSES

Determination of the actual supply of wood biomass, which may serve as an energy carrier, would have been possible only as a result of broad direct research; however such research would have been very expensive and time-consuming. In these circumstances, rationality principle was the reason for applying model approach in the research. In consequence, the volumes of supply presented in this study are described as “potential” or “computational”.

Since there are many diverse, potential sources of wood biomass, there was need to determine its supply from each source. Generally, the manner of proceeding consisted in determination of total supply of biomass created in particular source and pointing out a supply percentage that may be used for energy purposes. The starting point for calculations was analysis of former trends in the
development of the Polish economy and its main fields which created wood biomass supply in the period 2005-2010.

The supply for energy purposes of wood biomass originating from forestry was determined based on a harvesting volume of wood raw material assortments of worse quality and dimensional parameters (fuel wood) and a percentage of such assortments intended for energy purposes. In this case this percentage was assumed to be 70%. The amount of post-felling residues was assumed based on the secondary information sources [Stocki 2011].

In order to quantify the supply of wood biomass (from the wood sector) for energy purposes, first of all total supply of wood biomass produced in the wood sector was estimated and then part of the wood biomass volume intended for energy purposes was determined. The determination of total supply of wood biomass in the wood sector was based on: a thorough analysis of the Polish wood sector in terms of production volume and assortment, technical and technological aspects of production (especially raw material and material productivity), the type and structure of wood material consumption in final wood products, and the type of wood by-products. The determination of wood biomass supply for energy purposes took into account the priority of wood biomass consumption for material purposes, which priority is present in the wood sector industries, as well as the results of former research conducted by the authors [Ratajczak et al. 2003b; Szostak, Ratajczak 2003; Szostak, Ratajczak 2004; Szostak et al. 2008]. In particular economic fields the determined percentage of wood biomass supply for energy purposes in total computational supply of wood biomass was different and ranged from 37% to 100%.

To estimate the supply of wood biomass originating from municipal utility management a method developed in the Wood Technology Institute in Poznan was used [Ratajczak et al. 2003a]. This method is based on the concept of wood product life cycle and the developed system of rotation indices and average time of product use. It required thorough recognition and systematization of the properties and material composition of the analysed product groups as well as the places of their use. The important elements were the projection of technical and technological changes in the production of particular wood products, taking into consideration innovation and technology transfer, and also recognition of the phenomenon of wood substitution with wood materials. A crucial element of the diagnosis of supply of wood biomass in the form of post-consumer wood was the assessment of this wood suitability for energy purposes. To this end, post-consumer wood was grouped according to the following criteria: toxicity and inconvenience to the environment, content of non-wood minerals, and the form of wood. Eventually, it was estimated that 60% of total supply of post-consumer wood might be used for energy purposes [Szostak, Ratajczak 2004]. Ostatecznie oszacowano, że z całkowitej podaży drewna poużytkowego na cele energetyczne mogłoby być wykorzystywane 60%.

On the other hand, the amount of agricultural wood biomass used for energy purposes was estimated based on the area of fast-growing tree plantations in Poland and the index of wood dry mass yield from 1 hectare of such plantations. The estimate was prepared based on information from the secondary sources [Szostak et al. 2008].

The research process in the form of desk research was supplemented by a survey carried out amongst selected representatives of the economy sectors in which wood biomass is created, i.e. the wood sector, municipal utility management, and agriculture. The aim of the survey was to widen knowledge of the sources of wood biomass produced in Poland and of such aspects of economic practice of the use of wood biomass for energy purposes as, for instance, the manner of using the energy from wood biomass, the assessment of fulfilment of the demand for energy, the lines of wood biomass management (own energy purposes, sale to individual or collective customers). The obtained results were also an auxiliary tool for the diagnosis of the wood biomass sale system (number of customers, types of contracts, and average delivery distances) and the types of
customers purchasing wood biomass. The survey was carried out from April to September 2011. The questionnaire was sent to 288 respondents and eventually 64 business entities were analysed. The respondents were dominated by entities within the wood sector (84%), the entities of municipal utility management, i.e. companies trading in and processing wood biomass, accounted for 10% of the surveyed sample, and the representatives of agriculture, i.e. growers of fast-growing trees, for 6%.

METHODOLOGY OF A FORECAST OF WOOD BIOMASS SUPPLY FOR ENERGY PURPOSES

To prepare a forecast of wood biomass supply for energy purposes in Poland by 2015, a manner of proceeding similar to this assumed for the diagnosis was adopted. It required determination of total forecasted supply of biomass from its sources, and then pointing out the biomass percentage which may be intended for energy purposes. In the case of forestry it was assumed that 70% of forecasted harvest of fuel wood will be consumed for energy purposes. In the case of the wood sector, depending on industry, the percentage of wood biomass supply for energy purposes was determined to range from 37 to 100%, whilst an average for the whole sector was 50%. It was estimated that 64% of total supply of wood biomass in the form of post-consumer wood originating from municipal utility management is intended for energy purposes. In the case of agriculture, i.e. biomass from plantations of fast-growing trees, it was assumed that the whole supply of wood biomass will be used for energy purposes.

The starting point for the forecast was an analysis of trends in the development of the Polish economy and its fields, i.e. creators of wood biomass supply by 2015, whilst the year 2010 was the base year.

Taking into consideration the forecasted different pace of the development of the Polish economy and its individual fields, the forecast of wood biomass supply was developed in two versions:

- probable (moderately optimistic) resulting from a slower pace of changes in the Polish economy (3% yearly),
- optimistic resulting from a faster pace of the development of the Polish economy (4% yearly).

RESULTS

A DIAGNOSIS OF WOOD BIOMASS SUPPLY FOR ENERGY PURPOSES

In Poland biomass is of special importance amongst renewable energy carriers (table 1).

Table 1. Renewable energy production by generation sources in the period 2005-2010 in Poland

<table>
<thead>
<tr>
<th>Years</th>
<th>total</th>
<th>from biomass</th>
<th>geothermal</th>
<th>wind</th>
<th>water</th>
<th>The share of renewable energy production within total energy production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>thou. toe</td>
<td>%</td>
<td>thou. toe</td>
<td>%</td>
<td>thou. toe</td>
<td>%</td>
</tr>
<tr>
<td>2005</td>
<td>4432</td>
<td>5.43</td>
<td>4166</td>
<td>11</td>
<td>12</td>
<td>189</td>
</tr>
<tr>
<td>2006</td>
<td>4863</td>
<td>6.26</td>
<td>4588</td>
<td>13</td>
<td>22</td>
<td>176</td>
</tr>
<tr>
<td>2007</td>
<td>5034</td>
<td>7.23</td>
<td>4710</td>
<td>10</td>
<td>45</td>
<td>202</td>
</tr>
<tr>
<td>2008</td>
<td>5156</td>
<td>7.23</td>
<td>4799</td>
<td>13</td>
<td>72</td>
<td>185</td>
</tr>
<tr>
<td>2009</td>
<td>5735</td>
<td>8.52</td>
<td>5305</td>
<td>14</td>
<td>93</td>
<td>204</td>
</tr>
<tr>
<td>2010</td>
<td>6870</td>
<td>10.22</td>
<td>5865</td>
<td>13</td>
<td>143</td>
<td>251</td>
</tr>
</tbody>
</table>

Source: The authors’ study based on [CSO 2009; CSO 2010; CSO 2011].
In the period 2005-2010 total production of energy from biomass amounted to 85-94% of total energy production from renewable sources and demonstrated a continuous upward trend (from 4.2 M ton of toe to 5.9 M toe, i.e. by 41%).

The conducted research suggests that in 2010 in Poland potential supply of wood biomass for energy purposes amounted to approximately 15.2 M m$^3$ (table 2). Forestry was the greatest source of wood biomass for energy purposes. It is estimated that in the analysed year 6.1 M m$^3$ of wood biomass could have come from this sector (i.e. 40% of total potential supply).

Table 2. Estimated supply of wood biomass for energy purposes in Poland in 2010

<table>
<thead>
<tr>
<th>Detailed list</th>
<th>Wood biomass supply</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>thou. m$^3$</td>
</tr>
<tr>
<td>Forestry</td>
<td>6100</td>
</tr>
<tr>
<td>Wood sector, of which wood biomass from:</td>
<td></td>
</tr>
<tr>
<td>– sawmilling industry</td>
<td>5250</td>
</tr>
<tr>
<td>– wood-based panel industry$^1$</td>
<td>2320</td>
</tr>
<tr>
<td>– wooden windows and doors production</td>
<td>800</td>
</tr>
<tr>
<td>– furniture industry</td>
<td>1400</td>
</tr>
<tr>
<td>– wood pulp industry</td>
<td>550</td>
</tr>
<tr>
<td>Municipal utility management, of which wood biomass from post-consumer wood products from the following fields of economy:</td>
<td>3625</td>
</tr>
<tr>
<td>– construction$^2$</td>
<td>1880</td>
</tr>
<tr>
<td>– power industry and telecommunications</td>
<td>20</td>
</tr>
<tr>
<td>– transport</td>
<td>80</td>
</tr>
<tr>
<td>– commerce and stock management</td>
<td>465</td>
</tr>
<tr>
<td>– households, residential and non-residential buildings and their surroundings$^3$</td>
<td>930</td>
</tr>
<tr>
<td>– other</td>
<td>250</td>
</tr>
<tr>
<td>Agriculture</td>
<td>200</td>
</tr>
<tr>
<td>TOTAL</td>
<td>15175</td>
</tr>
</tbody>
</table>

$^1$ Including the production of veneers and face veneers.

$^2$ Post-consumer elements of building structures, auxiliary elements for construction works, indoor equipment elements, buildings and structures, wooden windows and doors, flooring materials.

$^3$ Post-consumer furniture and elements of wooden garden products.

Source: Based on [Ratajczak et al. 2011b].

The wood sector is also a supplier of considerable amounts of wood biomass. On the basis of calculations it may be said that this sector might have delivered approximately 5.3 M m$^3$ of this energy carrier, which was almost 35% of total supply of wood biomass in Poland in 2010. The industries that might have delivered the greatest amounts of wood biomass were the sawmilling industry (2.3 M m$^3$, i.e. 44% of total supply of the wood sector) and the furniture industry (1.4 M m$^3$, i.e. 27%). Forestry and the wood sector together were potential suppliers of 75% of total “computational” supply of wood biomass in 2010.

Municipal utility management is also important in the market in wood biomass. In the analysed year almost 24% (i.e. more than 3.6 M m$^3$) of total supply of this energy carrier might have come from this field of economy. The greatest amount of wood biomass from worn out wood products (approximately 1.9 M m$^3$, i.e. around 52% of total supply of wood biomass from municipal utility management) might have been delivered by the construction industry, followed by households, residential and non-residential buildings and their surroundings (930 thou. m$^3$, i.e. 25%). These worn out wood products consisted mainly of used furniture (715 thou. m$^3$, i.e. approx. 20% of total
supply from municipal utility management), elements of exploited buildings and structures (580 thou. m³, i.e. 16%) and used packaging, mainly pallets (465 thou. m³, i.e. approx. 13%).

The conducted research also indicates that hitherto the importance of agriculture (including the owners of fast-growing trees plantations) as a supplier of wood biomass for energy purposes was little in Poland. In 2010 it was possible to obtain 200 thou. m³ of wood biomass from agriculture, which was 1% of potential total amount.

The survey, which supplemented the research, confirmed the role of forestry and the wood sector as main sources of wood biomass supply. The responses of the surveyed users of this energy carrier suggest that these fields of economy together were potential suppliers of approximately 70% of wood biomass for energy purposes. Moreover, the research revealed that wood biomass for energy purposes originating from forestry and agriculture was in the form of chips, branches, and assortments of roundwood, whilst biomass from the wood sector was in the form of wood pieces, particles, dust, bark and also wood pellets and briquettes.

A FORECAST OF WOOD BIOMASS SUPPLY FOR ENERGY PURPOSES IN POLAND BY 2015

The calculations based on the methodical assumptions indicate that in 2015 in Poland supply of biomass for energy purposes may reach from 17.2 M m³ (version I) to 17.9 M m³ (version II) – table 3. In relation to the estimated supply of this energy carrier in 2010 this means a 14-19% increase.

Table 3. A forecast of supply of wood biomass for energy purposes in Poland in 2015

<table>
<thead>
<tr>
<th>Detailed list</th>
<th>Wood biomass supply forecast variants</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>Forestry</td>
<td></td>
<td>6400</td>
<td>6400</td>
</tr>
<tr>
<td>Wood sector, of which wood biomass from:</td>
<td></td>
<td>6105</td>
<td>6595</td>
</tr>
<tr>
<td>– sawmilling industry</td>
<td></td>
<td>2630</td>
<td>2845</td>
</tr>
<tr>
<td>– wood-based panel industry 1</td>
<td></td>
<td>965</td>
<td>1125</td>
</tr>
<tr>
<td>– wooden windows and doors production</td>
<td></td>
<td>225</td>
<td>235</td>
</tr>
<tr>
<td>– furniture industry</td>
<td></td>
<td>1720</td>
<td>1815</td>
</tr>
<tr>
<td>– wood pulp industry</td>
<td></td>
<td>565</td>
<td>575</td>
</tr>
<tr>
<td>Municipal utility management, of which wood biomass from post-consumer wood products from the following fields of economy:</td>
<td></td>
<td>4515</td>
<td>4720</td>
</tr>
<tr>
<td>– construction 2</td>
<td></td>
<td>1935</td>
<td>2025</td>
</tr>
<tr>
<td>– power industry and telecommunications</td>
<td></td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>– transport</td>
<td></td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>– commerce and stock management</td>
<td></td>
<td>940</td>
<td>985</td>
</tr>
<tr>
<td>– households, residential and non-residential buildings and their surroundings 3</td>
<td></td>
<td>1290</td>
<td>1350</td>
</tr>
<tr>
<td>– other</td>
<td></td>
<td>260</td>
<td>270</td>
</tr>
<tr>
<td>Agriculture</td>
<td></td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>17220</td>
<td>17915</td>
</tr>
</tbody>
</table>

1 Including the production of veneers and face veneers.
2 Post-consumer elements of building structures, auxiliary elements for construction works, indoor equipment elements, buildings and structures, wooden windows and doors, flooring materials.
3 Post-consumer furniture and elements of wooden garden products.

Source: Based on [Ratafczak et al. 2011b].
In the near future forestry and the wood sector will remain the main sources of wood biomass in Poland. It is forecasted that in 2015 these fields of economy together may deliver 12.5-13.0 M m$^3$ of wood biomass, which will constitute 73% of total potential supply. The supply from forestry may reach 6.4 M m$^3$, and from the wood sector may range from 6.1 to 6.6 M m$^3$ (depending of the forecast version), meaning that wood biomass supply from each of these fields of economy will be 35-37% of total supply of this energy carrier. In relation to situation in 2010, supply in 2015 will probably increase by approximately 5% in the case of forestry and by 17-26% in the case of the wood sector. Within the wood sector the biggest supplier of wood biomass for energy purposes with a delivered amount of 2.6-2.8 M m$^3$ (i.e. 43% total supply of the sector) will be the sawmilling industry, followed by the furniture industry which may supply 1.7-1.8 M m$^3$ (i.e. 28%) of this energy carrier. However, it should be added that most of wood biomass produced in the wood sector will be intended for own energy needs within the sector.

According to the forecasts, by 2015 it will be possible to obtain from municipal utility management 4.5-4.7 M m$^3$ of post-consumer wood, which may be used for energy generation. In relation to 2010 it will mean a 25-30% increase. It should be noted that within this field of economy in these five years changes in the growth of wood biomass supply may and should be the greatest. The construction industry will probably supply the greatest amount of worn out wood products (1.9-2.0 M m$^3$ of wood biomass). Within this amount 42% (815-855 thou. m$^3$) will be wood biomass from worn out elements of indoor equipment (windows, doors, flooring materials, wainscot, skirting etc.). Households, residential and non-residential buildings and their surroundings will be other important sources of wood biomass for energy purposes (1.3-1.4 M m$^3$), whilst they will primarily deliver furniture (955-995 thou. m$^3$, i.e. 74% of total supply of this wood biomass source).

In the case of wood biomass supply from agriculture, it is forecasted that in 2015 it will not change in relation to 2010 and will amount to 200 thou. m$^3$. In total supply of wood biomass forecasted for 2015 this energy carrier will account for only 1%. Statistical data suggests that since 2006 cultivation of fast-growing trees practically has not developed in Poland; however, looking at recent actions in this area taken by industry and the public power industry, a positive change of this situation may be expected [Krzykowski 2011; Rubczyński 2009]. An example here may be International Paper Company in Kwidzyn, a producer of paper and packaging, which has been executing a project consisting in starting a plantation of fast-growing trees for its own energy needs.

CONCLUSIONS
The priority of the energy policy in Poland is to assure energy safety of the country and high competitiveness of economy thorough increase in its energy efficiency and intensification of the environment protection processes. One of the strategies, which should assure attainment of these goals, is the development of renewable energy sources and their increased use. In Poland biomass, and mainly wood biomass, is the most important energy carrier amongst renewable energy carriers. However, former Polish economic policy states a priority of material use of wood, meaning that the use of wood biomass for energy purposes should not cause deficits of wood raw material for industrial purposes.

In Poland the great importance of wood biomass amongst energy carriers stems from the fact that it is relatively easily available. However, it is assumed that for energy purposes one should consume mainly low quality wood of poor dimensional parameters, by-products of the processing of wood and wood materials and wood-based materials, post-consumer wood, and wood from energy plantations. The other trump of wood biomass is the fact that it may be directly co-combusted with coal in power plants which dominate in Poland. The share of wood biomass within so-called
dispersed power industry, mainly heat generation (local heat-generating plants, individual households), is also important and growing.

The conducted researched suggests that in Poland potential of wood biomass for energy purposes is significant. In 2010 wood biomass supply was estimated to have been approximately 15 M m$^3$, whilst in the next years it may grow to reach 17-18 M m$^3$ in 2015. Forestry and the wood sector have been and will be the primary source of wood biomass in the future, supplying approximately 73% of total wood biomass supply. They are followed by municipal utility management (post-consumer wood – 26%) and agriculture (wood biomass from plantations of fast-growing trees – 1%).

REFERENCES:
Appendix: The article includes part of the results of research commissioned and financed by the state forests directorate general in Warsaw [Ratajczak et al. 2011a] and part of the results of research financed by the ministry of science and higher education [Ratajczak et al. 2011b] conducted in 2011 in the wood technology institute in Poznań.
Łukasz Sarniak

THE DEVELOPMENT OF INVESTMENT SERVICES AND ACTIVITIES IN POLAND IN THE YEARS 2005 – 2012

Abstract: The article presents an analysis of the development of investment services and activities in Poland in the period 2005 – 2012. An attempt has been made to identify the factors that have an influence on the shape and character of particular investment services. The analysis made it possible to try and find an answer to the question concerning the direction of evolution of the model of running investment services and activities in Poland – either towards the Continental Model or the Anglo-Saxon Model, and what are its implications for the Polish financial market.

Keywords: investment services and activities, brokerage activity, bank-based financial system, market-based financial system.

INTRODUCTION

Two fundamental models of financial intermediation have been developed in the world. The first one is the so-called Continental Model. The bank system plays a crucial role in this model. The Continental Model functions mainly in Western Europe (excluding Great Britain) and Japan. Its characteristic feature is the fact that bank credits are the main source of capital for economic entities. On the other hand, intermediation in capital markets is less developed and plays only a supplementary role. In this model, investment services are provided most of all by universal banks, which offer deposit and credit services as well as investment activities.

The Anglo-Saxon Model is the second model of financial intermediation. In the case of this model, financial resources are not acquired by enterprises through long-term bank credits, but by issuing securities. As a result, the capital market is given much more significance. In this model, investment services and activities are conducted most of all by large investment banks, which do not offer deposit and credit services.

In the literary references, one may find examples of a confrontation of views supporting or criticising the aforementioned models [Boot and Thakor 1997; Levine 2002]. The discussion refers mainly to the issue of determining the role of banks and stock exchanges in the financing of enterprises. The term "development of investment services and activities" is usually defined as an increase in the number of entities and the scope of services provided by them. The development of investment services and activities is affected by many economic, institutional and legal-tax factors. The most important factors in the years 2005 – 2012 included the introduction of the Markets in Financial Instruments Directive (MIFID) and changes in the stock market situation.

THE ROLE OF MIFID

The development of capital markets and integration processes in the European Union led to the formation of new legal regulations, which describe the rules of providing investment services in individual Member States. The new regulations include:

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25 The Polish economic literature uses the term “usługi maklerskie” more broadly than the English term “brokerage services”; in this article another term “investment services and activities” is used. This concept is characteristic of the Polish financial market. It closely corresponds to the definition included in the MIFID Directive, referred to later on in the article.

26 In the literature another term is used interchangeably: bank-based financial system.

27 In the literature another term is used interchangeably: market-based financial system.

28 In the codification of the Polish economic literature this term means: “rozwój usług maklerskich”.

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The aforementioned documents are jointly referred to as MIFID (Markets in Financial Instruments Directive).

MIFID introduced many changes connected with the provision of investment services and activities; the appearance of new types of services was the most important one. The first such service was investment advice. Investment advice means the provision of personal recommendations to a client, either upon its request or at the initiative of the investment firm, in respect of one or more transactions relating to financial instruments [Directive 2004/39/EC of the European Parliament and of the Council of 21 April 2004, Article 1]. Investment advice refers to the preparation of a written or oral recommendation based on the needs and situation of a given client. Hence, this activity has an individualised character and a specific addressee [Wierzbowski, Sobolewski and Wajda 2012, page 1083]. The second service introduced was organisation by investment firms of Multilateral Trading Facilities. This type of activity is popular in the United States and Western Europe. In Poland it abolished the rules of the so-called regulated market obligation [Chłopecki and Dyl 2011, pp. 17–18].

Table 1. Types of activities of investment firms

<table>
<thead>
<tr>
<th>Investment services and activities</th>
<th>Ancillary activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(Main services)</strong></td>
<td><strong>(Additional services)</strong></td>
</tr>
<tr>
<td>o Reception and transmission of orders in relation to one or more financial instruments.</td>
<td>o Safekeeping and administration of financial instruments for the account of clients, including custodianship and related services such as cash/collateral management.</td>
</tr>
<tr>
<td>o Execution of orders on behalf of clients.</td>
<td>o Granting credits or loans to an investor to allow him to carry out a transaction in one or more financial instruments, where the firm granting the credit or loan is involved in the transaction.</td>
</tr>
<tr>
<td>o Dealing on own account.</td>
<td>o Advice to undertakings on capital structure, industrial strategy and related matters and advice and services relating to mergers and the purchase of undertakings.</td>
</tr>
<tr>
<td>o Portfolio management.</td>
<td>o Foreign exchange services where these are connected to the provision of investment services.</td>
</tr>
<tr>
<td>o Investment advice.</td>
<td>o Investment research and financial analysis or other forms of general recommendation relating to transactions in financial instruments.</td>
</tr>
<tr>
<td>o Underwriting of financial instruments and/or placing of financial instruments on a firm commitment basis.</td>
<td>o Services related to underwriting.</td>
</tr>
<tr>
<td>o Placing of financial instruments without a firm commitment basis.</td>
<td></td>
</tr>
<tr>
<td>o Operation of Multilateral Trading Facilities.</td>
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</table>

Unfortunately, due to enormous costs and information obligations, no entity decided to introduce alternative trade systems to its offer. However, it seems that the appearance of such activities in Poland is just a matter of time. According to MIFID, investment activity is divided into: investment services and activities and ancillary activities.

Investment services and activities require obtaining a licence issued by a specific supervision authority. Ancillary services may be provided by any entity.

MIFID introduced significant changes in the scope of providing investment services on the territory of European Union's Member States. The rule of single passport was implemented. Based on this rule, after obtaining a licence for running investment services and activities in one's own state, an investment firm could provide the same services on the area of the entire community [Directive 2004/39/EC of the European Parliament and of the Council of 21 April 2004, Article 1]. The change introduced provided foreign investment firms with an easier possibility of providing investment activities in Poland. Figure 1 presents changes in the number of entities operating in the investment market in the period 2005 – 2012.

![Figure 1. Number of Polish brokerage houses and foreign investment firms in 2005 – 2012](image)


A dynamic increase in the number of foreign investment firms may be observed in Poland. The presence of entities providing investment services and activities on a global scale confirms the evolution of investment activity in Poland towards the Anglo-Saxon Model. It is also confirmed by a growing number of remote exchange members, i.e. entities that can directly place orders on the Warsaw Stock Exchange, without any help of a local broker. Changes in the number of exchange member are presented in figure 2.

Moreover, MIFID introduced unified rules of initial public offering on the territory of the European Union. Owing to that, the Warsaw Stock Exchange recorded débuts of new foreign companies. Shares of many companies were offered for trade based on the dual-listing rule. This proves increased importance of the capital market in the financial system. Hence, it is yet another argument confirming the tendency of investment activity's evolution towards the Anglo-Saxon Model.
STOCK EXCHANGE SITUATION

One of the most important factors influencing the development of investment activity is stock exchange situation. After an analysis of the situation in the specified period, it is worth noticing that the Warsaw Stock Exchange was witnessing a boom market until July 2007. During this time, share prices reached highest levels in the audited period. Then, until February 2009, a decline in the market was observed. The reasons for that included destabilisation of the mortgage loans market in the United States. In the next period, i.e. from February 2009, market consolidation took place. Values of the Warsaw Stock Exchange Index (WIG) in the years 2005 – 2012 are presented in figure 3.

Figure 2. Change in members of the Warsaw Stock Exchange in 2005 – 2012.


Figure 3. Change in the Warsaw Stock Index (WIG) in 2005 – 2012.

Source: Self-study based on the information accessible from the website www.gpwinfostrefa.pl (accessed on 10 May 2013).
The stock exchange situation has an essential influence on the scale of services provided by investment firms. During a market boom, interest in the stock exchange increases. Effective investment during the time of prosperity allows achieving significant income in a short time. The number of investment accounts and turnover on the Warsaw Stock Exchange went up in the audited period. Investors were willingly investing their savings, which was conducive to an increase in the number of public and private placements. Obviously, an intensified demand for investment services contributed to a rise in the number of entities operating in this sector. Hence, the importance of the capital market was growing, which gives evidence to the evolution of investment activity towards the Anglo-Saxon Model.

During the times of a decline and market consolidation, investors tend to withdraw from stock exchanges and look for safer (less risky) possibilities of investing their savings. Lower share prices affect decreased turnover, hence the income from brokerage fees is reduced. The situation in the case of the primary market is different. On the one hand, less interest in large public placements of shares was observed in the audited period on the Warsaw Stock Exchange. On the other hand, the Catalyst bond market developed. Hence, it was possible to notice a tendency to changing of the structure of obtaining capital. Companies began to issue bonds more often than shares. During the financial crisis, as was observed in many cases, companies found it much easier to underwrite financial instruments or place financial instruments on a firm commitment basis rather than get a bank credit (forms of credit collateral specific for the Polish bank system were not without significance [see: Chudobiecki, Kielar and Wanat 2009]). Therefore, during the analysed period, it is possible to talk about an increase in the importance of the capital market in Poland during the time of an unfavourable economic situation. This is yet another symptom, which confirms the evolution of investment activity in Poland towards the Anglo-Saxon Model.

A slump in the exchange market also forced investment firms to seek new sources of income. During the period of decline and market consolidation, investment activity dealing on own account was developing most intensely. Investment firms began to earn profits on performing the function of market makers. An average spread between the best purchase and sale order on WIG20 totalled 0.12%, while commission on transactions amounted to 0.06%. In case of valuable orders, investment firms acquired significant income. A well-developed activity on own account, based on short-term speculation transactions, is characteristic for the Anglo-Saxon Model.

During the times of decline and market consolidation, asset management services were also gaining in popularity. Investors, who recorded significant losses on the stock market, were increasingly more interested in entrusting their savings to experts [see: Potkański, Wanat and Chudobiecki 2011]. A growing number of companies offering asset management services confirmed the developing tendency of the capital market and investment activity in Poland towards the Anglo-Saxon Model.

**CONCLUSIONS**

Various macroeconomic, institutional and legal-tax factors have an influence on the development of investment services and activities in Poland. It needs to be noted that the introduction of MIFID and changes in the stock exchange situation played the key role in the audited period, i.e. 2005 – 2012. Owing to these determinants, services connected with investment on own account and offering portfolio management became more significant. These are characteristic activities for the entities operating in accordance with the Anglo-Saxon Model of financial intermediation. The evolution of the Polish market in this direction is confirmed by the structure of brokerage houses and firms in Poland. Fewer and fewer banks provide services in the form of separate organisational units. This is conducive to the formation of large investment banks. Moreover, many foreign companies became interested in the Polish financial market and began
operations in Poland. This is to a large extent an effect of implementing MIFID. An analysis of investment services and activities development according to law and economics would be an interesting extension of the theoretical studies in this scope [Wanat 2013, pp. 146-157 as well as Lis, Wanat and Chudobiecki 2013b, pp. 56-61]. Such an analysis would need to be conducted in the audited period as well as prognosticated in the medium-term perspective.

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Joanna Stanisławska 29, Agnieszka Kozera 30

THE FINANCIAL SITUATION OF POLISH HOUSEHOLDS IN 2010

Abstract: Based on values of indexes describing financial standing the analyzed aggregate units (socio-economic groups of different size) were classified into classes of a similar financial position. The analysis proved that the households of self-employed people with one, two or three people and non-workmen’s households with one or two people had relatively the best situation. The households were characterised by the highest disposable income per head, the lowest percentage of people living below the thresholds of the subsistence wage and social minimum and a high rate of the percentage of cash used to satisfy higher-order needs. The pensioners’ households with three, four, five, six or more people, old age pensioners’ households with five, six or more people, farmers’ households with four, five, six or more people, workmen’s and self-employed people’s households with six or more people were in the worst financial situation. Above all, their poor situation was proved by the lowest disposable income per head and the highest share of food expenses in their budgets.

Keywords: households, financial standing, cluster analysis

INTRODUCTION

The household is defined as a key unit in consumption. It is related with the essential goal of the household’s functioning, i.e. to satisfy its members’ common and individual needs. The degree of satisfaction depends on the financial situation of households, which is defined as the economic phenomena taking place within the households and directly related with the gathering and expending of cash. On the other hand, the management of household finances should be interpreted as the whole of its members’ activities, which consist in obtaining cash and expending it according to the assumed hierarchy of needs. The ultimate goal and simultaneously the criterion of management of the family’s 31 financials is to maximise satisfaction of its members’ needs [Bywalec 2009].

The financial condition of households is above all illustrated by such indexes as the level of income and expenses and the amount of savings [Roeske-Słomka 2004]. It is factually related with studying the living standard in households and it is an important source of information for government organs and institutions so that the state can lead an appropriate social policy. The aim of the article is to assess the diversification of the financial situation of households which were classified according to the socioeconomic group of the population and their size. Ward’s method of cluster analysis was applied for the assessment.

MATERIALS AND METHOD

The research problem under investigation was elaborated on the basis of individual data from the studies of households’ budgets made by the Department of Social Statistics, Central Statistical Office in Poland in 2010. The Central Statistical Office researched households’ budgets, i.e. the monetary and non-monetary volume of income and expenditures of all members of the household under investigation [Metodologia badania budżetów gospodarstw domowych (2011)].

Upon the data from the studies of households’ budgets the following aggregate units were formed: households with one, two, three, four, five, six or more members working as workmen,
non-workmen, self-employed, disability pensioners and old age pensioners. In order to achieve the research goal Ward’s method of cluster analysis was applied to classify the household groups according to their financial situation.

The above mentioned aggregate units were classified in the following stages [Wysocki 2010]:

Stage 1. Factual premises were used to choose the individual measures of the financial situation of households:

\[X_1\] – disposable income - zlotys/head/month (income),
\[X_2\] – expenses - zlotys/head/month (expenses),
\[X_3\] – savings rate - % (savings),
\[X_4\] – income from social welfare benefits - zlotys/head/month (social welfare I),
\[X_5\] – the share of income from social welfare benefits in households’ disposable income - % (social welfare II),
\[X_6\] – the percentage of households with lower income value than the subsistence wage basket (subsistence wage),
\[X_7\] – the percentage of households with lower income value than the social minimum basket (social minimum),
\[X_8\] – the share of expenses on food and soft drinks in total expenses - % (food),
\[X_9\] – the share of expenses on accommodation and energy carriers in total expenses - % (accommodation),
\[X_{10}\] – the share of expenses on health in total expenses - % (health),
\[X_{11}\] – the share of expenses on recreation and culture in total expenses - % (recreation and culture),
\[X_{12}\] – the share of expenses on restaurants and hotels in total expenses - % (hotels and restaurants),
\[X_{13}\] – the share of expenses on education in total expenses - % (education),
\[X_{14}\] – the share of expenses on transport in total expenses - % (transport),
\[X_{15}\] – the share of expenses on communication in total expenses - % (communication).

In order to eliminate excessively correlated variables the invertible matrix of correlation coefficients between the assumed variables was determined. Upon analysis of the diagonal elements of the matrix the following variables were eliminated from further research: \[X_1, X_5, X_7\]. The statistical assessment also included the coefficient of variation. Additionally, variable \[X_{15}\] was rejected due to its low degree of diversification \((v_e < 10\%)\). As a result, 11 variables were accepted for further research, four of which were categorised as the destimulants \((X_4, X_6, X_8, X_9)\) and the others as the stimulants of the financial condition of households.

32 Household groups were formed and analysed.
33 Simple traits were purposefully selected so that they would represent different groups of needs.
34 In order to eliminate the influence of the sociodemographic structure of households on their costs of living the original OECD equivalence scale (also applied by the Central Statistical Office) was applied in the analyses. According to the scale, weight 1 is assigned to the first adult aged 14 years or more, 0.7 – to each next adult, 0.5 – to each child aged under 14 years [Metodologia badania budżetów gospodarstw domowych (2011)]. For editorial purposes this article uses the term ‘equivalent unit’, which is identical with the term ‘person’ in the household.
35 Income from social welfare benefits comprises financial benefits from the budget or communes from special funds as well as products and services received from non-profit institutions (Households’ Budgets in 2010 2011).
36 The subsistence wage is the poverty threshold, which determines the minimum expenses necessary to survive and satisfy one’s needs at the lowest acceptable level [Kurowski 2001].
37 The social minimum, i.e. a particular limit of expenses, indicates the family’s average cost of living, which is sufficient to satisfy one’s needs at a specifically defined minimum guaranteeing a decent living standard. Thus, the social minimum category comprises not only elementary needs but also higher-order needs, which are satisfied at a low level, but the level enables the maintenance of social bonds, e.g. studying, participation in culture and recreation [Kurowski 2001].
Stage 2. The values of diagnostic variables were normalised, i.e. the destimulants were transformed into stimulants and the values of the variables were brought to comparability by application of the unitarisation procedure in accordance with the following formulas:

for the stimulants: \[ z_{ik} = \frac{x_{ik} - \min_{i} x_{ik}}{\max_{i} x_{ik} - \min_{i} x_{ik}}, \quad (i = 1, 2, \ldots, n; \quad k = 1, 2, \ldots, m) \]

for the destimulant: \[ z_{ik} = \frac{x_{ik} - \max_{i} x_{ik}}{\max_{i} x_{ik} - \min_{i} x_{ik}}, \quad (i = 1, 2, \ldots, n; \quad k = 1, 2, \ldots, m), \]

where:
- \( \max_{i} x_{ik} \) – the maximum value of the \( k \)th trait,
- \( \min_{i} x_{ik} \) – the minimum value of the \( k \)th trait.

Stage 3. Ward’s method of cluster analysis was applied to connect the nearest units until one cluster was formed. Variance analysis was applied to estimate the distance between the units and to minimise the sum of squared deviations within the clusters [Stanisz 2007]38. According to the method, of all the pairs of clusters that can possibly be combined at each stage the pair of clusters which will result in clusters with minimum diversification is selected [Everitt et al. 2011]. The proper number of classes of groups of households with a similar financial situation was determined upon analysis of the volume of intra-class variance growth in the process of combination of classes between individual combination levels (the course of agglomeration diagram). Relatively large variations in the growth values are understood as differences between consecutive agglomeration distances and they suggest the best number of classes [Wysocki 2010].

**RESEARCH RESULTS**

The normalised data concerning aggregate units were classified by means of Ward’s method. Ward’s method of hierarchical cluster analysis consists in combining the nearest units to each other until one cluster is formed. In order to determine the optimal number of clusters factual premises and conclusions drawn from the analysis of the course of agglomeration diagram were taken into consideration. As a result, the division of the population under investigation into seven clusters was assumed (Fig. 1).

**The first class** was made up of the households with three, four, five, six and more people employed as non-workmen and the households with four and five self-employed people (Fig. 1). The disposable income in this class was 1643.0 zlotys per month per head in the household. The relatively good financial situation of the households in the group caused that barely 2.2% of their average monthly income came from social welfare benefits. The main source of income of those units, their population and outstanding amount of disposable income implicated the highest share of expenses on education (1.9%) among all the classes. Simultaneously, there was a very high share of expenses on transport (9.8%) and recreation and culture (9.8%) in the class. This may result from the higher level of education of the non-workmen’s and self-employed people’s household members in comparison with the other socioeconomic groups of people. It determines a different hierarchy of needs and financial potential in the households.

A high level of satisfying higher-order needs was also found in the aggregate units of the second class, which was made up of self-employed people’s households with one, two or three people and non-workmen’s households with one or two people. The disposable income of 2842.0 zlotys per month per head was the highest in this class and it was more than three times higher than in the households of the fifth cluster (Table 1).

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38 Statistica 10.0 software was used for calculations.
a) Symbols of household groups: Pracr – workmen’s household, Pracnr – non-workmen’s household, Rol – farmers’ household, Pracwr – self-employed people’s household, R – disability pensioners’ household, E – old age pensioners’ household. The numbers 1, 2, 3, 4, 5, 6 refer to the number of people in the household, i.e. 1, 2, 3, 4, 5, 6 or more people, respectively. Due to the fact that the Central Statistical Office does not publish information about the households which support themselves from non-profit sources, this group was omitted in the research.

Figure 1. The classification of households according to selected indexes illustrating their financial situation

Source: The author’s calculations based on unpublished individual data from Budżety gospodarstw domowych made by the Central Statistical Office in 2010.

As Witek (2008) observed, self-employed people’s households achieve a higher living standard, which is the result of accumulated individual activities and enterprising initiatives of the members of this group of households\textsuperscript{39}. The effect was the lowest amount of cash received from social welfare benefits (14.2 zlotys per month per head) and its lowest share in the family budget (0.5%). The good financial situation of the households in question resulted in the degree of satisfying their needs, which was quantified with the amount of the social minimum basket. In order to satisfy the needs of the members of their households most families (nearly 90%) spent more money than the value of the social minimum basket, which is the limit of a decent living standard. A high share of cash spent on recreation and culture (10.2%) and restaurants and hotels (3.9%) was an important position in the structure of their expenses. The households also had the highest share of expenses on transport in the total expenses, i.e. 13.3%.

On the other hand, old age pensioners’ and disability pensioners’ households consisting of one or two people formed the third class. They had the minimum percentage of cash to finance their transport needs. This fact chiefly results from the hierarchy of those families’ needs. Those

\textsuperscript{39} As results from the research by Witek (2008), although some of the households of self-employed people found themselves on low levels of the wealth hierarchy but nevertheless, they did not come together with the group of the unemployed, receiving social welfare benefits.
households also had the highest percentage of expenditures on health, which can be explained by those people’s increasing needs related to health care caused by their age and the illnesses they suffer from. The level of the index in question was nearly twice as high as in the other classes (10.3%) due to their relatively high disposable income, i.e. 1427.6 zlotys per month per head, which made 92.5% of the average monthly income of all households. It is also easy to understand that the abovementioned households expended the least cash on education, because the share of these expenses in their disposable income was almost equal to zero.

The poorest financial condition could be observed in the households which made the fourth cluster. The cluster included disability pensioners’ households with three, four, five, six or more people. The disposable income was the lowest in this class, i.e. 783.2 zlotys per month per head. It was more than twice as low as the income in the households of clusters I and V and it was more than three and a half times as low as the income in the households of cluster II, where the maximum level of the index was noted. Due to the poor financial condition of the households in question, which did not enable them to satisfy their needs so that they could achieve a decent living standard, the households received social welfare benefits, which made 13.1% of their income in 2010. This situation was caused by the fact that multi-person households are usually families with a large number of children, where most people are not employed. Children aged under 17 years are a particular group endangered by the need to receive social welfare benefits. In 2010 they made 37% of the total number of beneficiaries [Pomoc społeczna – infrastruktura, beneficjenci, świadczenia w 2010 roku (2012)]. A very high share of cash spent on food products in this group of households resulted in the low level of their disposable income, which was only a half of the cash that the households in classes V and VI had at their disposal and as little as a third of the cash which aggregate units in class VIII had. In the year under investigation those households had the poorest financial condition, which was reflected by the degree of satisfying their needs, which were quantified with the categories of the subsistence wage and social minimum. The large families of disability pensioners had the highest percentage of households living below the subsistence wage basket, i.e. living in extreme poverty (28.9%). Nearly 88% of the households in question were able to satisfy their needs below the social minimum basket, i.e. below the limit of a decent living standard.

The fifth class was made up of farmers’ households with one, two or three people. The households had a high share of expenses on food in their budget, which amounted to 32.2%. It was related with the self-supply in the farmers’ families. The share of self-supply in the total food consumption was the highest of all the socioeconomic groups and it reached 28.45% in 2010 [Stanisławska, Kozera 2012]. Natural consumption is one of the causes of the high share of food expenses in the total expenses, which points to the fact that the financial situation of those units is usually poorer. The relatively low share of expenses on accommodation in the budget of class V families chiefly resulted from the fact that most farmers’ households own a house or flat and are not charged with fees paid to their owners. The households spent the least cash on recreation and culture and on restaurants and hotels, which made 3.8% and 0.5% of their budget, respectively. This situation may have resulted from the fact that some of the families living in rural areas had difficult access to recreational and cultural services. On the other hand, it may also have resulted from their hierarchy of needs and accepted customs. The low share of expenses on restaurants and hotels in this group of households, which chiefly inhabit rural areas, may have resulted from the fact that the number of restaurants and hotels in rural areas is still low. It is necessary to note the high rate of savings in this group of households, which amounted to 30%. It resulted from the specific character of farmers’ households, i.e. the combination of a household with a farm. The reason why this group of households gathered their financial surplus can be explained by their uncertainty of future income, which chiefly depends on the income from sales, which fluctuates, depending on the
economic conditions in a particular year. This results in the need to accumulate capital to cover the expenses both for consumption and investments related to the functioning of farmers’ household [Wasilewski, Mądra 2009; Strzelecka 2012].

The next, sixth group was made up of farmers’ households with four, five, six or more people, old age pensioners’ households with five, six or more people, workmen’s and self-employed people’s households with six or more people. The income of these aggregate units was lower than average, i.e. 1188.3 zlotys per month per head. The poor financial condition of those households made them unable to satisfy their needs at a decent living standard and caused them to receive social welfare benefits of 57.8 zlotys per month per head, which amounted to 5.5% of their total income. Nearly 13% of the total number of the households in question lived below the threshold of extreme poverty (subsistence minimum) and nearly 65% lived below the value of the social minimum basket (Table 1). The group was characterised by a high share of transport expenses in the total expenses, which was 12.5%. This may have resulted from the fact that the group consists of multi-person households with children and youth. The transport expenses in this group of families might be necessary expenses for appropriate functioning of the families, i.e. the expenses related to children and youth’s need to travel to schools.

Table 1. The intraclass trait values – partial measures of the financial situation of households –

<table>
<thead>
<tr>
<th>Specification</th>
<th>Class</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>Income (PLN/person/month)</td>
<td>1643.0</td>
<td>2842.0</td>
</tr>
<tr>
<td>Expenses (PLN/person/month)</td>
<td>1317.6</td>
<td>2328.5</td>
</tr>
<tr>
<td>Savings (%)</td>
<td>19.3</td>
<td>17.5</td>
</tr>
<tr>
<td>Social welfare I (%)</td>
<td>35.4</td>
<td>14.2</td>
</tr>
<tr>
<td>Social welfare II (%)</td>
<td>2.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Subsistence wage (%)</td>
<td>2.5</td>
<td>0.7</td>
</tr>
<tr>
<td>Social minimum (%)</td>
<td>33.9</td>
<td>11.5</td>
</tr>
<tr>
<td>Food (%)</td>
<td>23.8</td>
<td>17.8</td>
</tr>
<tr>
<td>Accommodation (%)</td>
<td>17.5</td>
<td>17.8</td>
</tr>
<tr>
<td>Health (%)</td>
<td>5.7</td>
<td>5.5</td>
</tr>
<tr>
<td>Recreation and culture (%)</td>
<td>9.8</td>
<td>10.2</td>
</tr>
<tr>
<td>Hotels and restaurants (%)</td>
<td>2.5</td>
<td>3.9</td>
</tr>
<tr>
<td>Education (%)</td>
<td>1.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Transport (%)</td>
<td>9.8</td>
<td>13.3</td>
</tr>
<tr>
<td>Communication (%)</td>
<td>4.5</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Source: The author’s calculations based on unpublished individual data from Budżety gospodarstw domowych made by the Central Statistical Office in 2010.

The last, seventh class was made up of workmen’s households with one, two, three, four or five people and old age pensioners’ households with three or four people. The households were also
characterised by low disposable income, which was below average and amounted to 1368 zlotys per month per head. Apart from that, the households had better financial situation than the families in groups IV and VI, which resulted in a lower share of food expenses and a higher share of expenses on recreation and culture (6.4%) and on restaurants and hotels (1.6%) in their budget. The high share of expenses on restaurants and hotels in the budget of the families in the group may chiefly result from the fact that the multi-person households include children and youth, who use school canteens.

CONCLUSIONS

The analysis proved that the households of self-employed people with one, two or three people and non-workmen’s households with one or two people (class II) had relatively the best situation. The households were characterised by the highest disposable income per head, the lowest percentage of people living below the thresholds of the subsistence wage and social minimum and a high rate of the percentage of cash used to satisfy higher-order needs.

The aggregate units of class IV and VI were in the worst financial situation. These were disability pensioners’ households with three, four, five, six or more people, old age pensioners’ households with five, six or more people, farmers’ households with four, five, six or more people, workmen’s and self-employed people’s households with six or more people. Above all, their poor situation was proved by the lowest disposable income per head and the highest share of food expenses in their budgets. This fact was also proved by the highest level of income from social welfare and the minimal share of expenses on recreation and culture in their total expenses.

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RESULTS OF OPERATIONAL AND FUNCTIONAL RESEARCH OF PHOTOVOLTAIC PANEL SYSTEMS

Abstract: The preliminary operational and functional research on a set of photovoltaic panels with power of 12.88 kW operating since June 2012 was conducted. The economic and energetic analysis of the research stand and its practical suitability for a small family farm in order to use the generated electric power for the farm’s current demands. The research results have shown that the amount of electric power generated by photovoltaic panels would be enough to cooperate with other renewable energy sources (e.g. power supply of heat pumps) collecting and processing heat from livestock buildings or from ground heat exchangers to make warm tap water and to heat up buildings. In a period from June 2012 to June 2013 there was generated electric power of 10480 kWh with an average power of 813.7 kWp/year (kilowatt peak per year) of one module of the panel. The panel was inclined at an angle of 20° to the Earth’s axis and at an angle of 210° to the north (as per the compass rose: S-S-W direction).

Key words: energy, electric power, renewable energy sources, solar panel, photovoltaics

INTRODUCTION

The Polish energy sector is presently being developed by two key factors: Poland’s structure of primary energy carriers and the compliance with international regulations, namely the provisions of the so-called “Climate and Energy Package” [Action Plan 2006].

The Government Centre for Strategic Studies [GCSS 2004] provides that Poland has an internationally unique structure of primary energy carriers comprising Poland’s fuel balance dominated by hard and brown coal.

The decline in Poland’s coal resources is demonstrated by a downward trend of coal mining: in 2010 there was mined around 65 million tonnes of hard coal (energetic), or by around 36% less than in 2003 (101 million tonnes) and by around 56% less than in 1990 (147 million tonnes) [Central Statistical Office of Poland, GCSS 2004]. At the same time, hard coal import is stated to grow, i.e. in 2010 it amounted to 5.09 million tonnes (compared to 3.06 million tonnes in 2006 and 0.6 million tonnes in 1990). This phenomena may be a threat to the energetic safety defined as “the provision of stable supplies of fuels and energy at a level that satisfies Poland’s demands (…), considering the optimal use of Poland’s energetic resources and the diversification of sources and directions of supplies of oil, liquid and gas fuels” with emphasis on the obtainment of electric power from “low-emission sources” [Energetic Policy 2009].

Another factor is a necessity to reduce the emission of pollutants and carbon dioxide (CO2) to the level determined by the European Commission. On 16th January 2011 the Ministry of Economy approved the Objectives of the National Programme of Low-Emission Economy Development (NPLEED) [Ministry of Economy, Ministry of the Environment, 2011] imposed by the need to reduce the emission of greenhouse gases and other substances emitted into air in all industries. The essence of the Programme is to ensure economic, social and environmental benefits (in accordance with the sustainable development principle) resulting from actions that reduce the emission and achieved, among others, through the innovation growth, implication of new technologies, energy consumption decrease, establishment of new workplaces, and consequently enhancing the growth of economic competitiveness.
Furthermore, it is worth emphasizing the problem of Poland’s power grid condition. Studies [Dreszer et al., 2003] show that power supply conditions, namely in rural areas, are constantly deteriorating. This results in the constant increase of the number of power cuts and the prolonged repair time. In the rural areas, such power cuts occur ten times more frequently than in cities and periods of emergency power cuts are 4-15 times longer. It is proved that this situation is a consequence of the long-standing under-investment of the rural power grids and of the use of the so-called economical technical solutions. It is estimated that around 20% of the power grids in the rural areas exceed the permissible voltage drops, the result of which is that 500 thousand rural receivers is supplied with electric power with a considerably lower voltage than the nominal voltage. As a consequence, the operational efficiency of load points is deteriorated and their time of life is shorter. In particular, it refers to microprocessor-operated equipment commonly applied in modern milking, ventilation etc. systems. According to S. Dołęga [2012] the threat to Poland’s power supply safety is highly probable to occur after 2015.

A recommended solution of the discussed issues is the use of solar radiation energy to generate electric power in house photovoltaic systems. These systems, contrary to passive solar and thermal systems, are not very popular in Poland, yet mainly because of high costs of silicon cells that condition a long return on investment [Lenarczyk 2013]. The chance for such systems is a support of the European Economic Area Financial Mechanism. Investors may expect favourable preferential credits and grants under the Regional Operational Programmes. Moreover, it is necessary to consider that the photovoltaic technology is recorded to have the fastest decline in production prices – by 20% within 20 years [Jankowska 2008].

A disadvantage of photovoltaic systems is the unequal generation of electric power per day and per annum [Jastrzębska 2007]. Efficiency differences in individual months are highly considerable and may account for 90% (efficiency difference in May and December) [Lenarczyk 2013]. Therefore, presently the most profitable solution is to sell the generated electric power to the provider. In addition, this solution prevents from costs of purchasing and handling batteries.

In order to assess the profitability of solar systems, up-to-date data from active systems and the experience of users of these systems are essential. This research is conducted by, among others, the Institute of Technology and Life Science in Falenty, Poznań Branch.

THE RESEARCH PROBLEM

On the basis of the analysis of the available reference books and the present knowledge gained under the previous research the following research problem is formulated:

1. What is the energetic and economic efficiency of photovoltaic panels used for farms’ demands?
2. Is there a justified need to integrate systems of various sources of electric power?

RESEARCH PURPOSE

The aim of the research was to conduct the energetic and economic analysis of solar photovoltaic panels in real conditions. The secondary aim was to review the correct operation of the system with respect to its technical efficiency, under which it was possible to prepare the technical and operating documentation to be practically implemented by farms.

OBJECT OF THE RESEARCH

The object of the research is a research stand comprising solar modules of photovoltaic panels of a total power of 12.88 kWp (kilowatt peaks).

System parameters:

-  56 modules Bauer BS 6P, with a capacity of 230W, connected in series with three strings, polycrystalline modules with an efficiency of 14.1%,

- system of vertical modules, roof pitch 20°,
- SMA inverters Sunny Tripower 12000TL-10,
- mounting system company Schletter.

**RESEARCH METHODOLOGY**

The research was conducted continuously from June 2012 to June 2013, considering all seasons of the year. The most significant ratios and parameters of the solar system operation (Fig. 1) were measured by one person every day at 7:00 a.m. before the panels began to operate effectively and the gathered data were provided in special tables comprising daily generation of electric power (kWh/d), average momentary power of the system (kW), total power generated from the first day of measures (kWh/d). Subsequently, the data were divided into months and years.

![Monitoring and control panel of the studied solar system](source: own study)

The research stand comprised solar photovoltaic panels and converter. The solar system of a total power of 12.88 kW comprising 56 photovoltaic panels of a total area of 1.86 m² and power of 230W was divided into three working groups (21 pieces, 21 pieces and 14 pieces – Fig. 2). Each solar panel was equipped with 3 emergency diodes (by-pass type) used to shut part of the panel module down in case of a shadow, dirt or snow, thanks to which the module did not overheat and the operational efficiency of the entire system did not decline unnecessarily.

The panel was inclined at an angle of 20° to the Earth’s axis and at an angle of 210° to the north (as per the compass rose: S-S-W direction). The solar system (Fig. 3) covered an area of 120 m² of the roof of the social and technical building (system size: 8m x 15 m).
The photovoltaic system studied from June 2012 to June 2013 generated 10480 kWh of electric power. Figure 4 shows the graph demonstrating the annual distribution of electric power generated by the studied solar system divided into months.

In that period, the average electric power output of the system was 873.33 kWh/month. However, due to operational characteristics of the solar system - with respect to seasons of the year – the electric power output was maximum in June - 1612 kWh and minimal in December -264 kWh. The difference between these two values equals to 1:6.1 in the relation of the period and the maximum electric power output to the period of the minimum output. In winter, photovoltaic panels generate only around 17-18% of electric power generated in summer, and this fact proves the data
shown in reference books. Considering that an average household consumes about 120-150 kWh of electric power monthly, a total annual amount of electric power to be generated by panels equals 1440-1800 kWh. In this case, it is noticed that the system was oversized and it is about 5.5 times too large for the household’s demands. In other words, the system comprising maximum 9 modules of a total area of 16.47 m² and power of 2.07 kW would be sufficient for the household to satisfy its demands.

However, if the fact that the average farm’s demand for electric power is 6000-12000 kWh is taken into consideration, it emerges that the studied system is an accurate solution that is able to cover the electric power consumption in a quantitative manner. In this case, however, the disadvantage is that the distribution of the supply of electric power generated by the photovoltaic system is unfortunately highly adverse since the consumption of electric power by the farm, particularly in the meat production, is even annually (e.g. preparation and supply of feed, cow milking, milk cooling, warming up of piglets) and this supply of electric power is required by the farm. The solar system does not meet this requirement. In this case, the best option would be to design and test in real conditions the system associated with another power source, e.g. a wind turbine of little power (around 1.2 – 1.5 kW). In winter, the insufficient electric power generated by solar panels could be supplemented by electric power generated by the house wind turbine, the characteristics of which in the electric power production is reverse – more electric power is generated in winter than in summer.

The conducted economic analysis is based on the following outputs:

- investment cost – EUR 1200 – 1400 · 1 kWp-1, average EUR 1300 · 1 kWp-1 is approved;
depreciation – 25 years, following this period productivity and efficiency of the system will decline by around 20%;

- costs of repairs and maintenance – 5% of investment costs.

The investment cost of the studied solar photovoltaic system amounted to EUR 16744, or EUR 669.71 annually, if the preliminary operational period of 25 years is taken into consideration.

According to the cost estimation methodology [Romaniuk 12] in the cost analysis maintenance costs and operational costs were included as elements of costs of equipment operation. Whereas, the operational costs comprise costs of repairs (Kn), man-hours (Krob), operational materials (Km), electric power (Kee), and the maintenance costs comprise costs of depreciation (Ka), insurance (Kub) and construction (Kbud) with reference to hours of operation (Wh):

\[
K_{uf} = Ka + Kub + Kbud \quad \text{[PLN]} \quad (1)
\]

\[
Kuż = Kn + Kee + Km + Krob \quad \text{[PLN/h]} \quad (2)
\]

The next component of costs was only costs concerning the use of the system because insurance costs (Kub) were omitted. The costs of repairs are assumed to be 5% of the investment costs in 25 years, or EUR 33.48 annually. The service costs pertaining to labour inputs of around 1.5 hours on average weekly equalled to 78 man-hours annually, or around PLN 1170 (EUR 275.30) annually. The total cost of the system operation amounted to around EUR 978.49 annually, or PLN 4158.58 according to the then-valid Euro (EUR) to Polish Zloty (PLN) exchange rate of PLN 4.25. Considering the electric power generation of 10480 kWh and the then-price of around PLN 0.60 for 1 kWh of electric power, the income of the generated electric power is PLN 6288 annually. In the balance with the operational costs of PLN 4158.58, the profit is PLN 2129.41 annually.

On the basis of the conducted research and the energetic and economic analysis, the following conclusions are made:

1. The studied solar photovoltaic system of 12.88 kWp generated 10480 kWh of electric power annually, the maximum generation was in June 2012 (1612 kWh) and the minimum one was in December 2012 (264 kWh).
2. The system emerged to be around 5.5 times larger than the average household’s demands.
3. The system comprising maximum 9 panel modules and with power of 2.07 kW would be enough for the household.
4. The operational costs of the studied system equalled to around PLN 4158.58 and the then-generated electric power amounted to PLN 6288, which means that the economic balance of the operated system is positive annually and generated the profit of PLN 2129.41.
5. It is necessary to conduct further research and to make a design and technology of the stand of the additional electric power source such as the wind turbine of little power (around 1.2-1.5 kW) that is able together with the existing solar system to balance the production of electric power in winter in order to balance a negative difference between electric power generated by panels in summer and in winter.

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Marek Tabert, Wojciech Lis

TYPES OF PLANNING ACTIVITIES APPLIED IN FURNITURE INDUSTRY ENTERPRISES

Abstract: Types of planning activities and principles governing them as applicable in furniture industry enterprises are presented in this paper. Dependencies between individual types of planning procedures are discussed and their classification is proposed taking into consideration distinguished types of criteria. The observations made within this study will contribute to clarification of problems, investigated in the field of organisation and management methods in a furniture industry enterprise. They may also be applied when designing and implementing computer data bases, which are to support planning at different organisational levels of the enterprise.

Key words: Types of planning activities, systematise terms concerning types of planning activities, production management, enterprises of the furniture industry

INTRODUCTION

According to Griffin (2003), the management process in an enterprise comprises four basic functions (groups of actions): planning, organisation, supervision and controlling. Planning is the first function performed in this process (a series of actions). It consists in the identification of an objective (or objectives) and selection of the best method to achieve it. It is selected among a set of viable (attainable) methods which may be achieved in a given enterprise.

The objective is a future state, which is to be achieved as a result of realisation of the plan. In an enterprise the objective is typically characterised by quantitative parameters, e.g. in the form of financial and technical indexes or by parameters of products, presented in the form of their structural drawings. The method applied to meet the objective is presented by listing stages (processes) needed to attain it and by indicating the resources of the enterprise (material, financial, human and information resources), using which it is to be achieved. In the course of planning the stages of objective realisation are connected with the time of performance as well as the dates of their onset and completion.

In manufacturing enterprises different types of planning are used. They vary depending on the branch of industry and the size of the enterprise, the item of planning, the specificity of entered data, the period covered by the planning activity, the type of the organisational unit in the enterprise, which they concern, as well as other detailed characteristics. Production processes in enterprises of the furniture industry are characterised by a discrete (non-continuous) course, thus enterprises in that sector use selected types of planning activities, adapted to their needs. The study presents a characteristic and classification of types of planning activities, which are applicable in enterprises of the furniture industry. The presented classification items clarify and systematise terms concerning types of planning activities and indicate their mutual relationships.

The dictionary of loanwords published by PWN (2013) defines classification (Latin classis = section + facio = I make), as a logical division in the scope of a given concept (name), consisting

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in the exchange of subordinate concepts in relation to that term so that the sum of their scopes is equal to the divided scope and so that these scopes are mutually exclusive”.

**BASIC CHARACTERISTIC OF TYPES OF PLANNING ACTIVITY AND THEIR CLASSIFICATION**

Planning realised in manufacturing enterprises in the furniture industry is a process, during which production tasks are established as objectives and resources of the enterprise required for the performance of these tasks are identified. The basic parameter defining the production task comprises the type and number of final products or their parts, which were assigned to be performed within this task.

The planning process has three primary traits, i.e. the period, for which tasks are planned, the number and type of items (problems), which this process concerns, and the type of the production unit, in which the planned tasks are to be performed. Based on these characteristics types of planning activities are distinguished, as applied in furniture manufacturing plants. They are listed in Fig. 1.

Depending on the period which is covered by planning we distinguish the following types of planning activities (see Fig. 1):

- extended – concerning the period over five years,
- long-term – referring to the period of 2 – 5 years; most typically planning concerns 2- and 5-year periods
- medium-length – concerning a year, quarter or monthly periods,
- short-term – referring to periods shorter than a month, such as a fortnight, ten days, one week, 24 hours, one day, one shift and one hour.

Types of planning activities, distinguished in terms of the time period which they concern, differ in the degree of specificity (aggregation) of introduced data and accuracy of obtained results. Specificity of obtained information is smallest for the longest time periods and increases with the reduction in the length of the time periods covered by planning.

Due to the number and types of items (problems) covered by planning we distinguish single-item (specific) planning and multiple-item planning. Single-item planning covers a numerous and diverse group of planning types, of which most may be included in specific planning. Furniture industry enterprises most frequently use planning of sales, production and financial planning. In large enterprises the following aspects are also planned on a regular basis: material procurement, employment, repairs, internal costs and investments (see Fig. 1).

In furniture manufacturing enterprises multiple-item planning is most typically represented by technical and economic planning. Such planning provides a set of interrelated specific plans. They establish production tasks and resources required for their realisation for the enterprise as a whole.

Technical and economic planning comprises production, material and economic planning. Production planning defines the types and the number of final furniture products to be manufactured in the assumed planning period. Material planning specifies material resources required for the manufacture of these products. In turn, economic planning establishes expected demand for financial resources and costs of realisation of tasks contained in the production and specific plans. In relation to the specific and economic planning a joint term is also used, i.e. planning of material and financial resources.

Planning of sales is based on the demand for furniture. It is established following two principles. According to the first principle demand is established based on the sales forecast. The forecast is prepared using information on the volume of sales, recorded in the period preceding the planning period. The forecast may next be adjusted based on the estimated changes in demand in the period of time covered by planning. Forecasting demand for furniture using other methods (e.g.
based on questionnaire surveys) is relatively rare. The result of a plan of sales prepared based on the forecast is the make to stock system, i.e. the enterprise produces furniture, which is stored in the final product warehouse waiting to be purchased.

Figure 1. Classification of types of planning used in furniture industry enterprises

Source: own study.

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According to the second principle demand for furniture is established based on orders placed by external or internal customers (the latter being organisational units of the enterprise). In such a case storing final products in the warehouses of the enterprise is considerably reduced or may not be used, since the customer is known from the beginning of the production process and manufactured products may be delivered to the customer immediately after they have been manufactured, with no warehousing required. In furniture industry enterprises demand for products is frequently specified using a combination of both principles, i.e. based on customer orders and forecasts of demand. In such a situation results of the forecast will be imposed on the production capacities of the enterprise not utilised to meet customer orders.

A single order (external or internal) may concern one or more types of furniture. At the same time quantitative demand for a specific type of products specified in this order may be divided into several different volumes and dates of realisation of deliveries (e.g. at the end of three successive months). Such placed orders are divided into items of the plan of sales so that each of them covered the number of units of furniture of one type, expected to be manufactured for the same final date. A simple order concerns only one type of product and one final date. In such a case it constitutes directly one item of the plan of sales.

When planning sales customer orders and forecasts are distributed in individual periods of time so that the production capacities are burdened with tasks relatively uniformly. The plan is prepared for the whole enterprise or separately for its smaller organisational units, such as branches or plants. It may be prepared for a one-year, quarterly or monthly period.

**CHARACTERISTICS OF PRODUCTION PLANNING**

Division of planning in terms of the types of production units concerns first of all production planning. It indicates the manufacturing unit in the organisational structure of the enterprise, in which the specified tasks may be realised. Thus the following types of production planning are distinguished (see Fig. 1):

- global plant – establishes production plans for final products for the whole enterprise,
- in-plant – concerns production planning in individual organisational units of the plant and cooperation between them. This type of planning is also referred to as operative or executive planning. In-plant planning comprises the following planning types:
  - inter-unit (inter-department, inter-section and inter-work centre) – establishes production plans for parts of products for primary production flow units (departments, sections, work centres),
  - intra-unit (internal department and internal work centre) – establishes production plans for parts of products for 1° units (work centres, production lines) and work stations. Internal department production planning is also referred to as workshop planning.

Sometimes in literature and practice we also apply the division of production planning into: global plant, inter-department and internal department. In such a case, the location of the planning unit within the production and administrative structure of the enterprise is used as the classification criterion. This type of division is rather ambiguous, since internal department planning includes in such a case inter-department planning, inter-work centre and internal work centre, i.e. types of planning distinguished based on two different criteria (i.e. production units located at different organisational levels of the enterprise).
Types of production planning identified in the presented classification (see Fig. 1) are interconnected due to the order of realisation of stages in production processes, as well as the location of manufacturing units covered by planning within the organisational structure of the enterprise.

Production planning starts with the construction of global plant production plan of furniture products. The production plan is a starting point for in-plant planning, within the framework of which inter-unit and intra-unit planning activities are performed.

The global plant production plan in an enterprise is constructed based on the plan of sales. The process of development of the global plant plan consists in the adjustment of individual items of the plan of sales with the level of stock of final products in warehouses of the enterprise. It a given enterprise does not keep such stock and production is run solely based on orders, the plan of sales and the global plant production plan are identical.

In the course of global plant production planning tasks included in individual items of the plan of sales are adjusted by stocks and they are analysed and allocated when possible uniformly in time – in successive planning periods of the same rank (e.g. in successive quarters) and allocated respectively to periods of lower rank (e.g. in individual months of the quarter). The global plant production plan is developed for annual, quarterly or monthly periods. In the quantitative aspect it is given in natural units (pieces, pairs, kits, sets). When prices and labour consumption of final furniture products are included in the plan we obtain a production plan in the value-oriented and labour consumption-oriented aspect. Individual items of the global plant production plan constitute assortment and quantitative production tasks.

Inter-unit planning consists in the assignment of tasks for cooperating production units in a manner, which guarantees a continuous flow of production between them, coordinated in terms of quantity and time. The basic type of inter-unit planning is inter-department planning. Quantitative and type tasks included in the global plant production plan are divided into individual departments of the enterprise and into planned periods, most frequently monthly periods. The volume of production for a specific department is planned taking into consideration its 24-h flow capacity. Inter-department planning provides framework schedules for production of final products and their parts. Inter-department planning is applied in bigger furniture industry enterprises with a multiple-department organisational structure and is typically prepared by the department of production development. Due to the applied principles there are no significant differences between inter-department, inter-section or inter-work centre planning.

Inter-unit planning consists in the assignment of production tasks to 1° units and included work stations. In furniture industry enterprises intra-unit planning is represented by internal department planning (department planning, work station planning). Within its framework tasks are assigned to production lines, work centres and work stations belonging to the department. In the course of internal department planning the stage of production in progress is included in volumes facilitating uninterrupted manufacture in successive planning periods. Dates of task realisation are set taking into consideration cooperation links between departments.

At the internal department planning level the order of performance is established for tasks, presented in the form of production orders, assigning them priorities. Next tasks are arranged from the highest to the lowest priority value and in such an order they are sent to be realised. For orders selected for implementation (opening) based on their priority the work station documentation is prepared. It covers among other things daily or shift production schedules. According to these

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schedules production orders are performed in individual manufacturing units. The degree of order realisation is recorded on job cards, according to the order of performed technological operations.

Internal department planning is also referred to as dispatching of production. This concept refers to the planning of tasks, delegation of commands as well as recording and settlement of manufactured production. Production commands are assigned to direct executors in the form of production (work shop) documentation, which serves a double function. It specifies types, quantity and date of execution of the planned task, as well as determines the manner of its realisation and the quantity of required materials. Upon the completion of the task the quantity of manufactured production, the volume of material consumption and the amount of used labour time are recorded in the work shop documentation. Recorded information is used to calculate remuneration of employees and to determine production costs of individual production orders.

CONCLUSIONS

The conducted categorisation of basic terms concerning components of complex products and the proposed classification of these components are an attempt at ordering within the analysed scope of the subject for the nomenclature in the field of organisation and management of production. The presented findings may prove applicable in the construction of computer data bases concerning complex final products and their material structures. They constitute the terminology network for the establishment of lists of components, particularly in the form of explosions and implosions of material and design structure of complex products.

REFERENCES
Maciej Sydor, Krzysztof Wiaderek, Beata Fabisiak, Robert Kłos

ECONOMIC ASPECTS OF KITCHEN WITH ASSISTIVE TECHNOLOGY EQUIPMENT

Abstract: In Poland the percentage of disabled individuals aged 0-14 years is 3.1%, while in the age group over 70 years it is as high as 45%. The article presents an attempt of a variant estimation of purchase costs of kitchen equipment for the disabled. Three hypothetical types of kitchen designs were investigated: low-budget, medium-budget and high-budget, respectively. Based on literature guidelines and a review of market prices it was established that the costs of the three kitchen design variants are approx. 6000 PLN (1240 €), 42 500 PLN (9870 €) and over 225 000 PLN (52 530 €). A high percentage of the total cost of kitchen equipment may be connected with specialised mechatronic equipment (up to 40% total kitchen cost). In the case of the cheapest kitchen variant a lack of expensive specialised equipment may be compensated by an appropriate layout of typical kitchen components.

Key words: disability, economic relation, kitchen, assistive technology, elderly people, quality of life, older adults

INTRODUCTION

The problem of disability may be investigated in two aspects, i.e. disability as a medical problem and disability as a social problem. Medical models measure the level of disability by the level of dysfunction of individual body organs. In this model disability is the problem of an individual and countering disability consists in the rehabilitation of impaired functions of the organism of a specific individual. In the other approach disability is not perceived as an attribute of an individual, but rather the problem of the society as a whole. This is manifested by the exclusion of a certain group of individuals from serving social roles. Prevention of disability in this model consists in such a modification of the technical and social environment so as to compensate for the limitations resulting from disability to the greatest possible extent (Peterson, Mpofu, & Oakland, 2010). One of the disability-compensation measures includes assistive technology devices.

The aim of assistive technology elements is to meet specific needs of the disabled, including also the elderly. Assistive technology is a term denoting technologies, equipment, services, systems used by the disabled and the elderly. They are applied in order to overcome social, infrastructural and other obstacles making it difficult for these individuals to lead independent lives (Borg, Larsson, & Östergren, 2011). As it was reported by (Balcerzak-Paradowska, Głogosz, Hebda-Czaplicka, Kołaczek, & Męcina, 2002), over 500 million people worldwide are suffering from different forms of disabilities. According to the data of the Main Statistical Office (GUS), approx. 13% Polish population are individuals affected by various degrees of disability. The percentage of the disabled increases with age. In the age group aged 0 to 14 years it is 3.1%, while in the group of individuals over 70 years it reaches 45% (Zajenkowska-Kozłowska, 2011). It is of crucial importance especially in the view of the forecasts indicating that by the year 2050 every fifth individual will be at least 60 years old (United Nations. Department of Economic and Social Affairs, 2007). Moreover it needs to be highlighted that the extension of mean life span may be observed in many European countries and also in Poland and thus the number of people suffering from different forms of disability is also increasing (Freedman & Martin, 1998; Hrovatin, Širok, Jevšnik, Oblak, & Berginc, 2012). Assistive technology devices support disabled individuals in

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performing daily chores and activities such as getting dressed, hygiene, preparation of meals and locomotion (wheelchairs, crutches). Universal, non-customised devices, designed with no consideration for a specific user may turn out to be ineffective in use and pose a hazard to the user. The disabled and the elderly experience an increased risk of accidents even when performing simple domestic chores (resulting in a fall, burns, injury or gas poisoning). Among the injured due to a fall 75% are over 64 years of age and 56% of them are women. It is estimated that 65% all deaths due to accidents at home concern individuals over 75 years of age (Wielka encyklopedia medyczna, 2011). As it results from the studies of (Kłos, Fabisiak, & Kaczmarek, 2014) conducted among individuals aged over 51 years falls account for 38% of all dangerous situations in the kitchen. The problem of disturbances in balance among seniors was indicated by Kabsch (2000), who stressed that mortality caused by fall accidents increases drastically after 70 years of age (2003). According to Stevens (2005) 30% of users over 65 years old experience a fall in their kitchen each year. Irrational arrangement of kitchen equipment may contribute to an increased risk of accidents (Sydor, 2002). The subject of kitchen furniture design adapted to elderly people needs in terms of safety and ergonomic requirements was described by (Hrovatin et al., 2012) paying particular attention to the arrangement of kitchen furniture, lighting and overall assessment of comfort of using kitchen. Aspects of modern e-kitchen equipped with information technology solutions as well as seniors’ attitude toward it were presented by (Fabisiak, Klos, & Maćkowiak, 2013). The theme of smart kitchen equipped with assisted technology was described also by (Blasco, Marco, Casas, Cirujano, & Picking, 2014). Designing for the disabled and/or the elderly should meet the requirements of universal design, i.e. designing of space as well as all its elements to be user-friendly for the greatest possible groups of people. Paradigms of universal design are described in the works of (Getty & Getty, 1998; Branowski & Zabłocki, 2006). In addition, when designing furniture for elderly people, a special attention must be paid to those solutions that can assist in performing those activities which cause the most problems. The assessment of the difficulties of activities performed in kitchen by two groups of users aged 40-60 and over 60 years was presented in the work of (Fabisiak & Klos, 2012). The results obtained indicated that the highest percentage of respondents had serious problems with using the traditional standing corner cabinet and wall cupboards, which in most cases were mounted too high. Base on the above, when making the purchase decision it is important to consider functional solutions implemented in the pieces of furniture mentioned above.

The interest of the authors focuses on economic aspects for individuals with impairments in functioning: 1) as a result of permanent impairment (sensory, locomotor, intellectual) or 2) due to temporal impairment (caused by e.g. pregnancy, convalescence, injury or temporal conditions – e.g. the need to provide child care). The aim of this study was to identify costs required to provide access to kitchen space for individuals with impairments.

**DECOMPOSITION STRUCTURE OF KITCHEN FURNISHING COSTS**

Prices of kitchen furniture vary considerably. They depend on the number of cupboards, the type and design of used hardware, used structural and finishing materials. Costs of complete kitchen equipment increase greatly when furniture is to be designed and custom-made for a specific user, particularly when it is a disabled and/or elderly person. For example, one of the Polish furniture manufacturers having their own chain of company showrooms offers a cheap kitchen set with an average price per running metre. The price of lower (base) cabinets with a work top is 437 PLN, while that of wall cabinets is 414 PLN. When arranging kitchen furniture for self-assembly to comprise 5 lower cabinets and 7 wall cabinets the average price is 2413 ±336 PLN, depending on the selected finishing decor. Another global brand of furniture showrooms in their 2013 catalogues offers three example kitchen designs. A small kitchen set (5 m²) with 5 lower cabinets and 3 wall cabinets costs 2030 PLN (+ 494 PLN assembly and installation). A medium kitchen set (8 m²) with
5 lower cabinets, 2 wall cabinets and a table is priced at 5494 PLN (+610 PLN assembly and installation). A large kitchen set (11 m²) with 6 lower cabinets and 6 wall cabinets costs 9583 PLN (+1030 PLN assembly and installation). Prices of these kitchen sets, apart from the typical furniture elements (cabinets, drawers, fronts, tops, shelves, masking panels, decorative strips, plinths, knobs and handles) cover also pull-out containers, hinges, shock absorbers, sinks and kitchen faucets.

Another example presents custom-made kitchen sets. The cost of a running metre of the custom-made kitchen set may range from 760 PLN to 2700 PLN or more, depending on the surface area to be furnished, applied materials and technical solutions. The price of kitchen furniture, whether batch production or custom-made, is determined by the surface area to be furnished (the number of cabinets), the type of material, used hardware and accessories as well as the degree of their automation, surface finishing, costs of production and assembly and very often also the designing costs.

In order to present costs of the three types of disabled friendly kitchen sets the following types of furnishings:

• A – low-budget kitchen (kitchen surface area 8 m²),
• B – medium-budget kitchen (kitchen surface area 12 m²),
• C – high-budget kitchen (kitchen surface area 25 m²).

The low-budget kitchen (A) is the kitchen with the smallest usable area, containing the smallest possible number of elements (cabinets, equipment and other appliances). It consists of the cheapest elements in the minimum number required for functioning. The analysed furnishing set includes 4 lower cabinets, 2 wall cabinets, a table and 2 chairs.

The medium-budget kitchen (B) is an example of a kitchen containing a typical number and type of elements. Each of the elements is average for its class in terms of its price. The intermediate kitchen is a kitchen with a medium usable area, i.e. such where an average number of equipment items may be placed. The furniture set for this kitchen includes 6 lower cabinets, 6 wall cabinets, a table and 4 chairs.

The high-budget kitchen (C) is a kitchen with a large surface area containing all possible elements of kitchen equipment. Each of the elements is the most expensive product in its category. When analysing this type of kitchens the furnishing set was specified as 15 lower cabinets, 10 wall cabinets and a table with 6 chairs.

All kitchen elements were divided into five groups:
1. Furnishing kitchen set (table 2) – comprising typical furniture components.
2. Construction adaptation of the room (table 3) – flooring and wall paneling as well as costs of other construction works.
3. Large household appliances (table 4) – stationary kitchen appliances.
5. Specialised equipment (table 6) – elements dedicated specifically to the disabled, including elements facilitating kitchen use for all its users.

Tables 2-6 present names, typical quantities and prices of individual kitchen components. Types and numbers of individual kitchen components were determined based on the personal

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50 It needs to be stressed here that the boundary between equipment dedicated to the disabled and universal devices (increasing comfort both for the disabled and healthy individuals) is arbitrary. For example, “electric drawer opening system” or “automated doors of wall cabinets” may be classified both as equipment dedicated to the disabled and for healthy individuals, who want to have enhanced comfortable use of their kitchen.

51 Prices were established on the basis of a review of market prices conducted in the early 2014 among companies operating on the Polish market.
experience of the authors in kitchen design as well as based on the guidelines presented in literature, e.g. (Guetzko & White, 1991; Alicia Casals, Portell, Xavier, & Contijoci, 1999; Sydor, 2002; Ma, 2002; Afacan & Demirkan, 2010; Johansson, Lundberg, & Borell, 2011; Branowski, Rychlik, Sydor, & Zablocki, 2011; Barnes et al., 2012; Stuparu & Bârsan, 2012). The cost of the cheapest kitchen was determined as the sum of products of the minimum number of component items and their lowest possible price (minimum number of elements × minimum price). The cost of the intermediate kitchen is the sum of the products of typical numbers of elements and their typical prices (typical number of elements × typical price). The cost of the most expensive kitchen set was estimated as the product of the maximum number of elements and their highest price (maximum number of elements × maximum price).

Table 1. A decomposition list of costs of the furnishing set and kitchen equipment – furniture set

<table>
<thead>
<tr>
<th>Item</th>
<th>Group of elements</th>
<th>Number of pieces / size</th>
<th>Unit price (PLN)</th>
<th>Value (PLN)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>min.</td>
<td>average</td>
<td>max.</td>
</tr>
<tr>
<td>1</td>
<td>Cabinet bodies</td>
<td>6</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>Joint for elements of cabinet bodies (pcs.)</td>
<td>100</td>
<td>140</td>
<td>300</td>
</tr>
<tr>
<td>3</td>
<td>Hinge of cabinet doors (pcs.)</td>
<td>28</td>
<td>50</td>
<td>80</td>
</tr>
<tr>
<td>4</td>
<td>Handle of cabinet door and drawer (pcs.)</td>
<td>16</td>
<td>20</td>
<td>32</td>
</tr>
<tr>
<td>5</td>
<td>Legs of lower cabinets (set)</td>
<td>0</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>6</td>
<td>Hanger of wall cabinets (set)</td>
<td>2</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>drawer guides (set)</td>
<td>4</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>Kitchen top (rm)</td>
<td>3</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>9</td>
<td>Furniture front</td>
<td>12</td>
<td>36</td>
<td>50</td>
</tr>
<tr>
<td>10</td>
<td>Drawer</td>
<td>4</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>11</td>
<td>Shelf</td>
<td>12</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>12</td>
<td>Table</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Chair</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>14</td>
<td>Cargo unit low/high</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>Corner turntable</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>16</td>
<td>Corner pull-out bin</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>1384</td>
<td>5560</td>
<td>43509</td>
</tr>
</tbody>
</table>

Table 2. A decomposition list of costs of the furnishing set and kitchen equipment – construction preparation works

<table>
<thead>
<tr>
<th>Item</th>
<th>Group of elements</th>
<th>Number of pieces / size</th>
<th>Unit price (PLN)</th>
<th>Value (PLN)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>min.</td>
<td>average</td>
<td>max.</td>
</tr>
<tr>
<td>17</td>
<td>Wall ceramic tiles</td>
<td>0</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>18</td>
<td>Floor ceramic tiles</td>
<td>8</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>19</td>
<td>Other wall and ceiling finishing elements</td>
<td>0</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>240</td>
<td>1420</td>
<td>9550</td>
</tr>
</tbody>
</table>
Table 3. A decomposition list of costs of the furnishing set and kitchen equipment – large duży appliances

<table>
<thead>
<tr>
<th>Item</th>
<th>Group of elements</th>
<th>Number of pieces / size</th>
<th>Unit price (PLN)</th>
<th>Value (PLN)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>min.</td>
<td>average</td>
</tr>
<tr>
<td>20</td>
<td>sink</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>21</td>
<td>Sink faucets</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>22</td>
<td>Microwave oven</td>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>23</td>
<td>Fridge</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>24</td>
<td>Ventilation hood/vent</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>25</td>
<td>Oven</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>26</td>
<td>Dishwasher</td>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>27</td>
<td>Hotplate</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. A decomposition list of costs of the furnishing set and kitchen equipment – small appliances

<table>
<thead>
<tr>
<th>Item</th>
<th>Group of elements</th>
<th>Number of pieces / size</th>
<th>Unit price (PLN)</th>
<th>Value (PLN)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>min.</td>
<td>average</td>
</tr>
<tr>
<td>28</td>
<td>Multifunction mixer food processor</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>29</td>
<td>Juice extractor</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>30</td>
<td>Cutlery set</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>31</td>
<td>Tableware</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>32</td>
<td>Set of pots</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>33</td>
<td>Coffee maker</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>34</td>
<td>Ice cube maker</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>35</td>
<td>Electric kettle</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>36</td>
<td>Toaster</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>37</td>
<td>Meat grinder</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>38</td>
<td>Blender</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>39</td>
<td>Deep fryer</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>40</td>
<td>Bread maker</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It results from the decomposition tables 1 - 5 that the furnishing set for the low-budget kitchen would cost approx. 6000 PLN, that of the intermediate kitchen – approx. 42 500 PLN, while that of the kitchen with no price limits would be 225 000 PLN. The tables may be presented in a simplified form giving prices of individual groups of elements for various kitchen types (tab. 6).
Table 5. A decomposition list of costs of the furnishing set and kitchen equipment – specialised equipment

<table>
<thead>
<tr>
<th>Item</th>
<th>Group of elements</th>
<th>Number of pieces / size</th>
<th>Unit price (PLN)</th>
<th>Value (PLN)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>min.</td>
<td>average</td>
<td>max.</td>
</tr>
<tr>
<td>41</td>
<td>Convalensence handle</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>42</td>
<td>Lowered upper cabinets</td>
<td>0</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>43</td>
<td>Slide work tops</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>44</td>
<td>Automated doors of upper cabinets</td>
<td>0</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>45</td>
<td>Electric drawer opening systems</td>
<td>0</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6. Value in PLN of groups of elements for individual types of kitchens

<table>
<thead>
<tr>
<th>Group of elements</th>
<th>Cheap kitchen (A)</th>
<th>Intermediate kitchen (B)</th>
<th>Expensive kitchen (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitchen furnishing set (furniture)</td>
<td>1384</td>
<td>5560</td>
<td>43509</td>
</tr>
<tr>
<td>Construction preparation works</td>
<td>240</td>
<td>1420</td>
<td>9550</td>
</tr>
<tr>
<td>Large appliances (stationary)</td>
<td>2910</td>
<td>8850</td>
<td>38600</td>
</tr>
<tr>
<td>Small appliances</td>
<td>1080</td>
<td>7950</td>
<td>46500</td>
</tr>
<tr>
<td>Specialised equipment</td>
<td>40</td>
<td>18850</td>
<td>87250</td>
</tr>
<tr>
<td>TOTAL</td>
<td>5654</td>
<td>42630</td>
<td>225409</td>
</tr>
</tbody>
</table>

Percentage shares of prices of individual groups of furnishing set elements – furniture and kitchen equipment, are presented in Fig. 1.

Figure 1. Percentage shares of costs of individual groups of furnishing set elements – furniture and kitchen equipment, in the total cost of kitchen furnishing
The percentage costs of specialised equipment (comprising mainly mechatronic equipment) in the case of medium- and high-budget kitchens constitutes approx. 40% total price.

CONCLUDING REMARKS

Social effects of disability may be compensated for by using equipment assisting in everyday activities. Prices of furnishing - the set of furniture and kitchen equipment, depending on the financial means of the investor and size of the kitchen may range from approx. 6000 PLN (1240 €) to over 225 000 PLN (52 530 €). Based on the estimates presented above for the execution of three types of kitchens the following conclusions may be formulated:

1. In the case of the cheapest kitchen set the expensive specialised equipment may be omitted and its availability for the disabled and the elderly may be provided thanks to an appropriate arrangement of other kitchen elements.
2. A large share of the kitchen costs may be connected with specialised equipment. For the intermediate kitchen and for the most expensive kitchen specialised equipment may account for as much as approx. 40% their total prices.
3. Specialised equipment, composed of mainly mechatronic devices equipped with automated drives facilitates functioning to all users, not only the disabled.

REFERENCES


