INDEXED IN
EMERGING SOURCES CITATION INDEX
THOMSON REUTERS

ISSN 2217-9739
No. 3-4 / 2020

# International Review

EDITOR- IN-CHIEF
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Faculty of Business Economics and Entrepreneurship

filo diritto editore DAL 2008

www.international-review.com

*ISSN 2217-9739*
*No. 3-4/2020*

# International Review

Editor
*Academician Professor Mirjana Radovic Markovic, PhD*

Faculty of Business Economics and Entrepreneurship

*FILODIRITTO*
*INTERNATIONAL PROCEEDINGS*
filo diritto editore DAL 2008



ISSN 2217-9739
ISBN 979-12-80225-09-2

First Edition December 2020



inforomatica.it

tel. 051 9843125 - Fax 051 9843529 - commerciale@filodiritto.com

Twice a Year Scientific Journal
ISSN 2217-9739
COBISS.SR-ID 192516620

**PUBLISHER**
Faculty of Business Economics and Entrepreneurship
8 Mitropolita Petra Street
11000 Belgrade, Serbia
www.vspep.edu.rs

**CO PUBLISHER**
Filodiritto Editore (inFOROmatica S.r.l.)
Via Castiglione 81
40124, Bologna
C.F./P.IVA 02575961202
www.filodiritto.com



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www.vspep.edu.rs, international.review@vspep.edu.rs

Printing 300 copies

CIP - Каталогизација у публикацији Народна библиотека Србије, Београд

37+33+327

INTERNATIONAL review/editor-in-chief Mirjana Radović-Marković. 2012, no. 1/2. Belgrade: Faculty of Business Economics and Entrepreneurship; Pianoro: Medimond, 2012 (Valjevo: Valjevo print). 24 cm

Dva puta godišnje

ISSN 2217-9739 = International review (Faculty of Business and Entrepreneurship) COBISS.SR-ID 192516620

# Notes from the Editor-in-Chief

The IR has yet attracted an international readership that is primarily academic. However, the primary target group of our peer Journal are not only sholars and researchers. We seek also students of PhD studies and professional audiences as well.

As an Editor-in-Chief, I continue to welcome articles that announce discoveries, present new information, as well as those that address innovative solutions in all aspects of their entrepreneurial endeavor. Regarding the actual situation influenced by COVID-19, I especially invite you to write about how the crisis has affected the businesses on national regional or global level.

December, 2020

Yours,
**Editor-in-Chief**
*Acad.Prof. Dr. Mirjana Radović-Marković,*

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# ADOPTION OF NEW TECHNOLOGY: THE IMPACT ON WORK, PEOPLE, AND ECONOMY

ORIGINAL RESEARCH PAPER

# GENDER AND TECHNOLOGY ADOPTION AMONG FARMERS IN BANGLASH

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## Abstract

The present study provides a systematic estimate of male and female participation in agricultural production and usage of agricultural technology and examines their influence in the adoption of modern technology in three upazilas in Jamalpur district. The study was followed by the simple random sampling technique to select 190 sample of respondents for household survey through the semi-structured questionnaire. There has been a significant change with the livestock rearing activities which are 118.79% after adoption of new technology. It is evident that the decision regarding farming with adoption of new technology attains the highest rank. The second highest ranked decision is technical training on technology. Similarly, the third ranked decision is use of modern technology. The modern technology improves the quality of management and materials (seeds, land, tools). The experience on modern technology of respondents has a positive coefficient and it was 0.492.

However, our research showed that about 65.2% of the respondents were women as users of traditional agricultural machinery. Given these facts, our research has explained what keeps women's rates of modern agricultural technology adoption low.

*Keywords: gender roles, agricultural technology, farming*

**JEL Classification: J11, J21, J22, J24**
**UDC: 005.591.6:631.153(549.3)**
**305-055.1/.2: 631**
**COBISS.SR-ID 28607497**

## Introduction

Technological progress is a prerequisite for the economic growth of countries, regions, and cities [1]. It allows efficient production of more and better goods and services. Adoption of agricultural machinery can significantly increase or reduce time spent in labour. Thus, through history, technology has proved to be extremely useful in the agricultural sector. One of the most important technological discoveries in agricultural history is the development high-yielding dwarf wheat and rice varieties, known as the 'Green Revolution' technology, that are coupled with adequate supplies of water, fertilizer, pesticides soil management and water control, and are adopted widely among nations. Bangladesh, being one of the most densely populated countries with highly unfavourable land-man ratio and widespread hunger, also pursued a policy of transforming agriculture through acceleration of technological development to keep up with the increasing population. In recent years, it is felt that the

productivity of this new agricultural technology is weakening and might pose a threat to the sustainability of economic development [2, 3].

Modern agricultural technology is an integral part of the green revolution model, which, among other things, promotes technological intensifications, contemporary farming and the use of new machines. On the other side, traditional agricultural technology, based on indigenous knowledge, traditional farming practices and local value systems, which has been accumulating among generations and over the years should also be considered. Technologies and techniques used by farmers, including a source of their leadership as well as methods of the most appropriate way of farming are also included [45]. Moreover, the availability of information is an important resource for women with potential for empowering them in terms of new attitudes [34-37].

Modern technologies have direct and indirect impacts on men's and women's access to income, including technologies, improving their quality of life through increase of production and productivity [4-7]. However, despite rapid technological development, there is a strong evidence that women's rates of adoption of agriculture technologies remains low in comparison to men [8-9]. Main challenges women face in access and adopting of agricultural technologies include socio-economic constraints, limited information, knowledge and skills, beliefs about gender roles, time constraints, etc. [10, 11]. Different preferences for technologies stemming from different tasks and responsibilities also greatly affect the process of the adoption of technology [12, 19].

Reducing gender gap is recognized as priority task to contribute to agricultural growth and development especially in developing countries [12-14]. Simultaneously, women's empowerment is broadly viewed as a key factor of achieving gender equality, improving productivity in agriculture, and advancing broader development outcomes [15, 16, 23].

Rural women's empowerment as well as agricultural technology adoption may have positive impact on technical efficiency, which can contribute to more efficient use of resources, better management of time and risks, increase of female farmers' productivity.

These production and quality improvements may lead to maximizing the returns to women's limited time, labor, land, and capital [15, 20]. In this regard, of great importance is recognizing the gender roles and priorities in the design of agricultural programs and initiatives, including development and introduction of improved technology [17, 10].

## The conceptual framework of the study

The ways of women empowerment and reducing gender disparity regarding adoption of modern agricultural technologies has been widely investigated in the literature. There is also a growing body of research that directs special attention to a decision-making process and women's role in adopting of agricultural technology. However, the recent studies compare decision making linked to the agricultural activities by women with those by men, ignoring the majority of agricultural households in which are both involved in production [18, 19].

Unlike other studies, our analysis included this aspect in the research. Namely, women often jointly with their spouses make production decisions in male-headed households [20], and vice versa – men also make such decisions together with their wives' female-headed households' [21]. Therefore, using gender of the household head as a gender indicator is not enough to describe overall details, like, for instance, the division of labour between women and men, gender roles, as well as gender-related politics in agricultural technology adoption.

Making decisions regarding technology adoption, by men and women in the same household, has been evaluated in several studies recently [23-25]. These studies present mixed evidence on gender-related differences in the process of adoption of agricultural technology. While some research points out that joint management has a positive impact on

technology adoption [23-24], other studies suggest there is no remarkable gender difference concerning this process [25].

There is a considerable amount of research studies that have empirically investigated gender differences in the adoption of agricultural technology by using the gender of the household head as an indicator [26-28]. Besides, gender roles vary greatly depending on the country or region [29, 30]. For instance, in southern Ethiopia, plots are mainly cultivated jointly by households, but only a few of them are farmed individually by men or women with relatively modest involvement of other family members. Apart from the gender division of labour, women's decisions related to agricultural technology adoption are also influenced by other gender-specific factors, such as social ties, landholding, access to extension services etc. [31, 32].

In Bangladesh, in recent times, the participation of rural women, in general, is increasing in agricultural work due to changes in values and norms [35]. According to Labour Force Survey in Bangladesh [38] about 49% of women were engaged in the agricultural activities.

Despite their important contribution, compared to men, rural women still do not have the same access to agricultural technologies. The other critical element besides agricultural technology is access to knowledge and resources as well as participation in the household decision-making process which represents a mixture of "access, capabilities and actions that shape whether women have influence over village life or decisions about their private life" [39]. Considering that the gender disparity creates obstacles and reduce the productive potential of women farmers by restricting their access to resources and decision-making opportunities, we were highly motivated to investigate this specific research area on the case of Bangladesh. Namely, it is a challenging task to draw common conclusions related to the issues of gender inequalities in agricultural technology adoption in rural Bangladesh.

Therefore, the study will provide an ideal setting for investigating gender role in agricultural technology adoption in a production system and livelihood improvement at the household level. In line with this, research is carried out to fulfil specific goals stated as follows:

- To evaluate male and female preferences for agricultural innovation.
- To analyse the factors that influence male and female adoption of agricultural technology.
- To examine the effects of technology adoption among male and female farmers.
- To identify the major problems in a gender differentiated technology and suggest approaches to close the gender gap in agricultural equipment service provision.

The study will benefit researchers and social thinkers who work on agricultural research as well as promoting and developing agricultural technologies for communities in Bangladesh.

In addition, the Ministry of Agriculture will benefit in terms of providing an extended service system. Farmers in Bangladesh, apart from the research area, will also benefit in areas with similar problems and challenges.

The concept of the study is based on traditional social and cultural value systems should help for recognition of women participation in household decision making and the use of modern agricultural technology (Figure 1).

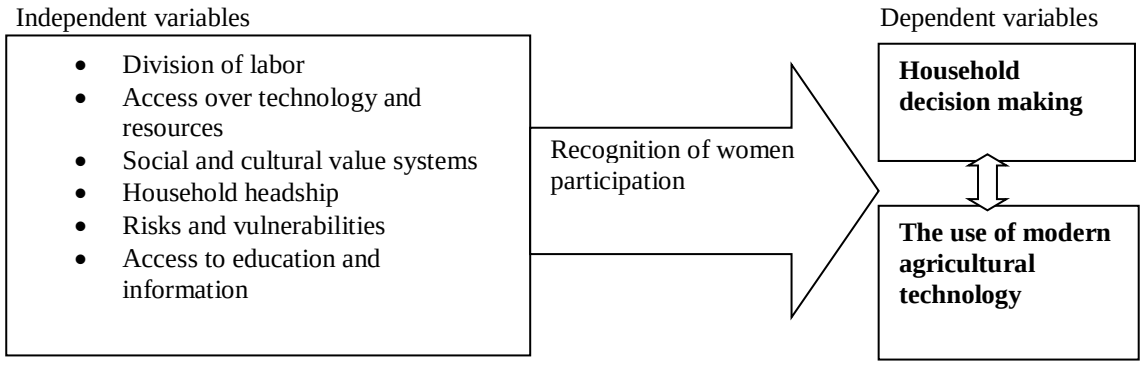


*Fig. 1. Conceptual framework for addressing gender decision making and the use of modern agricultural technology*
*Source: Authors*

As can be seen from our conceptual framework, gender role in Bangladesh is rooted in its tradition and patriarchal model of life. Taking it into account, the concept of this research is tested by regression analysis method.

### *Hypotheses*

This paper draws its findings from testing the following hypothesis:

**Hypothesis (H0).** Households headed by women and men in the area do not represent noticeable differences regarding adoption and use of the various agricultural machinery [40].

**Hypothesis (H1).** Women's involvement in rural household decision making is extremely limited [41].

**Hypothesis (H2).** Socio-economic characteristics such as education and household headship have a significant influence on women's decision making [33].

**Hypothesis (H3).** Involvement of women in household decision making was negatively associated with family size in Bangladesh [42].

## Materials and Methods

### *Sources of data*

Two upazilas, namely Sarishabari and Jamalpur sadar (Figure 2) were selected purposively as the locale of study. The area is ideal for this kind of study, because it is characterized by diverse agro-ecological zones, which dictate the type of farming systems that prevail in the area. It is one area where allocation and utilization of resources along gender lines is determined by existing environmental factors and other external influences such as the active participation of government and donor agencies in agricultural activities in the area. The data has been collected during the period February 2019-April 2019.

Contemporary environment and social ties, as well as other external factors such as government and donor agencies engagement, determine resource allocation and utilization in the above-mentioned district in the context of gender lines. To measure the variable, questions about the used technology, about who and why makes the technology purchasing and adoption decisions, including the manner in which plots are farmed, and the manner livestock are cared for (the seeds, pesticides, fertilizers, animal drugs, etc.)


*Fig. 2. The Jamalpur district: study location*

## Sampling techniques

An updated list of technology adaptors farmers of the selected area was prepared by the help of the Agricultural extension officer (AEO). In total there were 1900 farmers (head from each household) in these selected areas which were considered as population of the study. Ten percent of the population was randomly selected by using a table of random Numbers. Thus, a total of 190 agricultural technology adaptors farmers constituted the sample size for the study.

**Data collection methods:** Primary data were collected by face-to-face in-depth interview.

Six Focus Group Discussion (FGDs) were conducted with the help of semi-structured questionnaire and each FGDs group were composed 6-10 respondents (both male, female).

Secondary data were collected through Journals, Reports, Books and Articles. Data were collected by the researcher himself from sample the selected farmers. The interview was conducted with the respondents individually in their respective houses. The researcher took all possible care to establish rapport with the respondents so that they would not feel any hesitancy while starting the interview. If the respondents felt any difficulty in understanding any question, the researcher took utmost care to explain and clarify the same properly. No serious difficulty was faced by the researcher in collecting data.

## Data analysis techniques

Both qualitative and quantitative data analysis techniques were utilized. Qualitative techniques included detailed description of people's attitudes and feelings towards resource allocation, and its use and benefits derived from it on the basis of gender context.

**Content analysis** was used to analyses qualitative data, it refers to the process of categorizing verbal or behavioral data to classify, summarize and tabulate the data.

Quantitative analysis was used to measure the extent to which the different sexes have adopted agricultural technology and the characteristics of the adopters. Quantitative analysis was focused on the characteristics of the respondents and measurement of the extent to which the different genders have adopted agricultural technology. Frequency distributions, cross tabulations, and averages were intensively used. Statistical data are presented in form of pie charts and bar graphs. Gender perception index (GPI) was measured using closed from

questions in the interview schedule. The respondents were asked to give their opinion on nine selected indicators, which were identified during pretesting of the questionnaire along with their extent of confrontation using integrated homestead farming technologies. A five-point scale was used for computing their perception score. The weights assigned were 0 for "strongly disagree", 1 for "disagree" and 2 for "neutral" 3 for "agree" 4 for strongly agree.

The weights of responses of all the indicators were added together to obtain the Gender perception index score (GPI).

Descriptive analysis such as, number and percentages, rank order was used. Pearson's product moment correlation coefficient (r) was used in order to explore the relationship between the selected variables.

The Pearson's Product Moment Correlation Coefficient follows:

The equation is – $Yi = \beta0 + \beta1X1 + \beta2X2 + \beta3X3 + \beta4X4 + \beta5X5 + \beta6X6 + \beta7X7 + \beta8X8 ...\varepsilon i$ where,

Yi = Income of respondents:

- **a.** $X_1$ = Education (Years of schooling),
- **b.** $X_2$ = Family size (Number),
- **c.** $X_3$= Farm size (acre),
- **d.** $X_4$ = Experience of modern technology (Years),
- **e.** $X_5$= Training on new technology (Number of days),
- **f.** $X_6$ = Technological support from NGO (yes/no),
- **g.** $X_7$ = Decision making ability to use the new technology (yes/no),
- **h.** $\beta0$ = Intercept $\beta1$ to $\beta8$ = Regression co-efficient of the independent variables $\varepsilon$ = Disturbance term or error term.

**Measurement of the variable**

Yi = Income of respondents, Household income was the total financial return of a household from agricultural farm. The earnings from these sources were added together for computation of annual family income score. Annual household income was expressed in '000' Taka.

X1 = Level of education, Level of Education was measured as the ability of an individual respondent to read and write or the formal education received up to a certain standard. A respondent who did not know how to read and write his or her years of schooling score was given as "0" (zero), can sign only his or her years of schooling score was given as "0.5", 1 was given who attended to school for class one. If a respondent passed class v, his education level score was 5 and so on.

X2 = Family size, Family member was measured in terms of actual number of members in the family of a respondent. The family members included the respondent himself, his wife, sons, daughters and other dependents.

X3 = Farm size (acre), farm size of a respondent was determined as the total area of his/her land on which he continued his or her cultivation of crops during the period of this study. It included as area of land owned by him/her as well as those obtained from other by rented in, lease or other means. The cultivable land size of a respondent was measured in decimal by using the following formula:

$$Fs = Fa+F2+F3+F4+1/2\ (F5+F6)$$

Where,

Fs = Farm size

$F_a$ = Homestead area for farming

$F_2$ = Own land under own cultivation

$F_3$ = Fallow land

$F_4$ = Giving the land to other by share cropping (borga)
$F_5$ = Land taken from other under share cropping (borga)
$F_6$ = Cultivable area taken as lease by a respondent from others

X4 = Experience of modern technology was determined by total number of years used on modern technology.

X5 = Training on new technology was determined by total number of days of training received by the respondents from any organization on technology related in their entire lifetime.

X6 = Technological support from NGO, if farmers take get support from NGO regarding technology adoption support = 1, if not = 0

X7 = Decision making ability to use the new technology, if women farmers take decision alone = 1 not = 0

## Results and discussion

The demographic profile of respondents below shows that the total sample included 55 percent male and 45 percent female respondents (Table 1).

*Table 1. Demographic Profile of Respondents*

| Gender | | Total | % Number |
|---|---|---|---|
| *1.* | Male | 105 | 55.27 |
| *2.* | Female | 85 | 44.73 |
| Total | | 190 | 100 |

*Source: Field survey 2019*

Involvement of the respondents in agricultural crop production is about 66.84%, where 18.94% are involved in vegetable production, and 14.21% in livestock rearing (Figure 2).

Average yearly income was 154000 tk, 138000tk and 163000 tk respectively. Livestock rearing average income was high among the three groups, however there is a wide disparity among rural women in the Jamalpur district on the amount of money they earned per year from engagement in livestock rearing.

The gender dynamics around ownership, access, control, are key issues when it comes to income and assets. Contemporary gender conditions can contribute to resolving differences in male and female relationship to income and assets, but also to technology. Furthermore, comprehending these relationships is necessary for a better understanding of which factors improve or worsen women's and men's access to agricultural technologies including the benefits stemmed from their use.

Our research findings revealed that annual income has changed for 58.76% in agriculture cereal crop production and for 65.86% in vegetable production (Figure 3). And there has been significant change that occurred with the livestock rearing activities which are 118.79% after adoption of new technology (AI and beef fattening).

The research also showed that there is enough evidence of differences in the use and adoption of agricultural technology between men- and women-headed households. Findings also indicated that men-headed households are more significant adopters and users of modern equipment for land preparation, 55% male- and 36% of female-headed households, respectively. About 53% of women-headed households adopt and use indigenous tools in land cultivation compared to 28% of men-headed households.

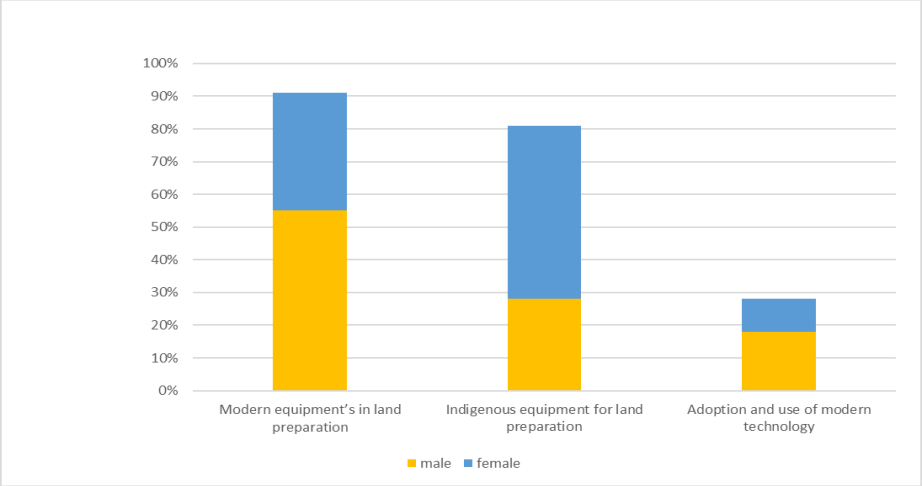


*Fig. 3. Gender identified uses of technology in sample households*

Preference and use of traditional agricultural technologies: FGDs findings show that women prefer the use of traditional agricultural technologies more often compared to men – about 65.2% respondents indicated women as users of traditional agricultural technologies, while men were mentioned by only 22.8% of respondents. Respondents (12.0%) were of the opinion that both male and female prefer and use traditional agricultural technologies.

Therefore, it is obvious that women are more inclined to use indigenous knowledge.

The number of factors has been evaluated to reveal the differences in preferences and implementation of traditional agricultural technologies proposed by the following percentage of respondents:

1. Very few types of machinery equipment are more convenient for women, while other are suitable for men (44%).
2. The amount of energy to be used in a particular technology (21%).
3. Rural women have greater access to traditional technology than modern ones (29%).
4. The use is determined by the level of technological knowledge (18.0%).
5. The levels of gender involvement in agriculture production depending on other non-farm activities (65%)
6. Availability of indigenous agricultural technologies compared to modern ones is more significant (36%).

The findings of the study show that decision-making regarding agricultural production is made in cooperation between women and men (57.1%). Hence, 42.9% of the respondents mentioned that decisions on agricultural production process are made by a single individual.

Majority of the respondents (57.7%) declared that decisions regarding planting, harvesting and livestock care are taken by a single individual.

The above data revealed that men are usually regular decision-makers regarding breaking the land, weeding, marketing, and land preparation currently in Bangladesh. Reversely, women make decisions primarily in matters related to planting, clearing, and packing.

However, women are often consulted with men about land preparation. The study also explored the existence of some gender differences in the decision-making ability about the timing of management practices in farming.

As mentioned by the respondents, males are involved in decision making process in the activities as follows:

sale of produce (81%), purchase and repair (73%), weed control (72%), land preparation (78%), spraying (67%) and planting (61%) (Figure 4).

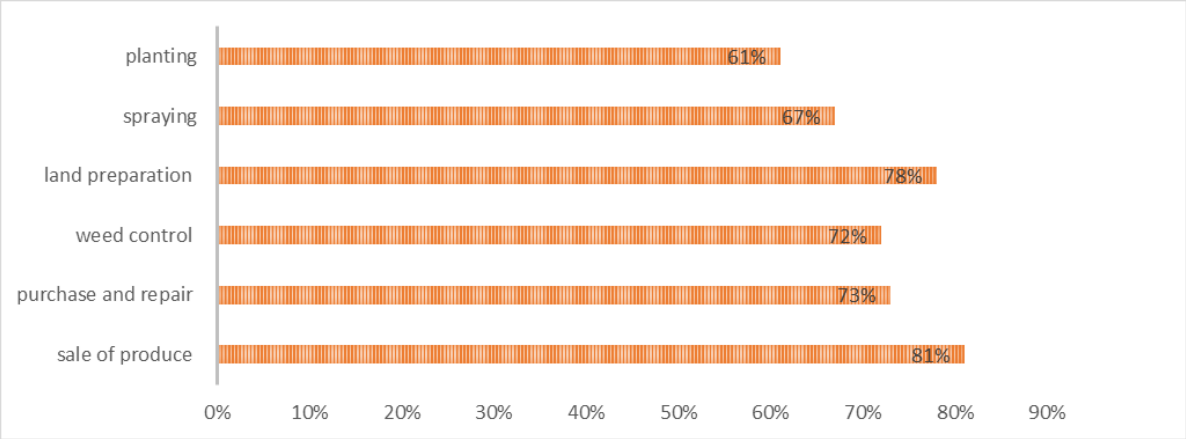


*Fig. 4. Percent of Male engaged in agricultural operation*
*Source: Field survey 2019*

On the other side, women respondents reported that they mostly did harvesting (87%), processing of product (79%), manuring for own crop field (45%) and weed control (58%) (Figure 5).

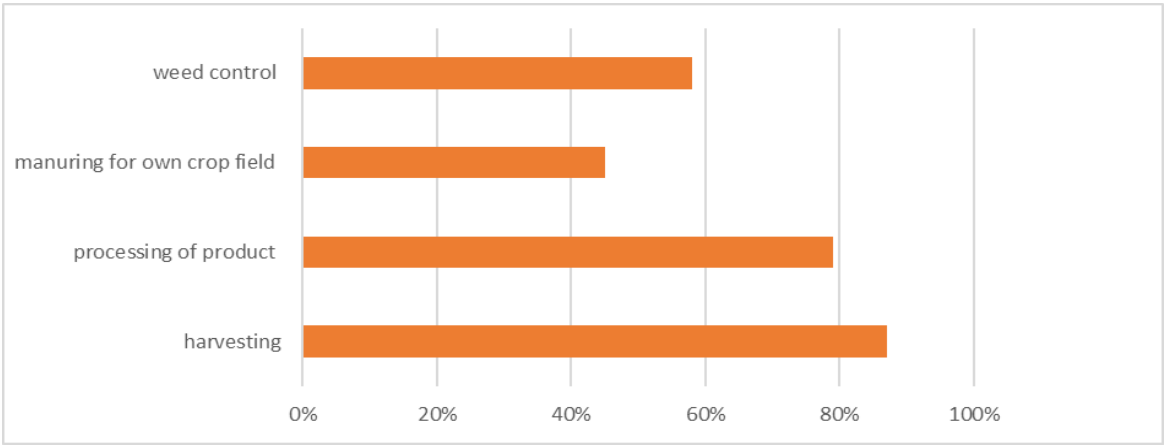


*Fig. 5. Percent of female engaged in agricultural operation*
*Source: Field survey, 2019*

The study also shows that 82 percent, 79 percent, and 72 percent of men have owned small equipment and thresher, Ox-plough, and power tiller while women own only 20 percent, 2 percent, and 5 percent respectively (Figure 6).

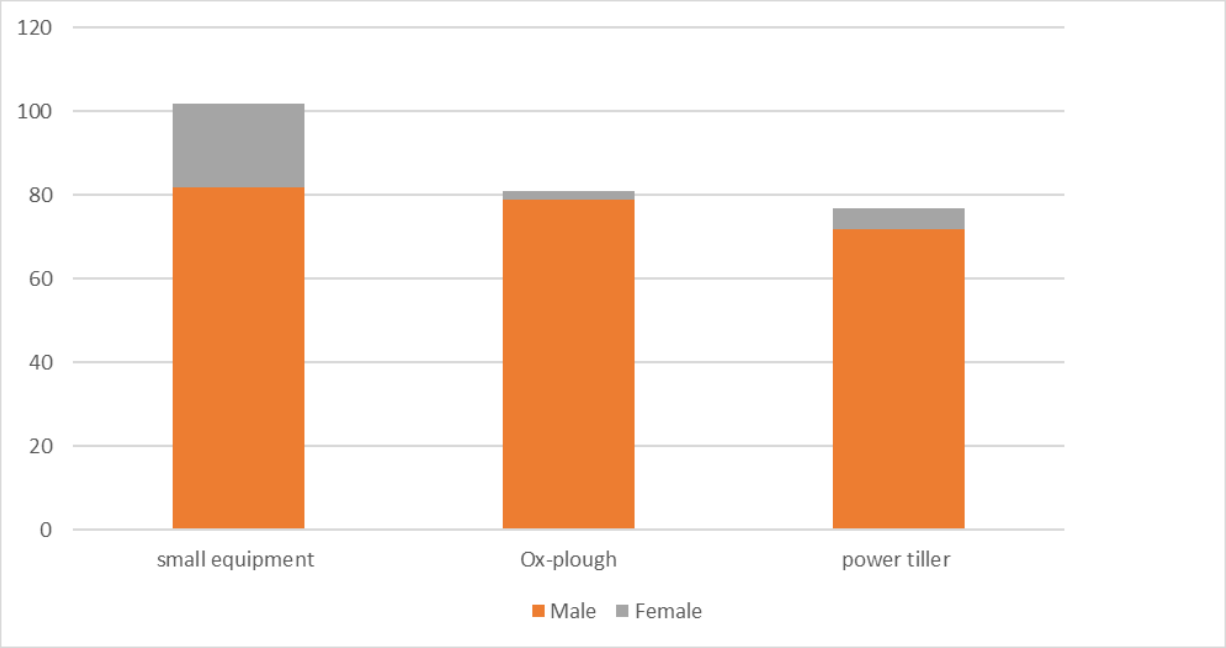


*Fig. 6. Gender access to modern agricultural technology*
*Source: Field survey, 2019*

Thus, it can be concluded that men have greater access to modern agricultural technology compared to women. Keeping in mind that men usually make decisions about the sale of agricultural products, and, generally, decisions on farming issues which require finance, it can be assumed that they most probably keep more returns from the farms than women. Hence, their benefits from the use of farm technologies are more significant.

### *The Pearson's Product Moment Correlation Coefficient*

The equation is – $Yi = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7 + .... \varepsilon i$

*Table 2. Pearson's Product Moment Correlation Coefficient for factors influencing income by using new technology*

| Variables | Coefficient | P-value |
|---|---|---|
| Constant | 6275.45 | .522 |
| Education ($X_1$) (Years of schooling) | .300 | .040** |
| Family size ($X_2$) (Number) | .16 | .03** |
| Farm size ($X_3$) (acre) | .140 | .382 |
| Experience of modern technology ($X_4$) (Years) | .492 | .000*** |
| Training on new technology ($X_5$) (Number of days) | .290 | .040** |
| Technological support from NGO ($X_6$) (yes/no) | .20 | .34 |
| Decision making ability to use the new technology($X_{7)}$ (yes/no) | .204 | .042** |
| Where, $Y_i$ = Income of respondents<br>$\beta_0$ = Intercept; $\beta_1$ to $\beta_7$ = Regression coefficients of the independent variables; and $\varepsilon$ = Disturbance term or error term | Observation = 190 | |

## Discussion

Findings of this research are in line with those of previous studies regarding education [46] and income [47-52] in Bangladesh.

Family size of respondents has a positive coefficient which is 0.16 and it is highly significant.

The respondents' experience in modern technology has a positive coefficient and it is 0.492. It was highly significant at 1percent level, which is evidence that more experienced respondents had a greater income.

The training on a new technology of respondents has a positive coefficient and it is 0.290.

It is significant at 5 percent level. It means that rural farmers training facilities have a great impact on their income. Further, decision-making abilities to use new technology also shows significant role on farmer's income in the study area and the coefficient is .204.

Technological supports from NGOs are not significant because they are free and farmers are not interested to accept it easily.

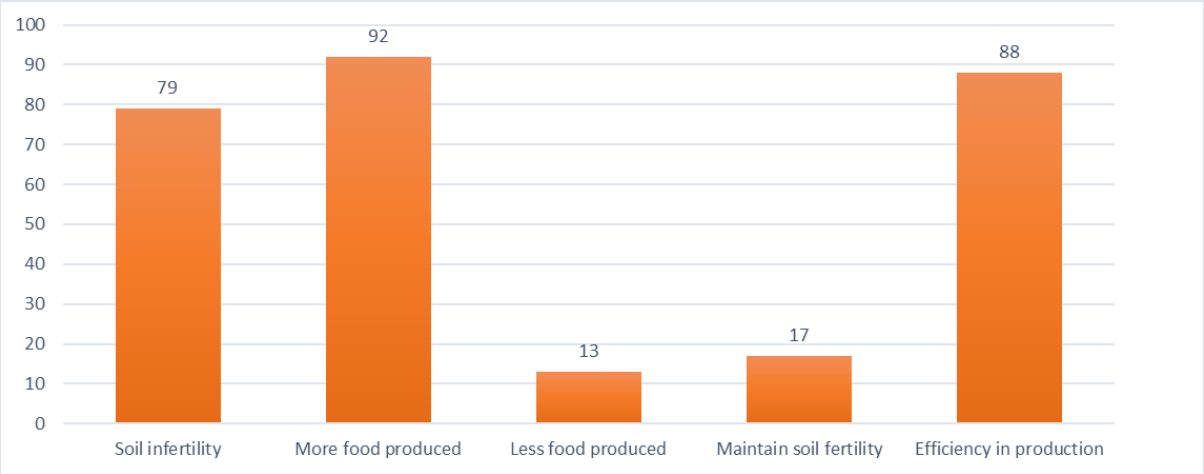


*Fig. 7. Effects of Modern Technology on Women in Agriculture*
*Source: field survey 2019*

The above data shows that 79 percent of the respondents noticed that soil quality is deteriorating due to modern technology though more food is produced, 88 percent agreed with the statement of remarkable increase of efficiency in production. A number of (87 percent) respondents reported workload has decreased. The adoption and use of different kinds of agricultural technologies do not depend on the gender of the household head. This is another null hypothesis which suggests that there are no noticeable differences in men- and women-headed households when it comes to adoption and use of the various agricultural technologies. Namely, both men and women adopt and use agricultural technologies almost equally and the agricultural technologies adopted and used in men-headed households, are similar to those used in the households headed by women (Figure 8).

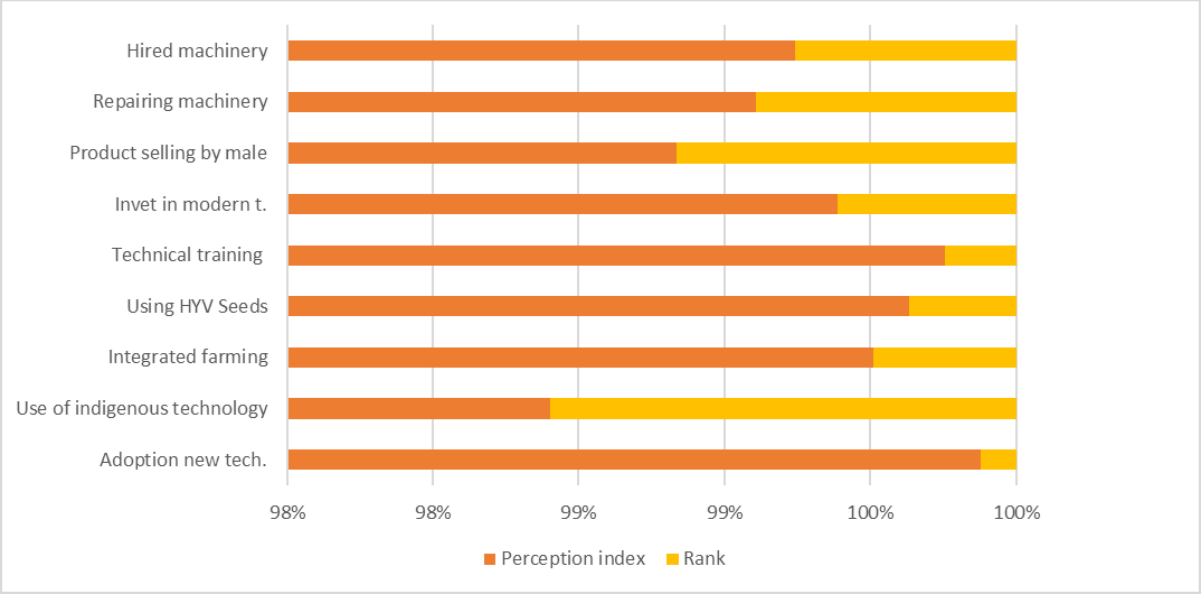


*Fig. 8. Gender perception index of respondents (GPI). (n=190)*
*Source: Field survey 2019*

In Bangladesh, mainly due to cultural constraints, women are often less engaged in the decision-making process. This research study was primarily focused on the analysis and synthesis of the pattern of respondents' involvement in decision making process as well as their perceptions in terms of agricultural technology inclusion. The level of gender involvement in the decision-making process has been measured by nine different scores given on the basis of the decision-maker. The results are shown in the above figure. It is obvious that the decision related to farming by adopting new technology reached the highest score of 823. The 2nd highest ranked decision is technical training on technology. Similarly, the 3rd ranked decision is adoption in HYV where the lowest rank score is on the use of indigenous technology; meaning that most of them prefer modern technology in terms of productivity. In rural society, most of the decisions about farming are predominantly made by men. The only exceptions are the decisions related to selling or buying some homestead products (like chicken, ducks, eggs, etc.), which are usually made by women. Therefore, comparison with other surrounding countries (India, Pakistan and Nepal) shows that in Bangladesh women play an insignificant role in the household decision-making process and have limited access and control over household resources in terms of physical and financial assets. Further, heavy domestic workloads, limited mobility, lack of education and cultural issues contribute to women's vulnerability [53-56].

**Gender-based challenges for agricultural technology**

- Lack of technical knowledge on farm equipment and machine.
- Most of the machinery and equipment are male friendly.
- High price of HYV of machinery/equipment.
- Societal barriers due to being female.
- Lack of family and community support.
- In some instant physically unfit.

**Suggested approaches to close the gender gap in machinery service provision**

- Improve the local availability of agricultural technologies and create market facilities.
- Enhance women's control regarding the technology's benefits.

- Carry out a gender and value chain analysis encompassing male and female roles, responsibilities, and activities on specific crops.
- Observe the effects of agricultural technologies on labour and time-use from the gender perspective.
- Build institutional arrangement where women are allowed all kinds of facilities.
- Design training strategy and technical facilities that consider women's time constraints.

In addition, it may enhance the development of technologies which will contribute to reducing women's workload burden, increase agricultural incomes, save costs and time, and generally improve the quality of life for farm families and communities. Finally, the gathered data and information could also be generalized to areas that share similar characteristics, with the assumption that the appropriate technology will be directed to the right demographic audience during program output realization.

## Conclusions

Overall development of the socio-economic situation of Bangladesh fully depends upon the development of the rural areas. Rural women in Bangladesh are facing adverse conditions in terms of social oppression and economic inequality [57, 58]. Namely, they are deprived of many human rights [59]. Their discrimination cannot be separated from the problems of rural Bangladesh [60, 61]. In line with this, it is necessary to support initiatives aimed at gender equality and women's empowerment in rural Bangladesh [62, 63] because [64] the woman is an essential part of society in its public and private fields, and its present and future.

As to the farming activities in the study area, both men and women are engaged in the decision-making process related to the various farm management issues, such as farmer's purchases, marketing, and farming techniques. Women are also participating in crop and vegetable production, post-harvest activities and preservation techniques, livestock and poultry rearing, and other activities. It is also discovered that certain decisions in the household are made by men while others by women or women headed households. The use and adoption of various agricultural technologies in the context of gender-related issues and access to these technologies are closely linked. Compared to men, rural women have limited access to advanced agricultural technologies in farming and consequentially use more traditional technologies. Furthermore, it has been confirmed by the study that rural women face physical and economic constraints in terms of access to modern techniques of farming.

According to our research results, we can recommend the following measures as follows:

- Address specific resources for gender capacity-building to leading gender focal points and gender facilitators, as well as to their operational counterparts and specialists.
- Encourage awareness among consultants or the field operating team about the significance of addressing gender-related issues to develop technology and promote innovation that benefits both men and women.
- Build the capacity of different stakeholders and the field operating team on tools and methods for achieving gender equality.
- Raise awareness among researchers and decision-makers of the importance of mainstreaming gender in order to help develop the adoption of technology and promote innovation.

## Limitations of the study and possible future research avenues

The results presented in this study should be considered in the light of a number of limitations. At the first-place sample is a relatively small. We pretended to have more respondents, but it was impossible to achieve this goal, because it was difficult to find farmers in rural areas who were ready to participate in interviews. Future research can be carried out on a larger sample and other locations with a similar methodological approach. Comparing results from different locations, we can get better insight into the whole issue throughout the country. In addition, further research in gender and adoption of agricultural practices and technologies would be useful in the areas such as understanding changes in gendered innovation processes in relation to changes in women's access to knowledge and resources as well as participation in the household decision-making process.

### *Acknowledgments*

Ministry of Science and Technology, Government of the People's Republic of Bangladesh and the Ministry of Education, Science and Technological Development, the Republic of Serbia.

### *Conflicts of Interest*

The authors declare no conflict of interest.

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**Article history:**
Received 26 September 2020
Accepted 15 November 2020

ORIGINAL RESEARCH PAPER

# ASSESSMENT OF THE INFLUENCE OF INNOVATION AND IT MARKETS ON THE PARAMETERS OF THE REGIONAL ECONOMY

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## Abstract

The significant increase in the influence of innovation and information technologies in the modern world, including on economic processes, their constant interaction with classical markets of production factors, and accordingly the need to develop a methodology for assessing their mutual influence - all this has determined the purpose and tasks of research.

The article discusses the features of markets mutual influence of innovation and information technologies, as well as their impact on the economy of the region. Based on the conclusions, a methodology for quantifying this influence is proposed, which is characterized by simple and convenient application in the implementation of state regulation of the regional economy. The study is based on the analysis of statistical data for more than 20 years of the economy development of the Russian Federation and the Republic of Tatarstan and is highly representative. The results of the study allowed justifying the theoretical approach, to develop methodological and practical recommendations on diagnostics, assessment and forecasting of the impact of the two most important components of the modern industrial revolution 4.0 – innovation and information technologies – on the stability and balance of the regional economy. The main product of the study is the system functional multi-sector model of the regional economy, which allows solving all the above-mentioned problems and problems in an optimal way.

*Keywords: Development Economics, Macroeconomics, Innovation Market, IT Market, Regional Economy*

**JEL: O10**
**UDC: 005.332:001.895**
**332.14(470.41)**
**COBISS: SR-ID 28616457**

## Introduction

The relevance of the study is due to the set of currently existing characteristic features of the functioning of both Russian and a number of similar economic systems.

Firstly, the high degree of the process's instability taking place in the national economy.

Against this background, traditional tools for analyzing the economic situation do not allow a full picture of the changes taking place. In turn, the high turbulence of the processes

taking place in the economy does not allow to ensure the construction of high-precision forecasts of the situation development and to carry out informed regional planning on the basis of them.

Secondly, there is insufficient clarity in the nature, mechanics, development and fading of imbalances and crises in the economy. These circumstances and non-monetary development cycles also add to the complexity of forecasting and planning processes.

Thirdly, in the light of the shift in the overall paradigm of global economic growth under the influence of the Fourth Industrial Revolution and the trend towards increased technologization and digitalization of various spheres of life, it is particularly important to determine the degree of interdependence of the functioning of regional economic systems from the sustainable development of innovation and information technology markets.

Thus, the study is aimed at developing a holistic vision and methodological tools for systemic multi-sector diagnostics of processes taking place in the regional economy, as well as an assessment of the mutual relationship between the most important parameters, which allows to explain the nature of "disturbances" in the regional economy in order to ensure the implementation of effective, adaptive, productive economic policy.

Analysis of classical and modern economic literature shows that problems of diagnostics, assessment and forecasting of influence of various economic phenomena on the balance of economic development of regions were quite widely considered both by foreign and domestic scientists. Existing theories and approaches to diagnosis, prediction, and management are based, in their bulk, on the methodology and approaches developed by J.M. Keynes [14].

Later, the model of economics by J.M. Keynes was developed in the writings of J. Hicks, A. Hansen, diverse approaches to the methodology of macroeconomic modeling were considered by the classics of economic thought: F. Kane, A. Marshall, L. Valras [17], V. Pareto, P. Samuelson [21], and Nobel Prize winners: R. Frisch, Y. Timbergen, S. Blacksmith, L. Klein, R. Solow, L.S. Schepley, E.E. Roth, W. Nordhouse, K. Shell.

A comprehensive analysis of the Russian economic literature to establish the existence of a systematic approach to assessing and predicting the mutual influence of various economic phenomena (especially with regard to the impact of innovation and information technologies on the sustainability and balance of the development of the modern economy) has revealed significant reserves in this area. Some aspects were covered in the works of S.A. Ashmanov [3], A.G. Aganbegyan, L.E. Basovsky [4], a little earlier – in the fundamental research of A.G. Granberg School, G.B. Kleiner School [15], in the works of V.V. Yegorov, M.R. Safiullin [20], S.A. Dyatlov [5], etc. Regional problems in the field of assessment of mutual economic phenomena were touched upon in the works of A.A. Anohin, V.P. Mozhin [19], in the studies of the Institute of Regional Economics Problems of the Russian Academy of Sciences, the Center for Advanced Economic Studies of the Academy of Sciences of the Republic of Tatarstan, the Institute of Social and Economic Research of the Ufa Federal Research Centre of the Russian Academy of Sciences, etc. Issues of scientific, technical and innovative activity were considered by G.A. Untura, A.E. Kogut, etc. [16]. The system of regional reproduction is analyzed, for example, in the works of A.I. Dobrinin, A.S. Marshalova and A.S. Novoselova.

Despite the significant contribution of scientists to the development of theoretical and methodological foundations of the influence of innovation and information technologies on the development of the modern economy, it should be emphasized that these issues have not been widely covered in modern literature, especially in Russian literature.

The study is aimed at the development of a holistic simulation and methodological tool for the construction of systemic multi-sector diagnostics of processes taking place in the regional economy, as well as an assessment of the mutual relationship between the most important parameters, which allows to explain the nature of "disturbances" in the regional economy in

order to ensure the implementation of effective and productive economic policy. In this regard, we propose to use a modification of the system functional model of the market economy – a system functional multi-sector model of the economy considering the innovation market and the information technology market. The functioning general principle of the system functional multi-sector model of the market economy is shown in Figure 1.

The proposed new simulation tools allow to integrate cost, quantitative and qualitative characteristics of the innovation and information technology market into the modern economic system, which makes it possible to fully understand the nature, relationship and multiplicative wave effects of the interaction between the output of innovative products, inflation, employment, involvement of fixed production funds, investment processes on the volume of innovative products output. We believe that the proposed approach is a holistic concept of determining the place and role of the innovation and information technology market in the interaction system of classical markets, based on 14 new stable inter-market segments.

The identified new inter-market segments can be conditionally divided into three main groups: innovative inter-market segment, IT segment, innovation and information inter-market segment.

The innovative inter-market segment is an area of interaction and interplay between the innovation market and classical markets in the economic system.

IT-segment is formed due to the mutual relationship and resulting interdependence of the information technology market and classical markets.

Innovation and information inter-market segment is formed in the zone of interaction and interaction between the innovation market and the information technology market.

## Specifics of Functioning of the System Functional Multi-Sector Model of the Regional Economy

The functioning of the innovative inter-market segment is determined by the interaction of the following identified new factors of interaction between the innovation market and classical markets.

The first inter-market segment was called the innovative return of fixed assets. It is a relationship between the capital market quantity (value of the fixed assets) and the innovation market value (volume of innovation output).

The next new segment is the impact of innovation prices, which describes the interdependence of innovation output and inflation. This segment is a consequence of the interaction between the innovation market and the commodity market.

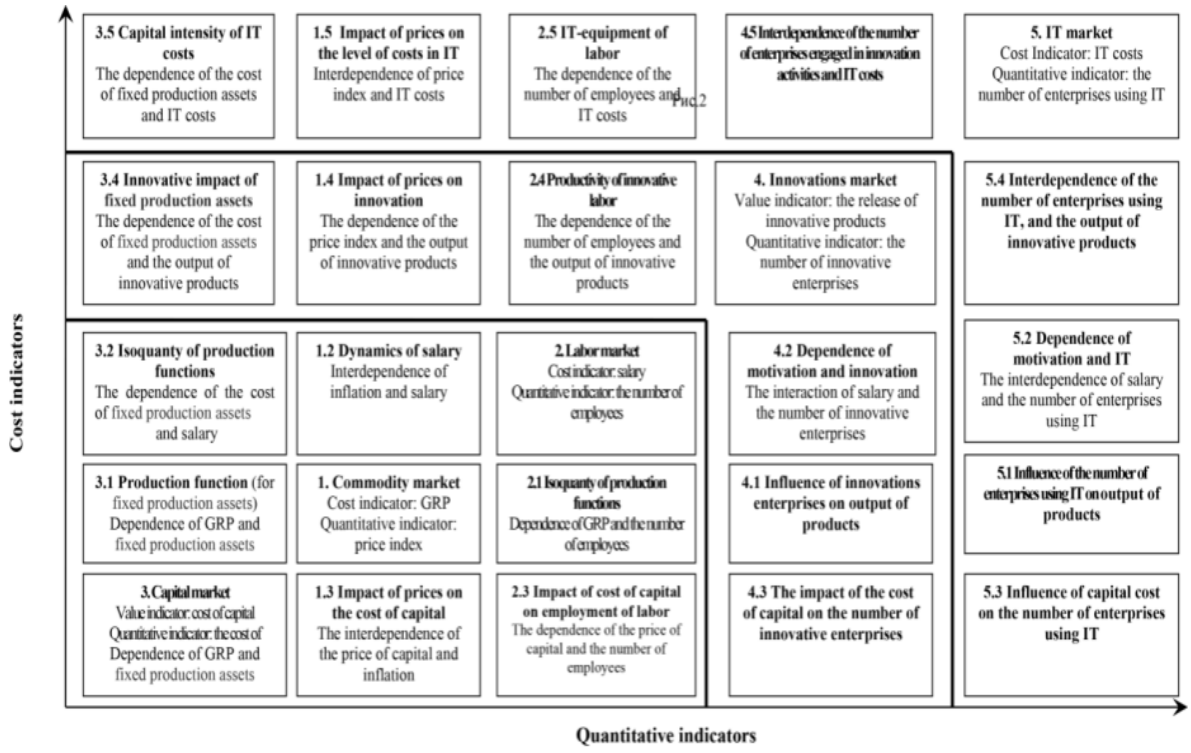


*Fig. 1. The principle of functioning of the system functional multi-sectoral model of the regional economy*

The innovation market here is represented by its value indicator – the volume of innovative products production, and the commodity market is represented by a quantitative indicator – the inflation rate.

Such a new inter-market segment as productivity of innovative labor determines the mutual relationship between the number of employees and the volume of output of innovative products. In this case the interdependence of the market of innovations and its cost index (release of innovative products) and also the market of labor and its quantitative index (the number of labor) works.

The dependence of innovation and motivation, which is also among the new inter-market segments, is the interaction of the quantitative indicator of the innovation market – the number of innovative enterprises and the value of the labour market – the level of wages.

Another new segment in the innovative inter-market space is the impact of the number of innovative enterprises on the volume of production of the total product. This segment is formed as a result of interaction of quantitative indicator of innovation market (number of innovative enterprises) and value indicator of commodity market (volume of produced products).

The last new inter-market segment in the innovative inter-market space is the impact of the cost of capital on the number of enterprises using innovation. Accordingly, the indicators forming it are the number of enterprises using innovation (quantitative indicator of the innovation market) and the rate of interest (value indicator of the capital market).

Analysis of the formation and functioning of innovative inter-market space will allow determining the peculiarities of the reproduction process of innovation both of the region and the country, to give an economic and mathematical description of the identified interdependence and to make appropriate recommendations in terms of the formulation of the main provisions of economic policy.

The development and construction of a system functional multi-sector model of the economy considering the innovation market and the information technology market allowed to identify, along with innovative inter-market space, another important such element – IT-

space. IT-space is formed due to functioning and interaction of information technology market (IT-market) and classical markets of factors of production.

The developed new concept of determining the interplay of the information technology market and classical markets describes the interaction of the following discovered new factors:

1. Capital intensity of IT expenses. It is a relationship between the capital market quantity (value of the fixed assets) and the value of the information technology market (cost of information technology);
2. The interplay of the IT price and cost index. As in the innovation space, this segment is a consequence of the interaction between the commodity market and the information technology market. The commodity market here is represented by a quantitative indicator – the inflation rate, and the IT market – by its value indicator – the volume of IT costs;
3. IT-armament of labor is the dependence of the number of employed and costs of IT, which are a quantitative indicator of the labor market and a value indicator of the information technology market, respectively;
4. The interdependence of motivation and the number of enterprises using IT is the mutual relationship between the number of enterprises using information technologies (a quantitative indicator of the IT market) and the level of wages (a value of the labour market);
5. The impact of capital costs on the number of enterprises using the IT-inter-market segment, which is a relationship between the quantitative indicator of the information technology market and the value of the capital market;
6. The impact of the application of information technologies on the volume of production of the total product reflects the results of interaction between the information technology market (and its quantitative indicator – the number of enterprises using IT) and the commodity market (and its value – the total volume of produced products).

Analysis and evaluation of the identified new inter-market segment with the participation of the information technology market will make it possible to draw a conclusion on the trajectory of development of information technology markets in the national and regional economy. The construction of a modified IT-market inclusion system model of the economy of the Russian Federation will make it possible to identify more stable interaction between the capital market and the IT-market than similar interaction in the regional economy of the Republic of Tatarstan.

The use of a modified system functional model of the economy as a tool for assessing the impact of innovation and information technology markets on the economy of the region, allowed determining how these markets actually interact and how this interaction will develop in the forecast period. In the course of the study, the following new zones of intermarket interaction were proposed and justified, which are part of the innovation and information intermarket space formed in the zone of interaction and interaction between the innovation market and the information technology market: interdependence of the number of enterprises engaged in innovation and costs in IT; and the interdependence of the number of enterprises using IT and the output of innovative products.

The relationship between the number of enterprises engaged in innovation and the costs in IT arises from the interaction between the IT-market value (IT costs) and the innovation market quantity (the number of enterprises engaged in innovation). The inverse interdependence of the IT-market quantity (the number of enterprises using IT) and the value of the innovation market (the volume of production of innovative products) give us the interdependence of the number of enterprises using IT and the production of innovative products.

In order to present our theoretical and methodological provisions in a visual form and to work out their main directions, we will calculate the system functional multi-sector model of the economy with the inclusion of the market of innovation and information technologies, presented in the next section of the study.

## Innovation Market in the System Functional Multi-Sector Model of the Regional Economy

In the previous sections of the study, we have described a new simulation toolkit that allows for the organic integration of the cost, quantity and quality characteristics of the innovation market into the modern economic system. We believe that this will make it possible to better understand the nature, relationship and multiplicative wave effects of the interaction between the production of innovative products, inflation, employment, the involvement of fixed production funds, investment processes on the volume of production of innovative products. Consider the proposed holistic concept in order to determine the place and role of innovation market in the system of interaction of classical markets, having built a system functional multi-sector model of a market economy with the innovation market inclusion for the economy of the Republic of Tatarstan (Figure 2).

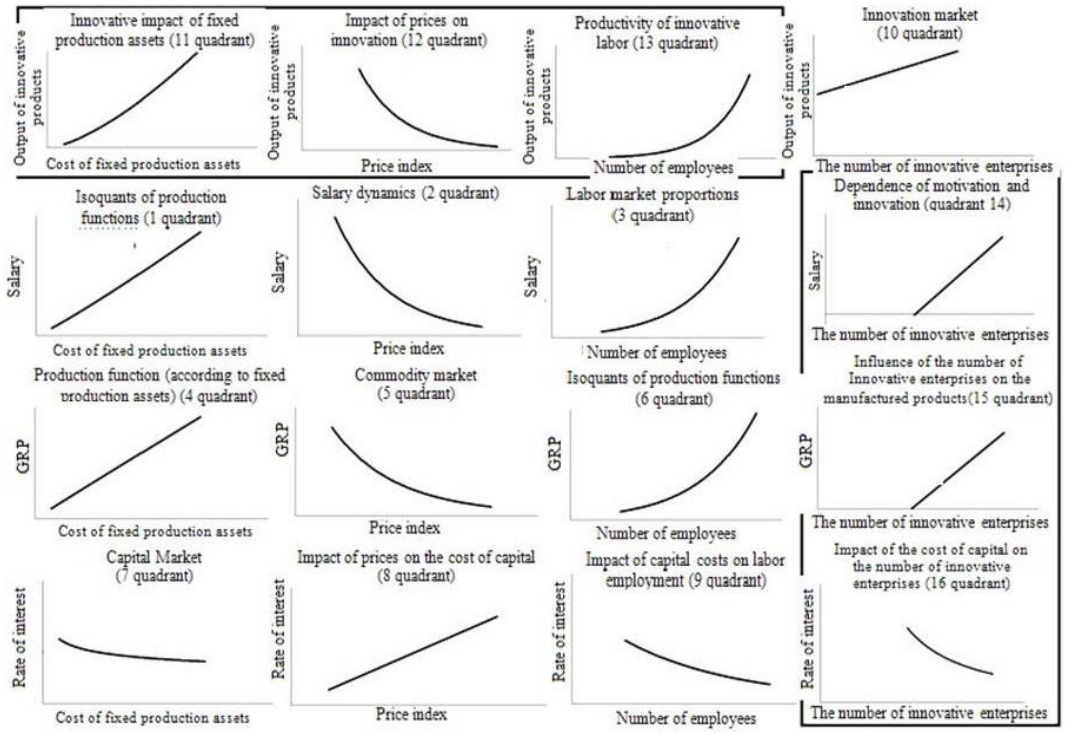


*Fig. 2. General view of the system functional multi-sectoral model of the economy of the Republic of Tatarstan considering the innovation market*

The figure shows new segments in the inter-market innovation space. We will analyze the formed segments and the market of innovation in the regional economy.

The innovation market (10 quadrants) is characterized by a high degree of dependence (R2 = 0.7799) of the production of innovative products and the number of innovative enterprises, unlike the innovation market of the Russian Federation, and is described by a linear function:

$$y = 0{,}1867x + 99{,}716 \quad (1)$$

Where: y – Volume of innovation products output;

x – Number of innovative enterprises.

It can be noted that with the increase in the number of innovative enterprises, the volume of production of innovative products is also increasing. In general, this conclusion is quite logical and presents a wide range of opportunities in the regulation of the innovation market.

In the analysis of the interrelationship of the innovation return of the fixed assets (value of the fixed assets and volume of the innovation output (11 quadrant)), it can be noted that the dependence is stable (R2 = 0.9214) and is described by the power function:

$$y = 7E\text{-}08x1{,}4811 \quad (2)$$

Where:

y – Volume of innovation products output;

x – Fixed assets cost.

The increase in the value of the fixed assets causes a steady increase in the volume of innovative products, and at a higher rate. This makes it possible to influence the output of innovative products by varying some aspects of the management of fixed assets (e.g., depreciation policies).

The interdependence between the output of innovative products and the price index, representing the impact of prices on innovation and presented in the 12 quadrants, is represented by the power function:

$$y = 1516{,}2x^{-26{,}05} \quad (3)$$

Where:

y – Volume of innovation products output;

x – Price index.

and has a low approximation ratio (R2 = 0.5376), indicating that an increase in the price index may not necessarily lead to a drop-in innovation output.

The productivity of innovative labor or the revealed interdependence of the number of employed and the volume of output of innovative products (13 quadrant) looks transparent: as the number of employed in the economy increases, the volume of output of innovative products increases and vice versa. This relationship is stable, as evidenced by a relatively high approximation coefficient (R2 = 0.7205):

$$y = 3E\text{-}100x^{31{,}217} \quad (4)$$

Where:

y – Volume of innovation products output;

x – Number of employees.

Thus, it can be concluded that varying the level of employment in the economy can also influence the innovation of products produced in the region.

It should be noted that the value of the impact of the innovation market on the regional economy of the Republic of Tatarstan has achieved relatively stable results, unlike the national economy of the Russian Federation. However, the quantitative indicator – the number of innovative enterprises – revealed a low-stable level of dependence on the market introduced into the model and the classical system model.

Consider the dependence of motivation and innovation, represented by the mutual relationship between the number of innovative enterprises and the wage (14 quadrants). Our research has shown that with the increase in the number of innovative enterprises, wages are also increasing in linear mathematical dependence:

$$y = 321{,}75x - 27739 \quad (5)$$

Where:

y – Salary;

x – Number of innovative enterprises.

However, the approximation ratio is relatively small here (R2 = 0.7361), which does not reveal clear control tools in this combination. The narrow capacity of government statistics in the field of accounting for the innovation market does not give us additional opportunities to

find other tools that could be incorporated into the systemic functional model of the market economy, considering the innovation market.

A similar situation is observed in the analysis of the impact of the number of innovative enterprises on the produced products (15 quadrants):

$$y = 19509x-2E+06 \quad (6)$$

Where:

y – The volume of the made products;

x – Number of innovative enterprises.

The study found that the growth of the number of innovative enterprises causes an increase in the volume of produced products, but a sufficiently high value of the approximation coefficient (R2 = 0.7559) suggests that an additional instrument of influence on the state of the economy of the republic has been formed.

In the analysis of the impact of the cost of capital on the number of innovative enterprises (16 quadrants), an unstable ($R^2 = 0.4583$) interdependence was revealed, which describes the power function:

$$y = 12209x-1,422 \quad (7)$$

Where:

y – Interest rate;

x – Number of innovative enterprises.

The reduction of the rate of interest causes an understandable growth of the number of innovative enterprises, which certainly gives clear guidelines in the formation of credit policy of the region.

With the help of the system functional multi-sector model of the market economy, empirical significant differences of national and regional inter-market spaces have been revealed, and it has been proved that the growth of the number of innovative enterprises is observed with the simultaneous reduction of wages and production volumes in the Russian Federation, which indicates a pronounced imbalance in macro-development, when innovation and their development do not have a serious impact on the development of the economy.

## Information Technology Market in the System Functional Multi-Sector Model of Regional Economy

On the basis of the new simulation tools proposed in the previous sections of the dissertation study, we have identified an additional new functional inter-market segment – IT-segment, characterized by stable relationships of cost, quantitative and qualitative parameters of the information technology market and "classical markets". Within the framework of the identified new inter-market space, we have developed and justified a new mechanism for determining the place and role of the information technology market in the system of interaction between classical markets.

In order to characterize the peculiarities of the reproduction process of the region and the country and the economic and mathematical description of the identified interdependence, we will build a system functional multi-sector model of the economy, including the information technology market.

We will analyze the formed segments and directly IT-market in the regional economy (Figure 3).

The 10-quadrant information technology market is characterized by the following key aspects: With an increase in the number of enterprises using information technology in their operations, the total cost of IT has a marked tendency to increase. In the mathematical expression, this relationship can be mapped as a linear function:

$$y = 0{,}0735x + 3177 \quad (8)$$

Where: y – Costs of IT;

x – Number of enterprises using IT.

This relationship is quite stable: R2 = 0.7909.

In addition, there are persistent (R2 = 0.9722) relationships between the IT market and the capital market (11 quadrant), represented by the capital intensity of IT costs. As the cost of fixed assets increases, IT costs are expected to increase in the following proportion:

$$y = 1E\text{-}05x^{1,4176} \quad (9)$$

Where: y – Costs of IT;

x – Fixed assets cost.

This phenomenon can be explained by the fact that the increase in the share of the use of information technologies contributes to the partial removal of fixed assets from the production process, which leads to an increase in the level of technological efficiency of the products.

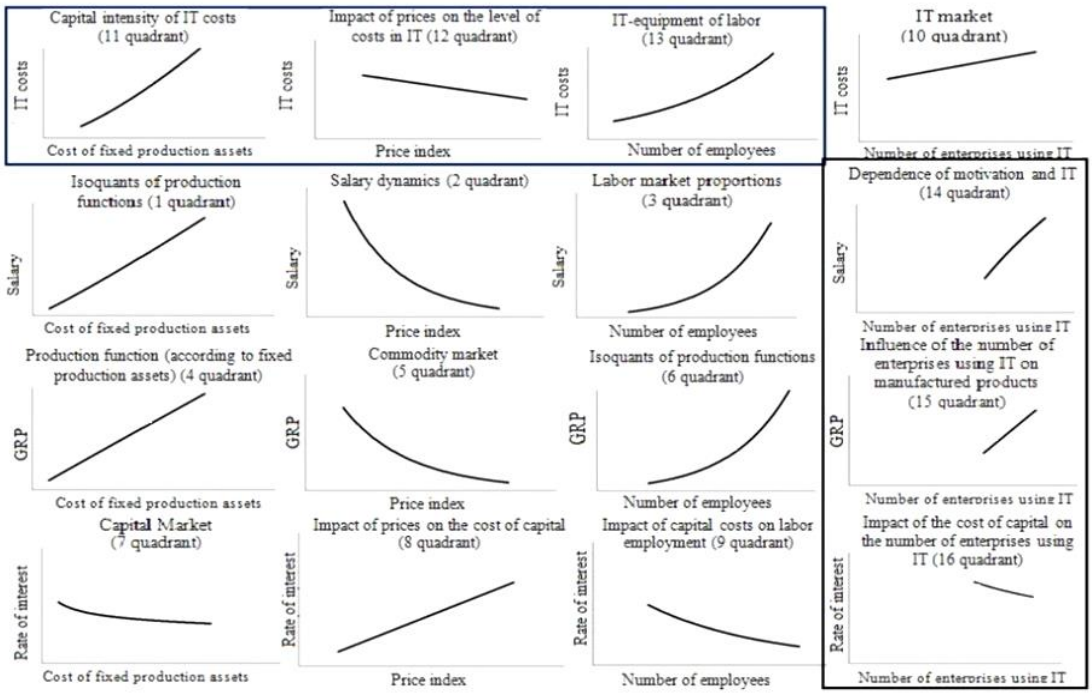


*Fig. 3. General view of the system functional multi-sector model of the economy of the Republic of Tatarstan, including the IT market*

In the analyzed period there is a very weak (R2 = 0.079) relationship between the index of prices and the level of costs for information technologies (12 quadrants), displayed by the indicator of the impact of prices on the level of costs in IT:

$$y = -83033x + 104169 \quad (10)$$

Where: y – Costs of IT;

x – Price index.

However, there is a downward trend in information technology costs as the price index increases.

Analysis of the obtained segment of IT-armament of labor showed that with the growth of the number of employed in the economy there is an increase in the level of costs in information technologies (13 quadrant):

$$y = 3E\text{-}51x^{16,738} \quad (11)$$

Where: y – Costs of IT;

x – Number of employees.

However, this dependence is unstable because the approximation factor is 0.282. Here, as in the case of fixed production funds, we can deal with the complication or simplification of the technological chain.

It should be noted that the interlinkages between the information technology market and its value index and classical markets in the economy of the Republic of Tatarstan are mainly low-tolerance, which does not allow to rely fully on established dependencies in planning and forecasting the actions of the authorities in the field of economic regulation.

We will analyze the relationship between the quantitative indicator of the information technology market and classical markets.

In the analyzed period there was a rather stable (R2 = 0.9734) dependence of motivation and IT (level of wages and number of enterprises using information technologies in their activities), presented in the 14th quadrant. This dependency is described by the logarithmic function:

$$y = 50413ln(x)-400672 \quad (12)$$

Where: y – Salary;

x – Number of enterprises using IT.

At the same time, the increase in the number of enterprises using IT causes wage increases.

Stable dependence (R2 = 0.944) is also observed in the analysis of the impact of the number of enterprises using IT on manufactured products (15 quadrants):

$$y = 703,18x-2E+06 \quad (13)$$

Where: y – The volume of the made products;

x – Number of enterprises using IT.

According to the data received, the more enterprises resort to the use of information technologies in their activities, the more products are produced in the Republic. This conclusion, in our opinion, is one of the most important results of work on the introduction of new markets into the systemic model of the market economy.

Finally, in the 16 quadrants of the system model of the market economy with the inclusion of the IT market, there is a low (R2 = 0.2716) level of the cost influence of capital on the number of enterprises using information technologies in their activities:

$$y = 787,47x^{-0,531} \quad (14)$$

Where: y – Interest rate;

x – Number of enterprises using IT.

However, with the reduction in the percentage rate, the number of such enterprises is increasing.

This fact should not be ignored in the forecasting of the economic situation and public planning.

## Conclusions

In the system functional model of the economy with the inclusion of the innovation market and the IT market, a number of main trends can be traced.

Thus, it can be noted that in general, the model for the Republic of Tatarstan shows less stable interdependence of IT-market and classical markets in the regional economy compared to the national economy. First of all, it concerns the relationship between quantitative indicators of IT-market and classical markets, where in the national economy there is stable interdependence, and in the regional economic system along with stable (dependence of motivation and IT, the influence of the number of enterprises using IT on produced products) interdependence there is low stability – influence of capital cost on the number of enterprises using IT.

Despite the presence of low-tolerance and unstable interdependence in models, the following leverage can be distinguished from the above in the system functional multi-sector model of the economy, including the innovation and IT markets.

First, the sustainable production function of the innovation market suggests a close relationship between the volume of innovation output and the cost of the fixed assets. It can also be surely argued that the growth of the number of employees in the economy allows increasing the output of innovative products (stable ratio of isoquant of production function).

In addition, there is a rather strong dependence of the innovative products output on the price index.

The identified relationships of the information technology market when it is included in the system functional model of the market economy make it possible to speak about the following key leverage. First, confident interdependence was evident in the construction of the IT-market production function, which indicates an increase in information technology costs with an increase in the cost of fixed assets. In addition, there is a steady dependence of wages on the number of enterprises using IT: the increase in the number of such enterprises causes wage increases and vice versa. In addition, the number of enterprises using information technologies affects the volume of produced products: the growth of such enterprises causes an increase in the volume of production in the republic. These conclusions make it possible to make appropriate adjustments to the process of forming recommendations on the construction of the economic policy of the Republic of Tatarstan.

***Acknowledgements***

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

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**Article history:**
Received 16 September 2020
Accepted 18 November 2020

SCIENTIFIC REVIEW

# ASSESSING THE IMPACT OF BLOCKCHAIN TECHNOLOGIES ON THE NATIONAL ECONOMY: METHODOLOGICAL APPROACHES AND THEIR TESTING

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## Abstract

Despite the very high interest from international and national financial institutions, and also enterprises from the real sector of the economy demonstrated in the distributed data storage technology, studies on the problems of assessing the use of the blockchain platform potential in the socioeconomic environment, and their theoretical understanding can be met vary rarely. As a rule, existing works reveal either the technical side of the study object or the regulatory or legal aspects of the applicability of blockchain technologies in the national economy. In this regard, this work attempts to overcome this conditional vacuum of understanding in order to make up for conditions with questions revealing other aspects of the research subject, for example, such as the economic and social effects of introducing blockchain technologies into the activities of business entities. A formalized assessment and scenario modeling of the dynamics of GDP growth in the new institutional business environment is carried out on the basis of the emerging effects assessment caused by the integration of distributed data storage technologies into the system of business operations.

*Keywords: scenario model, economic growth, blockchain, economy's financial sector, GDP, process management, credit risks*

*We would like to thank you for the help in the arrangement of the article to the members of the scientific project sponsored by the RFBR No. 18-010-00536*

**JEL: E40**
**UDC: 005.591.6:330.34**
**COBISS.SR-ID 28644873**

## Introduction

Similar to how the digitalization of the socioeconomic environment destroys traditional areas of business (for example, digital channels replaced analogue ones), blockchain technologies can significantly transform existing business processes, including in the financial sector, thereby continuing to develop the FinTech paradigm. In modern economic conditions, the financial market integrated into the global economy is of fundamental importance for the

development of the national economic system. The financial market generates hundreds of billions of roubles daily in all kinds of transactions and payments. The volume of electronic payments per year in Russia reaches the level of 1566 trillion roubles (according to data for 2019 [1]).

Realizing the significance and function of blockchain, it is worth mentioning that in spite of the contradictory strategies and opinions of specialists about the practicability and likelihood of applying blockchain technologies in the economic turnover of the economy, individual states are progressing and extending alongside the blockchain evolution route. As a clear instance, it can be mentioned the PRC, where from May 2020 on, the national cryptocurrency of China's Central Bank (DCEP) has been implemented into circulation [4].

From 2020 on, Chinese banks will utilize distributed ledger technology to register accounts, get payments as well as additional goals [5].

Generally speaking, depending on the policies and requirements established forth above, it is worthwhile to mention that blockchain technologies hold a doubly high potential level to optimize the functioning of the economy through decreasing transaction expenses related with:

- Data storage and accounting;
- Look up information regarding counterparties;
- Synchronization of heterogeneous information resources;
- Shift to business patterns with the least mediation level;
- Decrease of financial risks losses stemmed from the usage of incorrect data;
- Automation of business processes on the basis of using smart contracts;
- Shift to a decentralized plan to store and process data;
- A reduction in financial crime level as a consequence of the invariance of data on performed transactions;
- Decrease of time to process databases including actively evolving information concerning assets (transactions time, their owners, value)

It is important to emphasize that methodologically, the study relies on an analysis of the growth in the efficiency of the financial sector of the economy under the influence of the penetration of blockchain technologies through the prism of accounting and evaluating the improvement and optimization of its operational processes. This aspect is highlighted due to the fact that, in our opinion, the study of the blockchain technologies influence on the financial environment and the national economic system as a whole can be built on the basis of two main hypotheses. One of them is based on the hypothesis that distributed data storage technologies create effects that are generated as a result of lower transaction costs for financial transactions. This effect is caused by the potential to reduce intermediary links in on-going transactions that are being formed as part of the use of peer-to-peer blockchain systems (PPBS).

The second hypothesis determines the growth of the functioning efficiency of the financial sector of the economy due to the optimization of operational processes in credit organizations, which forms the basis for reducing (minimizing) credit and operational risks.

## Methods

At the first stage, scenario analysis of the impact of distributed data storage technologies on the effect of the GDP growth dynamics as a consequence of the transition of financial transactions to the blockchain environment was carried out, thereby forming a new type of financial relationship based on the use of crypto transactions.

Further, the scenarios of "blockchain transformation" of the economy and the transition of the financial transaction market to the crypto-blockchain environment were arranged so as to develop prognostic evaluations of the crypto transactions effect on the parameters and stability of GDP improvement (Table 1).

*Table 1. Scenario examination of commission earnings adjustment to credit organizations as a consequence of the financial system transition to crypto transactions (compiled Given the Russian Federation Central Bank [1]*

| Entire money transfer from 01/01/2019 | | Estimated commission rate, %* | Commission and Fee revenue, billion roubles | Sensitivity investigation of the decline in commission revenue of credit institutions as a consequence of a reduction in the "Cash Transfer" sign through: | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First Scenario: 10% | | | Second Scenario: 20% | | | Third Scenario: 30% | | | Fourth Scenario: 50% | | |
| | | | | The whole transfer of cash, billion roubles | Commission revenue and Fee earnings (billion roubles) | The expansion of business entities capital liquidity (billion roubles). ** | The whole transfer of cash billion roubles | Commission revenue and Fee earnings (billion roubles) | The expansion of business entities capital liquidity (billion roubles) ** | The whole transfer of cash (billion roubles) | Commission revenue and Fee earnings (billion roubles) | The expansion of business entities capital liquidity (billion roubles). ** | The whole transfer of cash (billion roubles) | Commission revenue and Fee earnings (billion roubles) | The expansion of business entities capital liquidity (billion roubles). ** |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| the amount, million units | volume, billion roubles | | | | | | | | | | | | | | |
| 1 715,7 | 1 566 461,4 | 0,09 | 1396,8 | 1409815,3 | 1268,8 | 128,0 | 1253169,2 | 1127,9 | 268,9 | 1096523,0 | 986,9 | 409,9 | 783230,7 | 704,9 | 691,9 |

** The rate value is defined through an estimation on the basis of the commission revenue ratio of credit institutions as well as the money transfers volume for the year*

*** The capital availability extension rate of economic entities matches to a decline in commission revenue of credit organizations (For First scenario, group four – group six)*

## Results and Discussion

Considering the outcomes of the evaluations, it can be concluded the extension potential for capital availability of business entities in the state economy as a consequence of the payment system transition to crypto transactions begins from 128 (first scenario) to 691.90 (forth scenario) billion roubles up to the range of the funds' transfer to the blockchain system.

Considering the low portion of the revenue of credit organizations made from commission revenue (approximately 1.0%), it is notable to say that the decline in revenue following this matter is not that substantial for credit organizations in the Russian economy's financial sector.

Moreover, the expansion of business entities capitalization may well be of vital significance immediately for the national economy as well as business entities overall.

Counting on the recommended research algorithm, and the dependencies acquired among the extent of transformations in modern assets and the GDP dynamics (Equation 1), table 2 displays the predicted prognostic estimations to the transition outcome of financial transactions to the blockchain on the dynamics of revenue as:

$$Y = 20513{,}2 + 0{,}79x$$

*Table 2. Scenario prediction of GDP extension for the Russian Federation following the level of financial transaction systems into the blockchain*

| | First Scenario | Second Scenario | Third Scenario | Fourth Scenario |
|---|---|---|---|---|
| GDP growth, (in %) | 0,70% | 2,30% | 3,90% | 7,90% |

The shown estimations express relatively average effects of the stages understudy on the economic growth dynamic, particularly based on scenario 1. Simultaneously, it is necessary to stress that while the volume of crypto transactions rises, this impact grows apparent further.

Further, corresponding scenario assessments were implemented when realizing the second stage of the study focused on analyzing the effect of blockchain technologies on the system of operational processes of financial market organizations.

Next, relying on the above effects, a formalized assessment was made. It was accepted as the main hypothesis of this stage of the study that the introduction of blockchain technologies in the operational activities of the banking sector of the economy will minimize/eliminate operational and credit risks.

Tables 3 and 4 present scenario calculations that determine the possible effects generated as a result of a decrease in risks in the banking sector of the Russian economy and, accordingly, a decrease in the size of capital requirements for banks in relation to operational and credit risk (Table 3, 4). It should be noted that scenario-based risk reduction models are in many respects consistent with the estimates of the consulting company AccentureConsulting [10].

*Table 3. Scenario parameters for the operating risk capital coefficient, in % of the average bank (financial institution) gross income for the last three years*

| | The coefficient value reflecting the average level of unforeseen losses due to operational risk in relation to the amount of income received | | | | | |
|---|---|---|---|---|---|---|
| | ScenarioParameters | | | | ActualParameters | |
| | 1% First Scenario | 3% Second Scenario | 5% Third Scenario | 10% Fourth Scenario | The value of operational risk (OR) with a coefficient of 12.5 in accordance with the instruction of the Central Bank of the Russian Federation. As of 01.01.2020 [11]. | 15.0% (in accordance with the operational risk assessment methodology set out in the Basel Committee capital adequacy agreement "Basel II"). |
| Amount of capital requirements in relation to operational risk, billion roubles | 651,0 | 1953,0 | 3255,0 | 6509,9 | 8137,4 | 9764,9 |

*Table 4. Scenario parameters for the credit risks capital (calculated based on the Regulation of [11; 12], in%*

| | 01.01.2017 | 01.01.2018 | 01.01.2019 |
|---|---|---|---|
| Scenario 1 | 173,3 | 187,9 | 214,7 |
| Scenario 2 | 3118,5 | 3654,5 | 4134,7 |
| Scenario 3 | 3869,1 | 4438,9 | 4923,6 |
| Scenario 4 | 4244,4 | 4831,0 | 5318,1 |

In relation to scenario modelling of credit risks, scenarios include:

1. Scenario 1 is an idealized model, according to which loans of such categories as doubtful, non-performing and uncollectible are eliminated as part of the systems penetration concept into the financial environment.
2. Scenario 2 provides for the "calibration" of decisions of a credit institution on the feasibility of including counterparty in the bank's circle of customers based on its reputation in an open blockchain system.
3. Scenario 3 is based on Scenario 2, considering the fact that the use of blockchain technologies in the financial system will reduce doubtful and non-performing loans by 50%.
4. Scenario 4 is based on Scenario 2, considering the fact that the use of blockchain technologies in the financial system will reduce doubtful and non-performing loans by 25%.

Given that bank reserves, in fact, "mothball" the liquidity of financial credit institutions, their creation generates the prerequisites for reducing the financial results of the banking sector of the economy. Undoubtedly, the formation of reserves is one of the mechanisms of the central regulator that contributes to the sustainable development of the financial sector of the economy in the context of its possible turbulence caused, for example, by the growth of overdue debts in the loan portfolio. Without going into details about the reservation rates established by the Central Bank of the Russian Federation for one or another risk of the banking sector, it is unambiguously necessary to state that financial institutions suffer losses as a result of reduced liquidity as part of the "freezing" of assets in reserved funds.

In order to detect such dependencies, models have been built that evaluate the result of operational and credit hazards on critical parameters of the financial results of the banking area (equation 1 and equation 2 – Models of the effect of credit and operational hazards on the financial results of credit organizations, respectively).

$$Y = 12{,}240 + 0{,}19\mathrm{X}_1 - 0{,}180\mathrm{X}_2$$

$$Y = -437{,}280 + 0{,}23\mathrm{X}_1 - 0{,}3\mathrm{X}_3$$

Where:

Y – Financial performance of credit institutions, billion roubles

X1 – The volume of loans issued billion roubles.

X2 – The value of operational risk (OR) with a coefficient of 12.5%, billion roubles.

X3 – The reserve created for possible losses on loans.

The reliability of the obtained models is determined by the correspondence of the essential factors to their normative values.

The results obtained predictably demonstrate a very significant effect of the growth of operational and credit risk reserves on the volume and dynamics of credit organizations financial results.

Returning to the previously constructed regression models that assess the relationship between the financial results of the banking sector and the level of reserved capital for credit and operational risks, Table 5. shows the calculations of the change in the indicator characterizing the financial results of the banking sector in accordance with the developed baseline scenario based on minimalistic estimates of the decrease in reserves.

*Table 5. The effect evaluation of credit and operational risks on changes in the profits of the economy banking sector (basic scenario 4 providing for the minimum possible effects generated by the penetration of blockchain inside the operational activities), billion roubles*

| The value of operational risk (Fact/baseline) | Credit Risk Value (Fact/Baseline) | The increase in financial results of the banking sector as a result of the decline: operational risk/credit risk/total |
|---|---|---|
| 8137,4/6509,9 | 5 712,6/5318,1 | +58,6 / +29,9 / +88,5 |

## Summary

The implemented calculations built within the framework of using the scenario modelling concept, demonstrate very impressive parameters for the growth of the banking sector's financial results in the process of using blockchain technologies in operational activities. In accordance with the estimates obtained, the introduction of distributed data storage technologies in the operational activities of credit institutions is able to provide an increase in financial results up to 88.5 billion roubles (which is about 4.5% of the actual value of the indicator as of 01.01. 2020) within the framework of the baseline scenario.

An assessment of the possible consequences of the blockchain technology penetration into the banking environment creates the potential for a formalized assessment of changes that may occur in the national economic system as a whole. This, in turn, allows us to move on to developing new models of economic growth under the influence of the digitalization elements of the economy (in particular, as a result of the blockchain technologies usage in the financial sector).

In accordance with the assessments implemented and relying on the previously proposed organizational chart to investigate the significance of blockchain technologies to the development items of the national economy, a model has been developed that assesses the relationship between the financial results level of credit institutions and the GDP dynamics (equation 3).

$$Y = 28846{,}7 + 45{,}8x_1$$

In accordance with the obtained model, prognostic scenario estimates of Russia's GDP growth were determined in penetration case of the distributed data storage technologies into the system of operational processes of credit organizations (in accordance with the basic scenario assuming the least possible effects) (Table 6).

*Table 6. Scenario prediction of the GDP extension in the Russian Federation based on the transition range of the financial transaction system to the blockchain system*

| The value of the increase in financial results of credit organizations (baseline scenario 4) | Estimation of GDP growth |
|---|---|
| +88,5 | +14,6% |

Furthermore, it is noteworthy that the functional effects of blockchain on the development efficiency of the national economic system are undoubtedly not limited to the effects considered here. The technologies under consideration also have a significant impact on the liquidity risk of credit institutions because of minimizing their reserved capital. No less significant effects are generated within the framework of the asset and liability management system, in the field of supporting business decisions, regulating relations with contractors, etc [10].

## Conclusions

This survey examines the national economy below the impact of blockchain technology.

To that end, methodological methods have been considered.

In conclusion, we would like to note that blockchain technologies can significantly transform existing business processes in the same way that digitalization of the socioeconomic environment destroys traditional areas of economic activity (for example, digital channels have replaced analogue ones). This also includes the financial sector; thereby the blockchain technologies would continue to develop the FinTech paradigm.

In this regard, given the very high rate of penetration of blockchain technologies in the economy's real-sector, as well as in the view field of the expert and scientific community, it becomes extremely important to overcome the vacuum in understanding the essence and importance of distributed storage technologies until they become a reality and finally penetrate in the sphere of business processes of business entities.

***Acknowledgements***

The research was conducted by permission from the Foundation of Russian Science (project Number 19-18-00202)

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**Article history:**

Received 18 September 2020

Accepted 28 November 2020

SCIENTIFIC REVIEW

# TOWARDS SUSTAINABILITY THROUGH INDUSTRY 4.0 AND SOCIETY 5.0

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## Abstract

This section provides general information about actual development directions of the concepts of Industry 4.0 and Society 5.0 in context of sustainable development. For the analysis of relations with sustainability of these concepts we will estimate their relations with sustainable development goals (SDGs). Also, we were investigating the case study of Russia in the context of transformation to Industry 4.0 and Society 5.0. As the research results, we conclude, that further success of the digital and socio-economic transformation will directly depend on the effectiveness and consistency of the joint efforts of government structures, the business community, and social institutions, in addressing the challenges of sustainable development of the national economy.

*Keywords: Industry 4.0, Society 5.0, fourth industrial revolution, sustainable development, sustainability, SDGs*

**JEL: M10, O33**
**UDC: 005.332:330.341.1(100) "20"**
**330.342.24**
**COBISS.SR-ID 28646409**

## Introduction

Scientific and technological progress has led to environmental conditions aggravation and socio-economic tensions throughout the world. Unfavorable environmental conditions complicate the task of sustainable development [1]. The achievement of key tasks of social and economic programs in most countries is increasing the welfare of the population, but does not provide the necessary quality of life. This determines the essence and direction of modern society's modernization as a process of ensuring technological progress in the field of economic development, and maintaining a safety environment constitutes the essential content of the fourth industrial revolution.

On the other hand, the fourth industrial revolution and the Industry 4.0 concept, initiate the global challenge for sustainable development [2]. From one side, industrial digitalization can make a positive contribution to the problem of emissions and resource use, and when it is necessary to use virtual reality for business projects [3, 4]. Industrial digitalization could be the reason for unemployment and new social challenges [5]. This imbalance is settled by the approach of the concept Society 5.0, or smart society concept [6, 7, 8].

Also, it is evident that it is not possible to prevent a fourth industrial revolution and industrial digitalization, which initiates some challenges for sustainable development. But this

situation was the driver for the development of a new, more sustainable concept of digitalization, Society 5.0, which is developing beyond Industry 4.0 and is oriented on sustainable development.

## Theoretical Basis of Industry 4.0 and Society 5.0 in the context of Sustainable Development

This section provides general information about actual development directions of the concepts of Industry 4.0 and Society 5.0. This section is structured as follows. First, we present the concept of Industry 4.0, the main elements of the concept of Society 5.0, and their relationship. Next, we will analyze their relations with SDGs and sustainable development.

The idea of the Fourth Industrial Revolution and smart factories was first presented by the President of the world economic forum, Karl Schwab, in Davos (2017) [9]. From this moment, many scientists around the world started to research more actively and develop the idea of Industry 4.0 and smart factories, and also in national strategies or programs of economic digitalization.

The smart factory idea, new approaches to exploit the possibilities offered by new technological developments in the context of Industry 4.0., were investigated by many scientists, especially in the national context, in Austria by Coumans [10], in Italy by Dassisti, Siragusa and Semeraro [11], in Sweden by Vestin, A., Säfsten, K., Löfving, M. [12] etc. In Russia, a country with a wide range of developed industries, the topic was investigated by Medovnikov, Oganesyan, Styrin, Abdrakhmanova, Rozmirovich, Merkulova, Bikbulatova (2017) [13], Vasin, Gamidullaeva, Shkarupeta, Finogeev, Palatkin [14], Popkova, Sergi [15] (2018).

The common conclusion in many of these researches is that the terms of Industry 4.0, fourth industrial revolution, and digital transformation, are considered synonymous. The foundation of smart factory and Industry 4.0 concepts is based on the massive introduction of cyber-physical systems into production, and an increase in the volume of interaction between machines in the production process by endowing them with artificial intelligence. In production, smart factories use a wide range of technologies, from 3D printing to drones, robotics, etc. [16, 17].

Also, industry 4.0 is developing a variety of business models: companies looking for customer – oriented solutions on the Internet, organizations that provide indirect services using platform workers, crowdsourcing, non-standard employment, etc. [18, 19]. These changes allow an increase in production, improve product quality, and reduce production costs in. All these factors improve business competitiveness enormously.

However, the robotization of industrial production automatically leads to negative social consequences, namely the reduction of jobs. The solution to this problem is not encompassed by the concept of smart factories. At the same time, solving the problem for digital enterprises retraining and employing the released personnel is a necessary process to ensure the socio-ecological and economic sustainability of the modern world. The concepts of Industry 5.0, which was promoted by Michael Rada in 2015[20], and Society 5.0 [21], were developed beyond the Industry 4.0 concept, as the scientific answer to the socio-economic challenges of Industry 4.0 [22, 23].

The main idea of the concepts of Industry 5.0 and Society 5.0 is developing from digital manufacturing to digital society [24, 25, 26, 27, 28]. Social orientation and technical innovations from Industry 4.0 developed the concept of Industry 5.0 as a universal model of sustainable development. The main idea of the concepts of Industry 5.0 and Society 5.0 is the following: digital technologies for the development of society.

The leading scientists in Industry 4.0 and Industry 5.0, K. Schwab and N. Davies, conclude in their publication: "To take advantage of the fourth industrial revolution, we should not consider promising technologies as simple tools that are completely under our conscious control, or as external forces that cannot be controlled.

Instead, we should try to understand how and where human values are embedded in new technologies, and how technologies can be applied for the common good, environmental protection, and human rights" [9]. The same conclusion is made by scientists for the concept of Society 5.0: according to Ozgür Onday [24], although Society 5.0 is a Japanese development system, it is not limited to Japan, since its goals are equivalent to Sustainable Development Goals [24].

On the other hand, there are also alternative points of view on the idea of Society 5.0, considering the socio-economic and cross-cultural problems of spreading the ideas of Society 5.0 [29, 30, 31]. Professor Bruno Salgues [28] notes the danger of underestimating, misunderstanding the consequences of upcoming social changes, and their unpredictability in the Society 5.0 concept [28].

So, sustainability is a challenge for the concept of Industry 4.0 and also for the concepts of Industry 5.0 and Society 5.0 [32, 33]. It is because the concept of Society 5.0 was designed after the concept Industry 4.0. [32].

In Table 1 we investigate the relations of Industry 4.0 and Society 5.0 concepts with sustainable development. We combine the research of Silvia H. Bonilla, Helton R. O. Silva, Marcia Terra da Silva, Rodrigo Franco Gonçalves 1,2 and José B. Sacomano (Graduate Program in Production Engineering, University of São Paulo, Brazil). They conducted a literature-based analysis to discuss the sustainability impact and challenges of Industry 4.0 from four different scenarios: deployment, operation and technologies, integration and compliance with the sustainable development goals, and long-term scenarios [35].

Also, we used the results of the research of Mayumi Fukuyama, general manager and chief information officer of the Technology Management Center, Technology Strategy Office, Research &Development Group, Hitachi, (Japan). This research is prepared by Mayumi Fukuyama and based on material from the Japan Business Federation (Keidanren) "Society 5.0 for SDGs" [6]. Due to results of analyses (Table 1) the concept of Society 5.0, which is called as smart society, has strong relations with DSGs. In Table 1 it is presented that the concept of Industry 4.0 has relations and positive influence on 4 of 17 SDGs or 23,5% of SDGs. It confirms the fact that the concept of Industry 4.0 has not strong correlation with sustainable development and many scientists think the same [33].

Due to the Table 1, it is important to notice that the concept of Society 5.0 has relations and positively influence on all 17 SDGs [36] and could be the model of sustainable development.

*Table 1. Industry 4.0 and Society 5.0 influence on Sustainable Development Goals*

| *№* | *SDG topics [34]* | *Positive influence of Industry 4.0 [35]* | *Positive influence of Society 5.0 [6]* |
|---|---|---|---|
| 1 | End poverty in all its forms everywhere | | + |
| 2 | End hunger, achieve food security and improved nutrition and promote sustainable agriculture | | + |
| 3 | Ensure healthy lives and promote well-being for all at all ages | | + |
| 4 | Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all | | + |
| 5 | Achieve gender equality and empower all women and girls | | + |
| 6 | Ensure availability and sustainable management of water and sanitation for all | | + |

| | | | |
|---|---|---|---|
| 7 | Ensure access to affordable, reliable, sustainable and modern energy for all | + | + |
| 8 | Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all | | + |
| 9 | Increase Industry, Innovation, and Infrastructure | + | + |
| 10 | Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation | | + |
| 11 | Make cities and human settlements inclusive, safe, resilient and sustainable | | + |
| 12 | Ensure sustainable consumption and production patterns | + | + |
| 13 | Take urgent action to combat climate change and its impacts | + | + |
| 14 | Conserve and sustainably use the oceans, seas and marine resources for sustainable development | | + |
| 15 | Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss | | + |
| 16 | Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels | | + |
| 17 | Strengthen the means of implementation and revitalize the global partnership for sustainable development | | + |

So, the results of Table 1 confirm the hypotheses of some researches about it [25]. Also, the concept of Society 5.0 is closely correlated with the followings SDGs as Zero Hunger (SDG 2), Clean Water and Sanitation (SDG 6), Sustainable Cities and Communities (SDG 11), Life Below Water (SDG 14), Life on Land (SDG 15) [52], which by the research of Áron Szennay, Cecília Szigeti, Norbert Kovács and Dániel Róbert Szabó strongly linked to ecological services.

## Industry 4.0 and Society 5.0 in Russia

In the global competition Index of the World Economic Forum (WEF) [37] Russia has 43 places in 2017 due to the high quality of education, infrastructure development and innovation potential. So, it means that that Russia has potential for the development of the concept Industry 4.0. Industry 4.0 and Society 5.0 concepts are in the top of research interests of Russian scientists. Russian science citation Index (RSCI) academic service in 2020 presented more than 6 thousand publications (articles, books, conference proceedings, theses) with term “digitalization” in the title / Also RSCI indexed more than 50 thousand publications with the term “digital”, about 13 thousand publications with the term “smart” and about 600 publications with the term “the fourth industrial revolution-industry 4.0”.

Among the major and most well-known works of Russian researchers in the field of the fourth industrial revolution and digitalization of the economy are, in particular, publications Medovnikov D., Oganesyan T., Styrin E., Abdrakhmanova G., Rozmirovich S., Merkulova D., Bikbulatova Yu. [13], Glazyev S. [38] and others.

The key issue of most Russian research on the subject under analysis is the challenges and opportunities that are relevant for domestic business in various sectors, as well as for public administration, education, and other areas of the economy and society in connection with the expansion and increasing pace of digitalization. Leading Russian universities and business schools, such as the Higher School of Economics, business-school Skolkovo and others, are engaged in studying the process of digitalization of the economy in Russia.

Due to one of the best researches of leading national universities Russia, HSE, Russia is still on the way to Industry 4.0 and Society 5.0. Due to this research almost 60% of the urban population in Russia is well provided with digital services and more than 50% of citizens have local digital services in cities of the Russian Federation (Results of report "Digitalization in small and medium cities of Russia" of Graduate School of Urbanism HSE, 2018) [39]. For cities situation is totally opposite and should be developed. Especially because of agglomeration reason [40], because digitalization of big cities influences positively on the speed of digitalization of small cities in surrounded [41, 42].

Also, this research group form Russian university HSE compare digital skills of Russia with world, Western Europe and Eastern Europe [39]. The results of HSE research proved that that there are no strong imbalances between federal districts of Russia and it means that the situation with Affordability of local digital services in Russian cities equable for all country [43]. The leading federal district is Ural federal district, the leading city is the capital of the country, Moscow [43].

According to researches of other Russian scientists [44, 45, 46, 47, 48, 49, 50] and to results of HSE research [39, 43] development of the digital economy in Russia as a key factor in economic growth and improving the quality of life of the population, awareness of the need for digital transformation at both the company and state levels will definitely come. But this will happen when most of the new digital markets have already been formed, and new technologies have been developed and patented by foreign companies. Also, the field of citizens and cities digitalization is investigated good, but there are no detailed official statistics or research about Russian business transformation in digitalization. We propose that it will be very difficult for Russian businesses to integrate into the digital ecosystem because of economic and social reasons.

## Conclusion

Industry 4.0 start to implement in all world and it is not possible to stop this process. In the most progressing cases the concept of Industry 4.0 id transforming to Society 5.0, which is the model of sustainable development.

On the case study of Russia, it can be concluded that the economy of the Russia and Russian business community are still on the way to a digital society, Industry 4.0 and Society 5.0.I. The further success of the digital and socio-economic transformation of worlds economy it will directly depend on the effectiveness and consistency of joint efforts of government structures, the business community and social institutions in addressing the challenges of sustainable development of the national economy.

***Acknowledgments***

The reported study was funded by RFBR, project number 20-010-00550 «Ensuring of sustainable competitiveness of innovative cluster formations in industry in the context of Society 5.0 challenges».

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**Article history:**
Received 18 October 2020
Accepted 29 November 2020

# PART II
# ECONOMICAL AND STRUCTURAL CHANGES OF BUSINESS AND ECONOMY

SCIENTIFIC REVIEW

# IMPACT AND CONSEQUENCES OF THE COVID-19 VIRUS ON THE ECONOMY OF THE UNITED STATES

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## Abstract

The crisis caused by the COVID-19 virus is not just a global health crisis. The impact of the pandemic, caused by this virus, has strongly affected almost all vital economic sectors of the United States, which has seriously affected the global economy and other financial markets around the world. Significant declining incomes at all levels, rising unemployment, and disruptions in the industrial and transportation sectors are just some of the consequences caused by this virus in the economy of the United States. As the COVID-19 pandemic continues, the United States strongly opposes further reductions in economic growth and profits with several measures taken to mitigate the effects of the virus. In that sense, proactive action by the Government of the United States is necessary to protect economic prosperity and maintain sustainable economic growth for a longer period.

*Keywords: economy of the United States, COVID-19, economic consequences, unemployment*

**JEL: E60**
**UDC: 338.124.4(73)**
**616.98: [578.834]:338.12.015**
**COBISS.SR-ID 28647689**

## Introduction

The World Health Organization (WHO) declared the beginning of the pandemic of the COVID-19 virus in January 2020. The pandemic, caused by the COVID-19 virus, has negatively affected the global economy in all economic branches, as well as the health system around the world in recent months. It is estimated that, since the beginning of the pandemic, the world economy has lost almost 90 billion dollars, which is the biggest economic recession in the last 100 years [1]. Government around the world are trying to reconcile the goals of their economic policies and the resulting health crisis.

The US economy was the world's largest economic giant since the end of the 19th century, and during 2018, the share of the US economy in the world's gross domestic product was 25.12%, while the share of China's gross domestic product was 14.9% [2]. In third place was the Indian economy with a 6.4% share in world gross domestic product. The biggest problem in the economy of the United States of America (USA), as one of the most developed economies in the world, is related to facing the budget deficit, which is directly proportional to the increase in social benefits for unemployed workers and employees who lost their jobs due to the crisis. Providing financial support to the U.S. national health system, which is under great pressure from the WHO, due to the vaccine development and testing process, is

classified at the same time as a financial effort aimed at caring for and protecting citizens. The implementation of monetary and fiscal policy, which supports the financial markets and stock exchanges in the United States to maintain economic activity, at the same time helps companies that are under pressure from financial problems and emerging illiquidity. The implementation of fiscal policy to stimulate economic activities in the United States, with households that have limited ability to spend, determine the levels of income and the course of their economy or the so-called precautionary savings.

The intervention of the Fed (Federal Reserve) and the US monetary authorities is mainly focused on debt and US corporate bond markets to stabilize the financial market and provide liquidity. This activity calls into question the ability of the U.S. financial market to perform its core price risk functions and capital allocation.

The fiscal and monetary policies of the USA, which have been adopted so far to solve the problems with the direct impact of the economic crisis caused by the COVID-19 virus, are in direct proportion to the measures related to financial support to households, companies, state and local governments.

Policymakers and participants in the U.S. financial and commodity markets largely hope that the global economic recovery will begin in the third quarter of 2020, assuming there is no second wave of COVID-19 virus infection. Some forecasts, however, increase the likelihood that a pandemic could negatively affect global economic growth over time with a slow economic recovery [3]. Without a quick resolution to the health crisis, the economic crisis may last longer than most economic analysts have assumed. U.S. policy is expected to select the most effective combination of additional fiscal and monetary policies, which can be applied. Additional financial measures may need to balance the competing needs of households, firms, state, and local governments.

## The impact of the COVID-19 virus on U.S. unemployment

At the end of June this year, a large number of US federal states demanded the re-establishment of guidelines for social distancing and the closure of certain companies, as a result of the increase in new confirmed cases of COVID-19 virus, with the possibility of delayed economic recovery. On June 29$^{th}$ this year, the Federal Open Market Committee (FOMC) indicated that the increase in COVID-19 cases in the United States had a significant impact on reduced economic growth and that the path to economic recovery will depend significantly on the flow of the virus itself. The current global health crisis will greatly hamper economic activity, employment levels, and short-term inflation rates in the U.S. economy and pose significant risks to economic recovery in the medium term.

Since the beginning of the pandemic caused by the COVID-19 virus, at one point more than 80 countries closed their borders to the arrivals of U.S. citizens, keeping their residents in quarantine. During the 21 weeks, from mid-March to early August 2020, 56 million Americans applied for unemployment insurance. The number of unemployed insurance beneficiaries was 15.5 million at the beginning of August, which is the maximum of 25 million recorded in mid-May [4] [5].

The total number of people seeking unemployment benefits under unemployment insurance on July 25$^{th}$ this year was 28.3 million, a record number compared to 1.7 million on the same date in 2019. The Bureau of Labor Statistics (BLS) has released data that 20 million Americans lost their jobs during April 2020, raising the U.S. national unemployment rate to 14.7%, the highest unemployment rate since the Great Depression in the 1930s. Preliminary data also show that the gross domestic product (GDP) of the United States decreased by 9.5% in the second quarter of 2020 compared to the first quarter, which is the largest quarterly decline in US GDP recorded in the last 70 years [6].

## The consequences of the pandemic on the US economy

Recognizing the growing impact of the pandemic on financial markets and economic growth, the US Federal Reserve (FED) has taken several steps to promote economic and financial stability that includes the Fed's monetary policy with its role as a provider of so-called final loan. Some of these actions are intended to stimulate economic activity, reduce interest rates, while others are intended to provide liquidity to financial markets so that companies have access to the necessary financial resources. Explaining its decisions, the Fed pointed out that "the process of eradicating the COVID-19 virus has damaged communities and disrupted their economic activities in many countries, including the United States". The first half of this year saw a 30% drop-in economic activity or more in economic sectors such as transport, tourism, and catering, as a result of quarantine measures adopted across the country. Unlike other sectors of the economy, food and beverage consumption increased by 25%, as a result of the transition of individuals who used food services in restaurants and other commercial establishments but are now preparing food at home. On August 5$^{th}$, the U.S. Census Bureau reported a total monthly trade deficit of $ 4.1 billion, indicating higher imports than exports of goods and services. The trade deficit in goods narrowed from $ 76 billion in May to $ 72 billion in June, while the trade surplus in the services sector rose from $ 21.4 billion to $ 21.5 billion [7].

During the month of June, exports of goods and services in the United States decreased by 15.7% compared to the period in 2019, while imports of goods and services decreased by 14.2%, due to a general decline in world trade level. Data on GDP during the second quarter of 2020 show that US trade decreased sharply in real or measured by indices in terms of the quantity of exported or imported goods and the value of those goods. The data show that the sharp decline in US trade was the result of measures taken at a global level, due to actions to prevent the spread of the COVID-19. pandemic [7].

Quantitatively, U.S. exports decreased by 25%, while imports in the second quarter decreased by 15% compared to the previous quarter. In terms of value, exports decreased by 6%, while imports decreased by 3.7% compared to the first quarter [8].

*Table 1. Before the changes in the most important US economic sectors*
*Source: U.S. Bureau of Statistics, Department of Economics, CRS*

| Sectors | Simple multiplier | Starting Effect | Direct effects | Indirect effects |
|---|---|---|---|---|
| Hospitality | 1.6212 | 1.0000 | 0.3617 | 0.2595 |
| Tourism | 1.3680 | 1.0000 | 0.2227 | 0.1454 |
| Education | 2.4498 | 1.0000 | 0.7697 | 0.6801 |
| Health Insurance | 1.5105 | 1.0000 | 0.3158 | 0.1948 |
| Retail | 1.7997 | 1.0000 | 0.4440 | 0.3557 |
| Public sector | 1.6728 | 1.0000 | 0.4662 | 0.2066 |
| Construction | 1.4714 | 1.0000 | 0.2823 | 0.1891 |
| Transport | 1.4961 | 1.0000 | 0.2987 | 0.1974 |
| Storage Services | 1.8451 | 1.0000 | 0.4772 | 0.3679 |
| Wholesales | 1.8296 | 1.0000 | 0.4639 | 0.3658 |
| IT industry | 1.4012 | 1.0000 | 0.2339 | 0.1673 |
| Banking sector | 1.1891 | 1.0000 | 0.1503 | 0.0388 |

*Table 2. After the changes in the most important US economic sectors*
*Source: U.S. Bureau of Statistics, Department of Economics, CRS*

| Sectors | Simple multiplier | Starting Effect | Direct effects | Indirect effects |
|---|---|---|---|---|
| Hospitality | 1.3629 | 1.0000 | 0.2086 | 0.1543 |
| Tourism | 1.7874 | 1.0000 | 0.4677 | 0.3197 |
| Education | 2.6027 | 1.0000 | 0.6698 | 0.9328 |
| Health Insurance | 1.9136 | 1.0000 | 0.4936 | 0.4200 |
| Retail | 2.0978 | 1.0000 | 0.5851 | 0.5127 |
| Public sector | 1.8986 | 1.0000 | 0.5046 | 0.3940 |
| Construction | 1.6275 | 1.0000 | 0.3722 | 0.2553 |
| Transport | 1.6446 | 1.0000 | 0.3871 | 0.2575 |
| Storage Services | 1.4867 | 1.0000 | 0.2464 | 0.2403 |
| Wholesales | 1.5969 | 1.0000 | 0.3498 | 0.2471 |
| IT industry | 1.5496 | 1.0000 | 0.3028 | 0.2468 |
| Banking sector | 1.7522 | 1.0000 | 0.4340 | 0.3182 |

Losses caused by the decline in the employment rate affected all sectors of the economy, along with all working groups. The gradual recovery or increase in jobs is slowly becoming recognizable in the tourism and hospitality industry (especially in restaurants and cafes), educational institutions, the public sector, retail trade, consulting services, and the health care sector. During May, the U.S. Department of Labor reported that the number of unemployed increased by 20 million, not including about 10 million part-time workers and another 9 million unemployed who are actively looking for work. The number of unemployed individuals increased the most in the tourism and hospitality sector, thus reflecting the implementation of a national quarantine policy to reduce the spread of COVID-19 by reducing social contacts.

*Table 3. Before the changes in the most important US economic sectors*
*Source: U.S. Bureau of Statistics, Department for Unemployment, CRS*

| Sectors | Simple multiplier | Starting Effect | Direct effects | Indirect effects |
|---|---|---|---|---|
| Hospitality | 1.2175 | 1 | 0.1405 | 0.077 |
| Tourism | 1.6976 | 1 | 0.3918 | 0.3058 |
| Education | 3.2561 | 1 | 1.4655 | 0.7906 |
| Health Insurance | 1.5896 | 1 | 0.3842 | 0.2055 |
| Retail | 2.3898 | 1 | 0.7799 | 0.6099 |
| Public sector | 2.6481 | 1 | 0.9814 | 0.6668 |
| Construction | 2.5007 | 1 | 0.7504 | 0.7503 |
| Transport | 2.9296 | 1 | 1.0464 | 0.8832 |
| Storage Services | 2.2292 | 1 | 0.6512 | 0.578 |
| Wholesales | 2.0491 | 1 | 0.5613 | 0.4878 |
| IT industry | 2.0128 | 1 | 0.5737 | 0.4392 |
| Banking sector | 1.3528 | 1 | 0.2465 | 0.1062 |

*Table 4. After the changes in the most important US economic sectors*
*Source: U.S. Bureau of Statistics, Department for Unemployment, CRS*

| Sectors | Simple multiplier | Starting Effect | Direct effects | Indirect effects |
|---|---|---|---|---|
| Hospitality | 1.3094 | 1.0000 | 0.1780 | 0.1314 |
| Tourism | 1.8688 | 1.0000 | 0.5235 | 0.3453 |
| Education | 3.6662 | 1.0000 | 0.9682 | 1.6980 |
| Health Insurance | 1.5365 | 1.0000 | 0.3112 | 0.2253 |
| Retail | 1.6697 | 1.0000 | 0.3869 | 0.2828 |
| Public sector | 1.5109 | 1.0000 | 0.3045 | 0.2065 |
| Construction | 1.4245 | 1.0000 | 0.2766 | 0.1480 |
| Transport | 1.6261 | 1.0000 | 0.3865 | 0.2396 |
| Storage Services | 2.9651 | 1.0000 | 1.2186 | 0.7465 |
| Wholesales | 1.8016 | 1.0000 | 0.4771 | 0.3245 |
| IT industry | 1.3912 | 1.0000 | 0.2300 | 0.1612 |
| Banking sector | 1.1972 | 1.0000 | 0.1346 | 0.0626 |

From the previous table, the biggest disruption will be the planned realization of GDP growth, followed by the unemployment rate, which is expected to increase by the end of 2020, if the second wave of infections caused by the COVID-19 virus occurs. Following the previous research, there is a statistically significant difference between the sectors that have suffered the greatest losses, such as tourism, catering, transport in comparison to the IT and banking sectors.

The Federal Reserve's analysis showed that nearly 40% of employees who worked in February and earned less than $ 40,000 a year lost their jobs during March [9]. The overall response of U.S. economic policy is to provide measures to facilitate and maintain liquidity and stability, with extended support for the country's economic recovery. Research shows that prolonged recessions could leave permanent damage to the production capacity of the U.S. economy in the coming years. Long periods of unemployment can damage or end a worker's career as their skills lose value leaving their families in higher debt.

The loss of several thousand SMEs across the country would ruin the lives and work of many business leaders and communities, limiting the power of economic recovery when it comes. These companies are the main source of employment, something we will hardly need when people are trying to return to work. The prolonged recession and weak recovery may also discourage business investment and the process of further business expansion, as well as limit job reopening as well as capital growth and technology development.

## The impact of the COVID-19 pandemic on the value of the dollar

All the current problems with currencies are caused by the disturbance of the balance on the world financial market, and they result from the relations between the USA and China, that is, the relations between the dollar and the yuan. When the Chinese currency, the yuan, approaches full liberalization of capital flows, it will become one of the more attractive currencies. Until that moment, a lot of time will pass because the Chinese still have significant trade and monetary barriers to the liberalization of financial flows. In addition to the substitution of the dollar by the euro in foreign exchange reserves, the substitution of the yuan can be considered in the future. Savings in Chinese yuan can be based on the following assumptions [10]:

1) in terms of total gross domestic product, China will, if it continues like this, overtake the United States in less than 20 years.

2) China is the country with the largest foreign exchange reserves in the world and with the largest economic potential.
3) in the last 2000 years, China has been the largest economic power for 19 centuries, which justifies its possibility of regaining the leading economic position in the world.

The autonomy of the Chinese currency, the yuan, is extremely important and it affects economic trends in the world. In the current world economic system, the demand can also be managed by financing its surpluses. Chinese surpluses are now being used by buying US Treasury securities.

According to the medium-term forecast, US GDP is expected to decline by 6.5%, the unemployment rate could rise to 9.3%, and the inflation rate by only 0.8% compared to the December 2018. projections. At the end of last year, GDP growth is projected at 2.0%, unemployment rates at 3.5%, and inflation rates at 1.9%. The possible reduction in GDP, however, could vary between -4.2% and – 10.2% with a possible unemployment rate between 7.0% and 14.0% [11]. According to the FOMC, a range of estimates was necessary to present the state of the US economy in the case of the so-called "extremely high uncertainty", which is directly proportional to the economic effects of the pandemic and the reactions or measures of the US economy to past economic shocks. As a result of the significant degree of uncertainty of further economic growth and the risk of economic downturn related to the COVID-19 pandemic, the public is increasingly mentioning a pessimistic scenario that includes the time it takes for the US economy to recover and achieve economic growth. and the development it recorded at the end of 2019.

According to initial estimates, they indicate the possibility of a second wave of the COVID-19 virus in the fourth quarter of 2020, with certain restrictions on social activities and business within the US economy [12].

*Table 5. SPSS analysis of changes in GDP, unemployment, and inflation*
*Source: SPSS calculation of the author's analysis*

| Variable | BDP Change | Projection December 2019 | Rate of unemployment | Projection December 2019 | Inflation rate | Projection December 2019 |
|---|---|---|---|---|---|---|
| M | -6,5 | 1,8 | 9,3 | 3,5 | 0,8 | 1,9 |
| Min | -7,6 | 2,0 | 6,5 | 3,5 | 0,6 | 1,7 |
| Max | -5,5 | 2,3 | 14,0 | 4,1 | 1,8 | 2,2 |
| Std. De. | 2,1 | 2,0 | 4,0 | 1,7 | 0,402 | 1,8 |
| Var. | -9,8 | 1,9 | 3,7 | 2,2 | 0,170 | 2,1 |

Comparing parameters such as the change in GDP, the unemployment rate, and the inflation rate at the end of the second quarter (June 2020) in relation to the projected value at the end of 2019, it can be noticed that they significantly deviate from the planned ones. The impact of the pandemic caused by the COVID-19 virus on the US economy has significantly disrupted their projected values.

The basic measures that the world's most developed countries are taking to address the global economic crisis and accelerate development, but sustainable are the establishment of confidence, growth and jobs recovery of the financial system to enable re-lending strengthening financial regulation to restore confidence establishment and reform of international financial institutions to overcome the crisis and prevent a future crisis by promoting global investment trade and rejecting protectionism, and fostering prosperity work for an inclusive, environmentally friendly and sustainable recovery. In order for such measures to be implemented, it is necessary to implement certain macroeconomic measures in

the world economy through fiscal policy, monetary policy, and enabling a sustainable economy [13].

All these measures and all actions must be coordinated between the governments of the states, then their financial institutions and organizations, as well as the international financial institutions. Within this, measures should be taken to establish sound financial audit and regulation. The lack of these measures is one of the main reasons for the global financial crisis. The decline in global demand, which was first recorded after 25 years, is a consequence of growing protectionist pressure as well as the withdrawal of commercial loans. Measures to revive world trade include removing barriers to investment or international trade in goods and services and stimulating exports, enabling the free movement of capital internationally, increasing the role of the World Trade Organization and greater involvement of developing countries in international trade.

The global economic crisis has enabled the most developed countries, such as the G-20, to face the social implications of the crisis, because it affects the poorest countries the most.

Social protection measures in these countries must start primarily from long-term investments that will enable them security of food supply, primarily through donations from the most developed countries through the World Bank [14]. To achieve economic development, and above all the growth of sustainable technology, financial sources are needed. In this way, the economy should be protected, and the overall growth of the world economy should be ensured.

The additional financial resources needed for the recovery of the world economy should be generated through the International Monetary Fund and multilaterally developed banks that would support development, and it is estimated that an additional 850 billion dollars are needed for these activities.

It is also a very important way of distributing these funds, where $ 250 billion should be set aside in bilateral measures through bilateral financing of IMF members, and then a new way of borrowing from the IMF should be expanded and made much more flexible. One of the measures is to increase the IMF's lending capacity by its founders to meet the needs of low-income countries as much as possible and to provide additional limits for special drawing rights were the equivalent of $ 250 billion is planned to increase global liquidity. Of that amount, $ 100 billion should be invested directly to improve market conditions and economic development. It is necessary to direct all these resources and opportunities to increase the capacity of international financial institutions to better respond to the economic crisis [15].

Developing countries, as well as the poorest ones, need to be better represented and more concretely seen in these institutions. Significant resources from monetary funds should be invested in meeting the large global demand for electricity and transport, so that energy needs are met by renewable sources (solar energy, biomass fuel, wind, etc.). The negative consequence of energy demand is further planning for the use of nuclear energy sources.

## Macroeconomic conditions in the world during the crisis caused by the COVID-19 pandemic

The world economic crisis, which spread to the whole world at the speed of light, taking its toll both in developed countries and countries in transition, and thanks to the process of world globalization, managed to remove numerous economic and non-economic barriers. At the very beginning of the globalization process, it was believed that the developed ones would achieve a larger amount of savings from investments and by placing them through direct investments and foreign direct involvement in developing countries. Guided by this opinion, it was considered that developed countries would achieve a high level of surplus within the current part of the budged balance during the process of globalization. The initial assumptions

for this claim were based on parameters such as a higher level of product quality, a wide range of products, and cheap labor in the so-called countries of the third world.

Developing countries are characterized by low wages and access to technologies that, thanks to the transfer of know-how, provide favorable opportunities for high investment rates.

Developing countries had the opportunity and the prospect of achieving high rates of economic growth due to low personal incomes, the impossibility of aging the high rate of savings deposits, and as a consequence of such economic opportunities and the realization of a high balance of payments deficit. The current account deficit was particularly pronounced in the area related to its current part. Although no one expected such a course of events, the causes of such developments in the international financial market are due to a greater propensity to save due to uncertain economic policies and inadequate living conditions that are characteristic of these Asian countries. In the same period, OPEC farmers sold their financial surpluses, which they earned from the export of oil and oil derivatives, through investment funds.

Observed from an Asian country's point of view, low personal incomes, and technology transfer from developed countries did not give the expected results for a higher level of investment due to the uncertainty of property rights. Another argument in favor of developing countries is the tendency to resist (aversion) to the possibilities of risk and the willingness to invest in more lucrative and legally secure businesses with lower returns. This reason was the key reason why banks and other financial institutions from developing countries decided to invest in the US market, which was considered to be less exposed to risk. The lower level of risk-taking by the United States has found its foothold in the view that the United States has a high degree of liquidity and investment security [16].

The tax rate in times of recession should not discourage investors from investing their money, and a policy that advocates a higher level of tax than the current one is unacceptable.

Lower tax rates mean more money to spend and thus accelerate the recovery of the economy. This attitude had, so far, a mostly positive effect on the wealthy U.S. population.

The reform of the financial system requires the separation of commercial banking from investment banking. The biggest changes in theory brought about by the current crisis are related to the regulation of the financial sector, the change in attitudes towards inflation, the place, and the role of central banks. The reform of the financial system is also based on models that advocate proposals to cover the shown losses in the future with the funds of shareholders instead of taxpayers.

## Conclusion

The world economic crisis, whose beginnings date back to December 2019, is not ordinary but is one of the phenomena that can only be compared to the crisis of 1929. The global financial crisis, caused by the COVID-19 pandemic, is still ongoing, and its final consequences will be seen only in the years to come.

Today's achievement of scientific-technological, economic, and social development level has enabled companies to license their technology, jointly invest capital, create alliances in "third world" countries where their organizational and production units are already located, etc. All these facts have contributed to the process of globalization, which has contributed to the global economic crisis largely prevailing in all countries of the world in a relatively short time. In that way, the internationalization of capital took place, that is, the placement of capital on an international scale. The aspiration of large monopolies to make as much monopoly extra profit as possible on the one hand and cheap raw materials and labor on the other contributed to the creation of international monopolies whose capital eroded during the ongoing global financial crisis.

The real depth of the global financial crisis is hidden by numerous government interventions and the effects of the crisis are more realistically on the side of unemployment than it was reflected in the decline in gross domestic product. The losses caused by the crisis are huge and are reflected in a large drop in the gross domestic product, in the enormous growth of public debts, and in the monetary expansion that was accompanied by uncontrolled printing of money. The clearer impact of the global financial crisis is visible through the increased current deficit account and external debt than it was reflected through the level of the budget deficit and the amount of public debt. As a result, the economies of countries around the world have been misled that only by controlling public spending can a crisis be avoided while ignoring borrowing from the private sector.

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**Article history:**
Received 4 November 2020
Accepted 10 December 2020

SCIENTIFIC REVIEW

# MANAGEMENT OF ECONOMICAL AND STRUCTURAL CHANGES OF BUSINESS IN ENERGY-INTENSIVE INDUSTRIAL SECTORS (USING THE EXAMPLE OF THE PETROCHEMICAL INDUSTRY)

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## Abstract

The petrochemical industry is one of the main branches of Russian industry development.

The average growth rate of the petrochemical industry in 2016-2018 was higher than in the manufacturing sector-about 5%; in 2019, it was 2.7%. The growth of production due to the high level of demand for the products of petrochemical enterprises determines the same characteristic of their investment activity. The desire of Russian petrochemical companies to develop the production of high-value products, economic analysis of production, structural analysis of production, availability of raw materials, assessment of energy intensity and competitiveness of existing technologies is extremely important. In this regard, the article is devoted to the management of structural changes in the business in the petrochemical industry. Recently, an analysis of average electricity consumption by petrochemical enterprises in Russia and abroad shows that enterprises lag far behind, although foreign enterprises produce slightly more than Russian enterprises in terms of production volumes.

The main reason for the desire of enterprises to restructure are, of course, unsatisfactory values of financial indicators, there is also a shortage of working capital, large amounts of accounts payable, operating costs. In the process of enterprise restructuring, it is increasingly planned to create gas and petrochemical conglomerates-clusters that form the basis for the development of production; the production chain will be implemented from the production of hydrocarbons to the production of consumer goods.

*Keywords: business structure, petrochemical products, oil, gas, product competitiveness, energy intensity of production, the enterprise energy efficiency*

**JEL: L10**
**UDC: 005.332.3:005.72**
**338.4:620.9**
**005.5:665.71**
**COBISS.SR-ID 28648969**

## Introduction

The Russian Federation has the largest hydrocarbon reserves, producing approximately 10% of the world's oil and gas. In 2019, oil and gas condensate production amounted to 687.4

m (*million*) t *(tonnes = 1000 kg – translator's note)*, more than half of which was directed to refining. It is worth noting that more than 40% of associated petroleum gas is processed at Russian plants. Production of petrochemical raw materials has reached more than 60 mt, these indicators exceed the needs of the entire petrochemical industry. One of the main advantages of the Russian petrochemical industry is the low cost of raw materials which is provided by both tax and customs subsidies. Transportation and its cost are also important; transportation rates are high due to the use of special containers that must meet all fire and explosion-proof requirements. As for the transportation of such bulk polymer materials as polyethylene or polypropylene, it is much safer and cheaper. Enterprises engaged in the production of petrochemical raw materials in the region that produce these products should enjoy this advantage.

It is clear that the transport component has an impact on the products produced by petrochemical enterprises: depending on the distance from the sales market, enterprises choose an economically attractive solid product.

Enterprises of the petrochemical industry diversify their production by including such activities as oil and gas production and processing, developing into large vertically and horizontally integrated structures.

## Methods

The algorithm of the outlined research is presented by the following chain: concepts of the petrochemical industry – structural changes in business – problems and prospects of change management at petrochemical enterprises – improvement of the processes management of reducing the petrochemical production energy intensity.

## Results and Discussion

Oil and gas production in the Russian Federation is the leading in the world, as there are huge reserves of hydrocarbons. The petrochemical industry is able to use these advantages effectively economically occupying only 1.5% of the economy.

Pyrolysis plants that were formed more than 50 years ago and have been modernized serve as the production base of the petrochemical industry. The total production capacity of Russian companies for ethylene is slightly more than 3 mt per year (less than 2% of the world). For comparison, in countries that are much more modestly provided with petrochemical raw materials, the total capacity of pyrolysis plants is many times greater. As for the pyrolysis of hydrocarbon raw materials, these are the basic petrochemical processes; the main intermediates are obtained at petrochemical enterprises – olefins (ethylene, propylene), butadiene, isoprene, aromatic hydrocarbons and other products.

According to experts, an increase in the share of petrochemical production in Russia's GDP is possible if 1) new sales markets appear; 2) world prices for minerals increase [6]. In the current complex political environment between countries, it is quite problematic to enter a new market (countries such as China are promising areas, but this is still in theory).

The world market regulates the price policy for petrochemical raw materials, and in the absence of consensus among OPEC member countries, the indicator values are rapidly moving down. The petrochemical industry is understood as an energy-intensive industry that has a high specific consumption of both electric and thermal energy. For example, in order to produce 1 ton of chemical fiber, it will take about 20,000 kW/h of electricity, as well as more than 10 tons of fuel. As for the total consumption of resources, the indicators in oil and gas chemistry make up 20% of industrial consumption. These indicators, unfortunately, can be considered inflated.

Petrochemical plants usually use sources of cheap electricity which, in turn, helps to increase efficiency, intra- and inter-industry communication between petrochemical enterprises, allowing them to provide various combinations of production and implement effective technologies.

It is important to emphasize the high consumption of water resources in oil and gas chemistry, which are spent on washing and cooling production units, minimizing water. The total consumption of petrochemical enterprises in relation to other enterprises in Russia, of course, takes a leading place, which is a disadvantage. In order to produce 1 t of fiber, it is necessary to spend up to 5,000 cubic meters of water, the cost of producing a water-intensive unit of production is 20%.

The comparison of average electricity consumption by petrochemical enterprises in Russia and abroad (for example, in the United States), shown in figure 1, reflects a significant lag in Russian consumers. As for the volume of products produced by enterprises of the petrochemical industry, US enterprises produce only 1.21 times more than Russian ones which are a slight advantage compared to the resources spent. In this case, the business structure of Russian enterprises is the most rational.

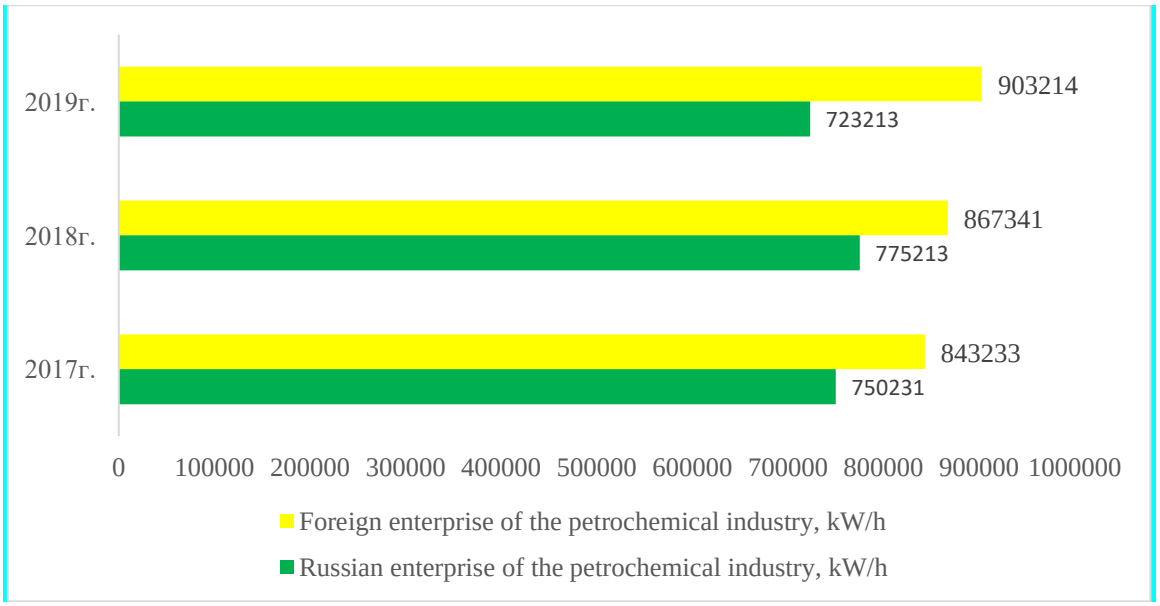


*Fig. 1. Average electricity consumption by petrochemical enterprises in Russia and abroad (using the example of the USA) [6]*

A similar situation is observed in the area of kerosene consumption (see Figure 2.)

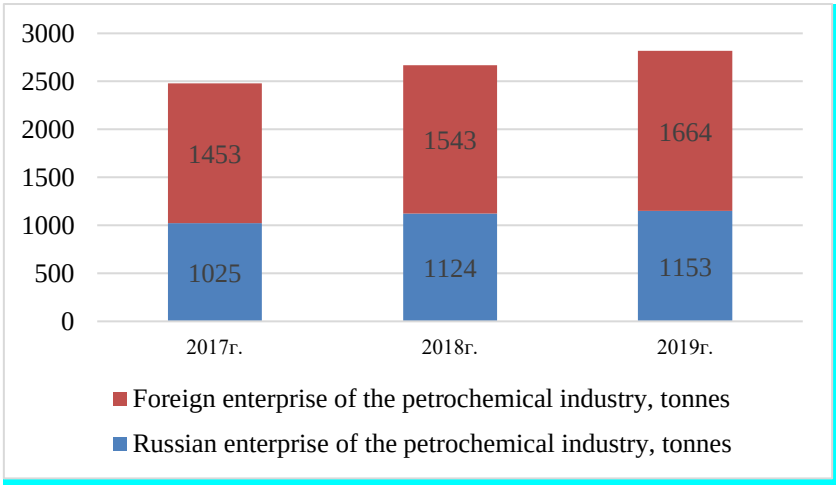


*Fig. 2. Average indicators of kerosene consumption by enterprises of oil and gas chemistry [10]*

The formation of territories where enterprises for the production of plastics and synthetic resins were located took place both in the Central region of Russia and in the Volga-Vyatka region. The enterprises were mainly provided with imported raw materials. At the moment, due to the expansion of the field of application of hydrocarbon petrochemical raw materials, there is a territorial dispersion of enterprises throughout Russia. For example, there are enterprises observed in the area of oil refining, oil production and on the oil and gas pipeline routes: Volga region (Volgograd and Kazan), Ural region (Ufa and Nizhny Tagil), Central region (Moscow and Ryazan), Northwest region (Saint-Petersburg) [7].

The volume of oil and gas condensate production in Russia is shown in Figure 3.

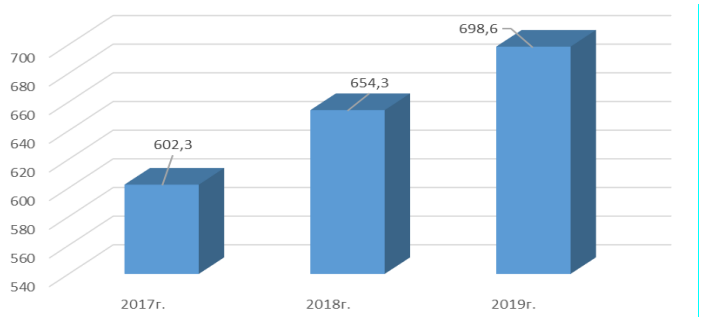


*Fig. 3. Oil and gas condensate production volumes in Russia, million tonnes [10]*

The data in Figure 3 reflect the annual growth in oil and gas condensate production, which totaled 698.6 m t in 2019. The financial condition of the industry enterprises is characterized by high indicators of profitability of production and consistently generated positive cash flows from operating activities. High indicators of financial and economic efficiency of petrochemical enterprises are determined by the customs aspect (subsidies), and pricing policy (import parity between price and transportation) in the case of deliveries to the domestic market [11].

The largest petrochemical structures in Russia are: TAIF Group of Companies, Rosneft, LUKOIL, Gazprom, Nizhnekamskneftekhim, SIBUR Holding, the main business models of companies are shown in Fig. 4.

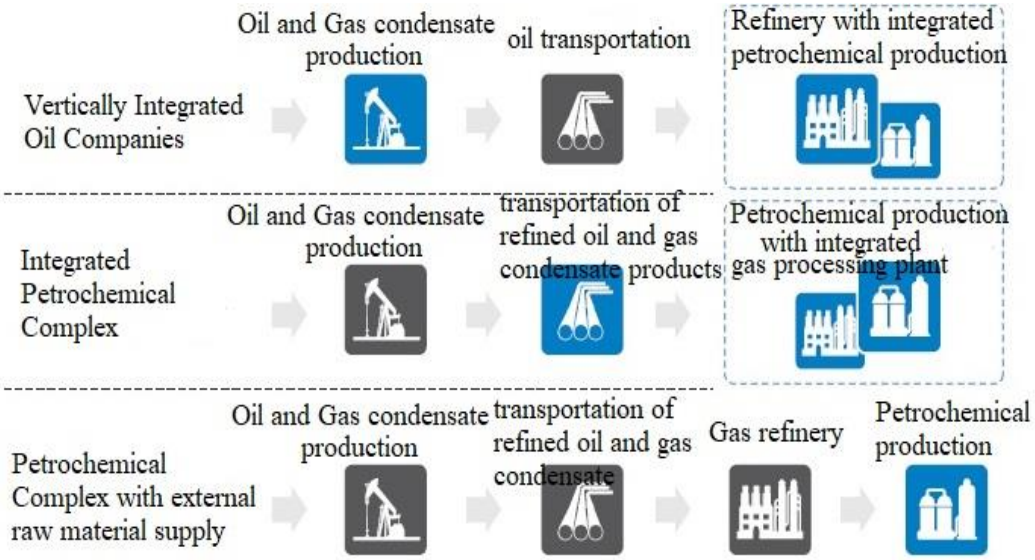


*Fig. 4. The basic business model of a petrochemical companies of the Russian Federation*

An important feature of the business models of the companies described is long-term guaranteed deliveries, since the oil and gas transportation infrastructure are considered very developed, an important point is the location of production facilities near pyrolysis plants [10].

In modern conditions in the petrochemical industry, there are cases of enterprise restructuring - changes in the structure of the enterprise (the location of elements), as well as elements that form the business, considering the influence of factors both external and internal environment. The restructuring includes:

- Measures to improve the management system;
- Measures to improve financial and economic policy;
- Measures to improve marketing communications and sales channels;
- Measures to improve personnel management.

The main reason for the desire of enterprises to restructure is the low efficiency of their activities, which is expressed in unsatisfactory values of financial indicators, a lack of working capital, a high level of receivables and payables, and operating costs.Over the past five years, as part of the restructuring of enterprises, it was planned to create special large gas and petrochemical conglomerates - clusters that would solve one of the key structural tasks – the formation of a base for the development of production.

In each cluster, it was planned to implement the production chain (starting with the production of hydrocarbons and ending with the production of final consumer goods). In accordance with international experience in creating clusters, this strategy was analyzed and approved.

The main advantages of the production organization are the reduction of operational logistics costs and the possibility of using a large-scale effect. The benefits of creating this infrastructure, as well as various types of petrochemical products, consist in the concentration of a large number of industries [6].

Petrochemical companies have announced projects for the production of olefins, which are central to the cluster. The total combined annual production capacity of ethylene was 7.8 mt in 2017, and by 2022 this figure was planned to reach 12.8 mt. Peripheral enterprises included in the cluster were small and medium-sized enterprises focused on the production of final consumer products. It was also planned to create a management company (a special

organizational structure), its main objectives were to ease joining the cluster of new enterprises, as well as to accompany implementation of logistics issues [3].

Ultimately, this implementation would reduce the deficit of production capacity, improve domestic demand for petrochemical products, and stimulate exports.

It should be noted that in modern conditions clusters are not introduced: these projects are either postponed to a later date, or canceled altogether (Figure 5).

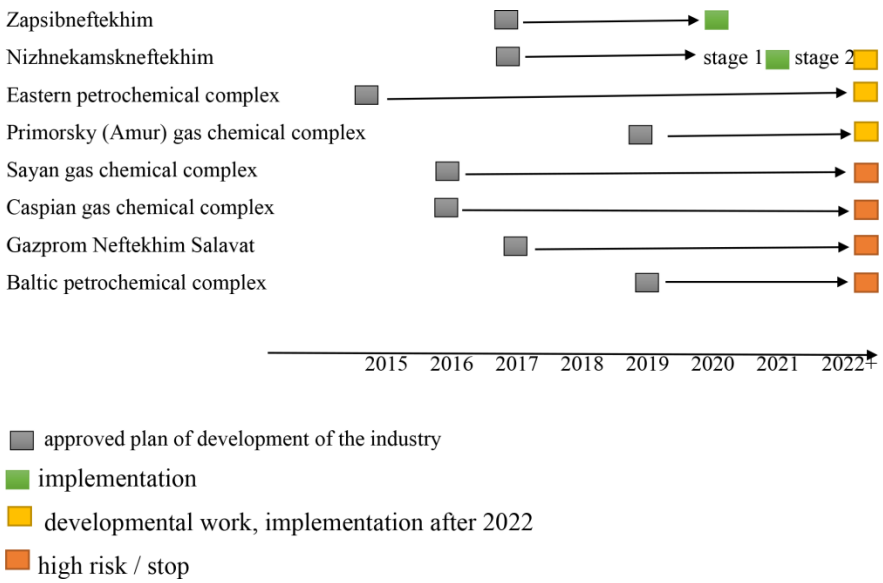


*Fig. 5. Status of pyrolysis plant construction projects up to 2030 [7]*

The key problem encountered in the implementation of investment plans was the problem of providing raw materials and developing transport infrastructure, which is extremely capital-intensive and makes the project implementation process financially more difficult.

Despite this, investment processes in individual enterprises are being implemented, so in the period up to 2025, it is planned that the ethylene capacity will grow by more than 2.1 mt, propylene – by 1 mt.

In 2019, ZapSibNeftekhim was commissioned with a capacity of 1.5 mt of ethylene and 500,000 t of propylene per year. In addition, the production of olefin will increase at the existing facilities of SIBUR (Fekhtin 2019).

The expansion of paraxylene capacity is focused on the introduction of new capacity for Terephthalic Acid (TPA), which is currently in short supply. In addition to the growing volume of PET production, additional demand for TPA was provided by the new production of the Plasticizer Dioctyl Terephthalate (DOTP, 100,000 t per year), launched at SIBUR-Khimprom in early 2019. SIBUR will complete the modernization of TPA production at the Blagoveshchensk Polyef production site, which will increase capacity from 270 to 350 thousand tonnes.

The stagnation of the Russian economy, combined with energy intensity and a lack of sources of investment in expanding the production capacity of enterprises in the petrochemical sector of the economy, may threaten Russia's ability to serve export markets.

Indonesia and the United Kingdom provide examples of how the economic situation in the industry has affected the transformation of the country's position from a net exporter of oil and gas to a net importer. Countries such as Mexico and Iran are expected to follow this path.

Despite the significant raw material potential of Russia, its implementation can be ensured by the flow of investment and technological capital. Projects aimed at improving energy efficiency and returns from the activities of petrochemical enterprises are seen as economically justified in terms of investment volumes and payback periods [9]. In the face of

limited production capacity and increased demand, reducing energy intensity will be a key factor in ensuring adequate supply [5].

The institutional system of the industry already uses mechanisms to encourage investment in technologies that improve the efficiency of petrochemical raw materials and gas production (for example, incentives for gas production from deep horizons rich in gas condensate). One of them is the technology of Cycling, which allows you to extract valuable components from the fat gas, and the dry gas is pumped back into the reservoir, providing reservoir pressure.

In addition, measures to improve the efficiency of the use of energy resources of enterprises of the petrochemical complex should include:

- Unity of the methodology of the energy saving process in order to introduce unified regulations and rules in the petrochemical industry;
- The use of modern methods for determining the potential (Pinch Analysis, Life-cycle cost analysis (LCCA), Exergy Analysis). Pinch Analysis refers to the minimization of energy consumption of various chemical processes by calculating the minimum energy consumption; LCC Analysis refers to the method of estimating costs over the entire life span; Exergy Analysis refers to the thermodynamic analysis of systems interacting with the environment. These links allow you to evaluate the effectiveness of your work and determine areas for improvement;
- Implementation of automated systems for accounting and monitoring energy use.

All these aspects should occur simultaneously and continuously: initial energy consumption, formulation of a feasible goal, methodological and expert support, exchange of knowledge and experience.

## Summary

Structural changes in the activities of petrochemical enterprises are expressed in the institutional features of the organization of the business model, which determines the level of production diversification and product differentiation of the business. The need to improve approaches to business organization in this sector of the economy, in addition to the natural desire to improve the financial results of management, is associated with the goal of improving the energy efficiency of domestic production, which has been declared at the Federal level. Meeting the goal under the conditions of significant energy intensity of industry enterprises is mediated by investment activity of enterprises in the direction of improvement of technologies and modernization of production facilities most of which was built in 80-ies of the last century. In these conditions, financial assistance will help enterprises in the petrochemical industry to implement state tasks, coordinate actions with the development strategy of related industries, create conditions for stimulating production development, and make choices for raw materials and products with an understanding of the market.

## Conclusions

The financial condition of the industry enterprises is characterized by high indicators of profitability of production and consistently generated positive cash flows from operating activities. The analysis of measures to improve the efficiency of energy use of petrochemical enterprises has allowed to reveal a complex of them: energy conservation with a view to implementation in the petrochemical industry common provisions regulations; the use of modern methods of determining capacity; the introduction of automated systems of accounting and monitoring of energy use.

***Acknowledgements***

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

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**Article history:**
Received 18 September 2020
Accepted 25 November 2020

SCIENTIFIC REVIEW

# ECONOMIC ASSESSMENT OF THE DEPENDENCE OF AN ORGANIZATION'S COMPETITIVENESS ON REPUTATION CAPITAL

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## Abstract

There are many interpretations of the term reputation'. Most authors refer to the general definition of reputation, considering reputation (fr., From lat. 'Reputatio' reflection, reasoning) as "a common opinion about the merits and demerits of someone, smth". The nature and essence of the business reputation of the enterprise are multifaceted and depending on the discipline studied, each researcher has his own interpretation. As well as the very concept of reputation for various fields of science is interpreted differently, the methods of assessment differ. In this article, we analyze the Economic Assessment of the Dependence of an Organization's Competitiveness on Reputation Capital and consider the tools that form reputation capital and methods for assessing it. Based on a review of existing factors in the formation of reputation capital and valuation methods, we will be able to identify key focuses for further research. In the course of the analysis carried out in the work, we found that the formation internal factors of reputation capital play a significant role in ensuring competitiveness, namely, the organization's personnel, its corporate culture.

*Keywords: reputation, corporate reputation, methods, internal environment*

**JEL:M14**
**UDC: 005.332:347.715**
**005.336.6:334.7**
**658:339.137.2**
**COBISS.SR-ID 28649481**

## Introduction

There are many interpretations of the term reputation. Most authors refer to the general definition of reputation, considering reputation (fr., From lat. 'Reputatio' reflection, reasoning) as "a common opinion about the merits and demerits of someone, smth".

The nature and essence of the business reputation of the enterprise are multifaceted and depending on the discipline studied, each researcher has his own interpretation.

The concept of business reputation is supplemented by interpretations and emphasis, depending on the discipline that shows interest in this phenomenon (Table 1 shows the

interpretation of the definition of "reputation" depending on six areas of knowledge, according to Charles Fombrun and Key Van Rila) [3].

*Table 1. Definition of "goodwill" in various disciplines*

| | Definition |
|---|---|
| Marketing | Reputation as a cognitive perception of the company by stakeholders, forming their position in relation to the company and willingness to support. |
| Economy | Reputation as signals generated by a company about its key advantages in order to increase competitiveness. |
| Management | Reputation as a barrier to customer mobility. In other words, it keeps customers and provides profit for the company. |
| Sociology | Reputation as a public assessment of an organization's activities relative to norms and expectations. Sociologists emphasize the multiple nature of the actors involved in the process of building a reputation, and their interconnectedness. |
| Economy of the enterprise | Reputation is the perception of external agents about the company on the basis of leadership behavior strategies, interest in how they are perceived from the outside and corporate culture. |
| Finance and Accounting | Reputation as an intangible asset ("goodwill") that measures the difference between the carrying amount of a company and its market value. |

As well as the very concept of reputation for various fields of science is interpreted differently, the methods of assessment differ.

Of interest is the research conducted by Graham Dowling and Peter Roberts [5], in which they tried to trace the relationship between corporate reputation and changes in financial performance. The business reputation in their work was evaluated by company executives and corporate analysts on eight parameters.

They were able to identify the following:

1. A positive corporate reputation increases the length of time to maximize revenue.
2. A positive corporate reputation helps to reduce the time required to achieve financial indicators comparable to the average level.

## Methods

*Table 2. Classification of methods for assessing reputation*

| **Type** | **Evaluation Method** | **Methodology developed based on the method** |
|---|---|---|
| Quantitative | Accounting method | Goodwill – difference between market and book value |
| | Methods based on financial indicators | Interbrand, Brand Finance, Brand Valution & Analysis |
| Quality | Sociological survey methods | Reputation Quotient (RQ) |
| | Expert method | AMAC, Fortune |
| | Comparative method | Fortune 500 |

*Source: Compiled by the author*

In Table 1, we present the methods of valuing business reputation that exist in modern practice. Conventionally, they can be divided into two groups: quantitative and qualitative.

Among quantitative methods, the most common is the method of assessing business reputation as goodwill – this is the difference between the market capitalization of the company (the value of all its shares on the stock exchange) and its book value (the amount of net assets calculated according to accounting data).

However, in our opinion, such an assessment cannot be sufficiently reliable in connection with various external factors: for example, the actions of speculators, etc. Moreover, the Russian securities market is not so developed, so the purchase and sale of shares is not a

direct indicator of reputation. In other words, the fact that the price of shares has dropped or increased does not mean at all that those who want to buy a controlling stake will appear.

At the same time, a quantitative assessment can be divided into determining the actual value of the goodwill based on financial statements and forecasting the future value of goodwill on the basis of extrapolating the actual financial statements (used by the seller to assess the market value of the business if it is sold in the future or by an investor to assess the appropriateness of acquiring a business).

Most of the existing methods for assessing business reputation are of a qualitative nature.

All qualitative methods for assessing reputation can be divided into three groups: expert methods (based on the opinions of experts), social survey method and comparative method.

The first group includes compiling business reputation ratings by independent organizations. The most common and published annually is Fortune Magazine's America's Most Respected Companies (AMAC) project.

Methodologically, reputation ratings are derived by inviting participation from a large group of managers, analysts, and corporate directors. Questionnaires are circulated among potential respondents in the companies to be rated, and "official responses" are obtained. In each questionnaire, raters are asked to respond to eight questions that constitute the "key reputation attributes" on scales from 0 to 10:

1. Quality of management;
2. Quality of products or services;
3. Financial soundness;
4. Ability to attract, develop, and keep talented people;
5. Use of corporate assets;
6. Value as long-term investment;
7. Innovativeness;
8. Community and environmental responsibility.

Thus, after a review of existing methods, we concluded that the internal factors that shape the reputation play a significant role. Therefore, we consider it necessary to consider the tools that shape the reputation.

## Results and Discussion

An increase in the volume of reputation capital is expressed in an increase in public trust in the company, in strengthening a positive image, in the formation of a positive public opinion.

The competitiveness of the organization has a positive trend due to increased prestige, as well as improving the market functioning of the organization and increasing sales. An important factor in building the organization's reputation is the result of interaction not only with the external competitive environment, but also with the internal environment of the enterprise.

The staff is an integral and very strategically important resource of each organization.

Personnel – an object of close and constant attention of managers, as the most important component of the formation of the organization's reputation capital. The foundation for creating a positive reputation for an organization is intellectual resources. When working with staff, management needs to solve the problem of a sense of business solidarity and corporate patriotism. Embed in the minds of employees the prospect of developing their organization. In order to increase the intellectual value of the enterprise, and, consequently, its business image with reputation capital, it is necessary to conduct staff training.

Developing training technologies contribute to staff development, the emergence of extraordinary thinking among employees, the ability to implement new innovative ideas.

Thanks to this, an internal positive reputation is formed, which directly affects the creation of the external reputation of the company. Developing training helps to create a special professional intelligence among employees, thereby turning them into the intellectual capital of the company. Thus, developmental training helps each employee to gain new abilities, making him more mobile in the labor market.

The company, in turn, receives a unique workforce. An additional effect is the development of the company's reputation capital, which today represents an undeniable competitive advantage.

The solution to this issue can be found in the training technologies for personnel development.

*Table 3. Promoting company reputation capital*

| Name | Name Recommended type of training technologies for personnel development |
|---|---|
| Achieving the required category | Achievement of the required level, categories Increasing the level of qualification and status of the employee; practical exercises; workshops; trainings; business games; internships; |
| Additional knowledge | Additional knowledge "Full-time, distance, distance learning technologies" |
| Computer knowledge | Computer Knowledge Automated Learning Technologies |
| The development of related professions | Mastering related professions Internships; full-time; intraorganizational; standard training courses |
| Certification of workplaces | Certification of jobs Certification |
| Acquisition by the Manager of knowledge on the formation of the company's business image | The acquisition by the head of knowledge on the formation of the business image of the company Developing; lectures, practical exercises; workshops; international training |
| Acquisition of knowledge by employees on the formation of the company's business image | The acquisition by employees of knowledge on the formation of a business image of a company. Courses that enhance the status of an employee; intraorganizational training |

Considering the reputation as an intangible asset of an organization, special attention should be paid to the process of its formation. With the complex and systematic use of reputation building tools, this asset can become the most valuable and at times increase the total cost of the organization.

Reputation tools are a set of tactical measures, united by certain criteria in order to influence the overall perception of the organization. Based on the analysis of bibliographic sources, the following reputation building tools were identified: media relations, a complex of marketing communications, advertising, corporate communication, corporate social responsibility.

Media relations, as a tool for building a reputation, is to inform about the company's activities by sending press texts, responding to media inquiries, and organizing events for journalists. It is important to note that these are tactical events that individually act as tools for creating an image. Specific features of media relations are systematic, systematic and continuous work with the media.

Marketing communications represent a wide range of components, such as branding, direct marketing, etc. However, we note that when building a reputation through marketing communications, it is important to consider the scope of the organization.

Corporate communications include many tactical activities related to the formation and development of corporate culture and internal communications in general. When working with this tool, it is necessary to determine the organizational structure of the company and the type of internal corporate communications, on the basis of which to build further communication with employees to build the reputation of the organization.

The corporate culture of an enterprise is a combination of beliefs, attitudes, approaches to work, communication methods adopted and observed by most employees during their professional activities in the organization. When using this tool, it is necessary to build communication with employees to build the reputation of the organization based on its organizational structure and type of internal communications.

The company's reputation is formed under the system influence of factors. The company is influenced by the internal and external environment. The formation of reputation capital occurs as a result of the interaction of the internal and external environment of the enterprise, the effectiveness of which determines the size of reputation capital, and its impact on the competitiveness of the organization.

Allocate the tools with which the reputation is formed (Figure 1). These are tactical measures that are aimed at influencing the general perception of the company:

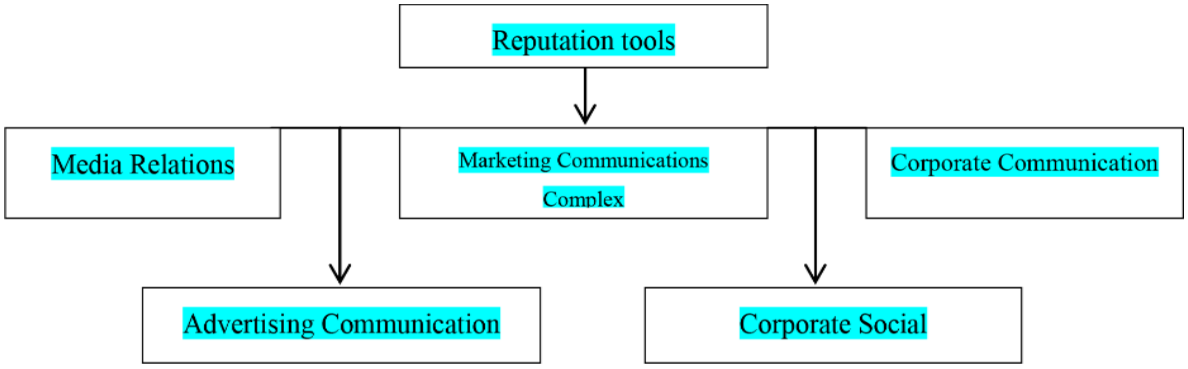


*Fig. 1. The composition of the tools used in building a reputation*

In accordance with Figure 1, the first tool builds a reputation by sending press texts, replies to the media, and organizing events for journalists. These activities are individually used to create an image.

Allocate the main means of influence in the complex of marketing communications (Figure 2).

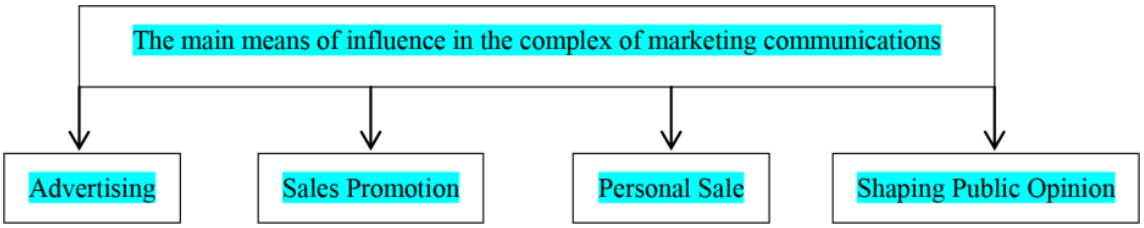


*Fig. 2. The main means of influence in the complex marketing communications*

Marketing communications also include branding, direct marketing. When using this tool, it is necessary to consider the sphere in which the company operates. Advertising communication builds a reputation through sociocultural transformation.

The main function of advertising follows from its very definition, namely: to interact with the consumer of a product or service, to assist in the formation of demand and stimulate the sale of goods using a large number of different methods and schemes at its disposal. The social function of advertising involves the formation and consolidation of certain consumer values and norms of a given society in the minds of consumers.

Advertising communication, as an independent tool for building a reputation, increases brand awareness and informs about the benefits of the organization's products or services.

Corporate social responsibility is understood as the realization of the company interests by ensuring the social development of its team and the active participation of the organization in

the development of society. The development of social responsibility is an integral part of entrepreneurial activity.

A socially responsible organization before society has a number of very significant advantages:

1. Improving financial performance;
2. Reduction in operating expenses;
3. Improving the image and reputation of the brand;
4. Increasing sales and customer loyalty;
5. Reducing staff turnover, increasing staff loyalty, increasing employee motivation.

A well-thought-out social policy of the organization, its transparency in relation to environmental protection can positively affect financial performance. In addition to improving financial performance, a well-thought-out social policy helps reduce operating costs.

Recognition by the consumer of a company as socially responsible helps it to remain competitive in the market. The same level of sales and customer loyalty is growing among socially responsible corporations.

Social responsibility is voluntary, based on the ethical principle and internal moral values, and norms.

The internal form of corporate social responsibility involves conducting business practice in relation to its own personnel, everything related to the development of human resources in the enterprise. The appearance of corporate social responsibility involves sponsorship and charity events.

## Summary

In the course of analyzing the assessment methods and tools that create reputation, we can conclude that the assessment of reputation must be considered not only from the point of customers view. Reputation is also assessed from within the company by employees whose assessment of their work organization indirectly creates a reputation through their behavior towards customers and other external economic agents.

Existing methods of reputation assessment, on the one hand, are subjective and do not always sufficiently reflect the real picture, but only the point of view of financially-oriented stakeholders who are generally not interested in issues of social responsibility or working conditions.

On the other hand, their quantitative assessment methods are either focused on evaluating the reputation as a component of the brand, or cannot be sufficiently reliable due to various external factors: for example, the actions of speculators, etc.

Thus, as part of the development of the reputation capital theory, in the future it is necessary to develop more independent quantitative methods for assessing reputation.

## Conclusions

We consider it appropriate to present the whole range of measures for the formation, tactical and strategic management of reputation capital in the form of a reputation strategy.

The ultimate goal of building a reputation strategy is to create a competitive advantage for the enterprise.

Reputation capital is an intangible asset of the enterprise and has the constituent elements: image and reputation. The composition of the tools used in building a reputation is different, but the main tools are a complex of marketing communications and corporate social responsibility of the business. To implement the formation and management of reputation capital, a reputation strategy is carried out. Corporate reputation is most often studied through

the prism of marketing, so many works on the assessment of business reputation are mainly focused on brands.

Reputation assessment is carried out by specialized companies in order to determine how companies in various countries, for example, the USA, European and Asian, are treated.

The staff of the enterprise plays a significant role in building a business reputation. Each department should be able to contribute to the success of the organization.

***Acknowledgements***

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University. The reported study was funded by RFBR, project number 20-31-70001.

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**Article history:**

Received 15 September 2020

Accepted 15 November 2020

ORIGINAL RESEARCH PAPER

# SELECTION OF A DISTRIBUTION CHANNEL USING THE INTEGRATED FUCOM – MARCOS MODEL

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## Abstract

The management of manufacturing companies faces a number of decisions, and one of the most important is the selection of distribution channels. A large number of these companies do not sell their products directly to end consumers. For this reason, there are marketing intermediaries between manufacturers and end consumers whose primary function is to connect manufacturers and consumers. Their task is to provide the goods from manufacturers to consumers with the satisfaction of logistics characteristics: at the right time, at the right place and in a form that is convenient to use, and certainly with minimal costs. Distribution is one of four marketing mix instruments without which the optimal combination of the instruments would not be obtained. Thus, the decision on selecting distribution channels is as important as the decisions regarding products, prices and promotion. Based on the set criteria and the evaluation of certain distribution channels by the criteria, the management of the company will be able to make the best decision. The evaluation of distribution channels based on the set criteria was performed by marketing experts and experts in certain markets using an integrated multi-criteria model. The FUCOM method was applied to determine the significance of the criteria, and then the distribution channels were evaluated by applying the new MARCOS method. Thereafter, a sensitivity analysis was performed using other MCDM methods to verify the results previously obtained.

*Keywords: distribution, FUCOM, MARCOS, logistics, manufacturing company*

**JEL: M32**
**UDC: 658.86/.87**
**005.311.12**
**COBISS.SR-ID 28650761**

## Introduction

All four instruments have to be considered when deciding on the optimal combination of marketing instruments, i.e., the marketing mix. Therefore, decisions about products, prices,

promotion and distribution have to be coordinated since one influence the others. Distribution channels are an instrument of the marketing mix that serves manufacturers as a connection with consumers. Manufacturers come in contact with the consumers of their products through various distribution channels. Distribution encompasses all the activities that allow products to reach from manufacturers to consumers. The name "distribution *channel*" originates from the French word "canal" and represents the path that a product passes from the manufacturer to the consumer, i.e., each product has a channeled flow from the manufacturer to the consumer [1]. Certainly, the easiest way of distribution would be to sell products directly to consumers, however, some manufacturers do not have the possibility to sell their products in that way. The possibility depends on a number of factors, such as product characteristics, consumer habits, costs generated by direct sales, geographic distribution of consumers, i.e., market size, etc. For this reason, manufacturers have several types of distribution channels at their disposal. There are two main groups of distribution channels, i.e., intermediaries that are involved in delivering goods from manufacturers to consumers. The first group consists of intermediaries that take ownership of the goods and they work in their own name and on their own behalf. The second group consists of intermediaries that do not take ownership of the goods and they work in the name and on behalf of others, i.e., they work on commission. In distribution channels, there are also ancillary entities that allow the production process to proceed smoothly. The ancillary entities do not take ownership of the goods nor negotiate with consumers the terms of sale and purchase, but only help to complete the distribution process in the right way and without interruption. The ancillary entities are transport companies, freight forwarders, insurance companies, warehouses, banks and other entities that participate in ancillary activities in the distribution of products.

The successful and competitive performance of a company is the result of good decisions made by the management of the company. The competitiveness of economy and its economic entities in the global market is vital for the development of national economy since it reflects its ability to be involved in the international division of labor [2]. Thus, it is necessary to make the right decision on the selection of distribution channels. All the factors that affect the functioning of distribution channels are a variable category, and therefore once selected distribution channels are not the best option in all cases. Hence, in order to make the right decision on selecting distribution channels, all the factors that affect the functioning of distribution channels have to be constantly monitored.

In this paper, distribution channels were evaluated by marketing and logistics experts on the basis of certain criteria. After the introductory considerations, a review of the literature, i.e., papers on this topic are presented. The following section of the paper refers to the results of the research and the formation of a decision-making model. Based on the model, it will be possible to decide on selecting a distribution channel of a particular company. The company that needs to make this kind of decision has participated in the survey by providing basic information about its business, products and distribution method so far. The data were collected using a questionnaire forwarded to the management of the company. The last section of the paper is related to the concluding considerations.

## Literature review

How important the decision on selecting distribution channels is for a company and how much the same decision influences the performance of the company is indicated by the fact that there is a large amount of literature analyzing this topic. Dent [3] analyzes the concept and significance of distribution channels in great detail. In a very clear and precise way, Rosenbloom [4] provides explanations of distribution channels, their relation with other marketing instruments, as well as decision-making about the selection of distribution

channels. Marketing instruments are interconnected and one without the others would not represent the optimal combination of the marketing mix, therefore the decision on one significantly influences the decision on the other instruments. The business success and competitive advantage of a company significantly depends on decisions about how to combine marketing instruments in the best possible way [5].

No matter what business the company is engaged in, it has to decide on how to make the products available to consumers. It is also confirmed by scientific papers referring to distribution channels in various fields of production (McCabe *et al*., [6]; Schegg *et al*., [7]; Camilleri, [8]; Vasiliauskas *et al*., [9]; Atănăsoaie, [10]; Thakran & Verma, [11].

The factors that influence the selection of distribution channels are most commonly product characteristics, consumer habits, financial situation of the company, price, geographic concentration and width of product assortment. All of these factors determine to some extent which distribution channel a particular business will use for the placement of their products to consumers. Accordingly, certain authors also addressed the factors that influence the selection of distribution channels. Saremi & Zadeh [12] analyzed decision-making regarding distribution on the basis of certain criteria and its impact on the overall marketing system of the company. When selecting a distribution channel, the management of the company have to consider the goals of the company as a whole since the decision on selecting distribution channels has a significant impact on achieving business results as it is directly related to the placement of products and their sallling in the market [13]. With the development of science and technology, there have been changes in all spheres of business, as well as in distribution channels. In their research, Watson *et al*., [14] observe a period of development of distribution channels from 1980 to 2014, where significant changes are noticed in the functioning of distribution channels. Galkin [15] analyzes the influence of factors on the selection of distribution channels by specific regions, and he has proved that all factors that may influence the selection of distribution channels should be considered for each region individually since their influence varies from region to region. Sabiote *et al*., [16] state that consumer behavior, consumer habits and culture can significantly influence the selection of distribution channels.

Liu & Cui [17] analyzed the impact of product line length on distribution channels.

Stoddard *et al*., [18] determine a link between consumer habits, distribution channels, and products. The way in which a particular product or service can influence the selection of distribution channels is explained in the research by Kim *et al*., [19].

In order for a company to be always prepared for a competitive response, it has to consider any changes in the factors affecting distribution channels and, accordingly, change the decision on the selection of distribution channels [20].

The FUCOM method is widely used as proved by numerous scientific papers where the method has been used. The FUCOM method assists managers in prioritizing criteria using simple algorithms, as well as in assessing phenomena according to current requirements of decision-makers [38]. Sofuoğlu [22] notes that the FUCOM method in combination with other methods provided successful results when making decisions in a manufacturing company engaged in the manufacture and processing of newly developed high strength parts.

Durmić [23] uses the FUCOM method to evaluate the criteria when selecting suppliers.

Prentkovskis *et al*., [24] use the FUCOM method to determine the weight coefficients of quality dimensions when measuring service quality. The FUCOM method is used in various decision-making fields and when evaluating certain alternatives Nunić, [25]; Pamučar, [38]; Fazlollahtabar *et al*., [26]; Badi & Abdulshahed, [27]; Bozanic *et al*., [28]; Ibrahimović *et al*., [29]; Erceg & Mularifović, [30]; Nenadić, [31].

## Methods

The methodology for deciding on the selection of a distribution channel used in this paper consists of three phases (Figure 1). In the first phase, data from a particular company are collected. In this phase, the current state of distribution in the company has been defined.

Based on the current state of distribution and the intention of the company to improve the distribution of its products, the criteria for selecting distribution channels as well as potential alternatives are determined. Subsequently, the second phase is approached, where the FUCOM method is applied. By the application of the FUCOM method, the weight coefficients of the criteria are defined. The third phase consists of the application of the MARCOS method. By applying the steps of this method, the ideal and anti-ideal solution and the values of utility functions of alternatives are obtained. Then the alternatives are ranked from the best to the worst. The best-ranked alternative will be the one with the value of utility function closest to the value of the ideal solution, and the worst will be the alternative with the value of utility function closest to the value of the anti-ideal solution. Thus, the choice of the company should be the alternative that is ranked best.

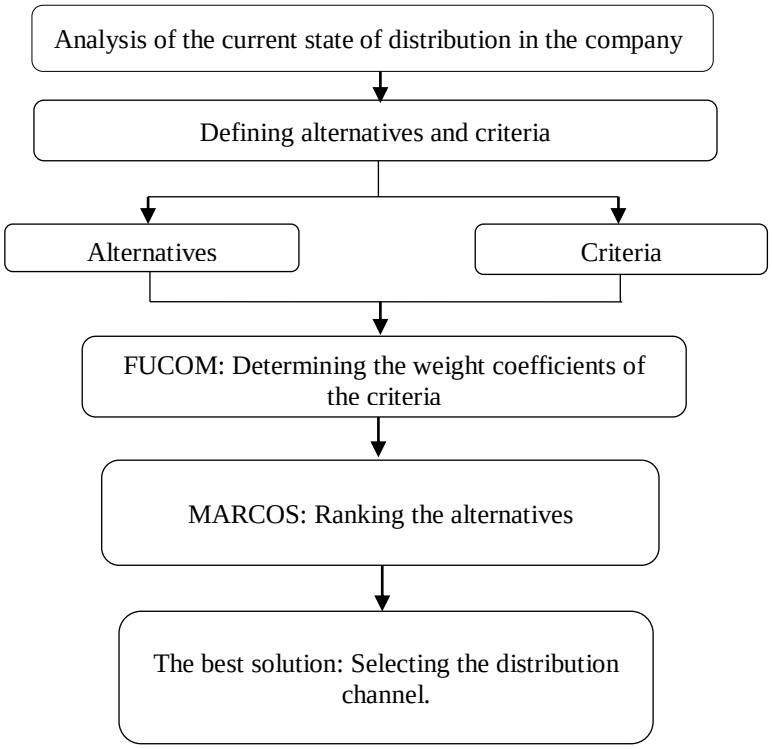


*Fig. 1. Methodology for deciding on selecting a distribution channel*

The FUCOM method is based on the principles of pairwise comparison and validation of results through deviation from maximum consistency [21]. Benefits that are determinative for the application of FUCOM are a small number of pairwise comparisons of criteria (only n-1 comparison), the ability to validate the results by defining the deviation from maximum consistency (DMC) of comparison and appreciating transitivity in pairwise comparisons of criteria. The FUCOM model also has a subjective influence of a decision-maker on the final values of the weights of criteria. This particularly refers to the first and second steps of FUCOM in which decision-makers rank the criteria according to their personal preferences and perform pairwise comparisons of ranked criteria.

However, unlike other subjective models, FUCOM has shown minor deviations in the obtained values of the weights of criteria from optimal values [21], [28], [23], [32], [26].

Additionally, the methodological procedure of FUCOM eliminates the problem of redundancy of pairwise comparisons of criteria, which exists in some subjective models for determining the weights of criteria. Figure 2 presents the FUCOM algorithm [33].

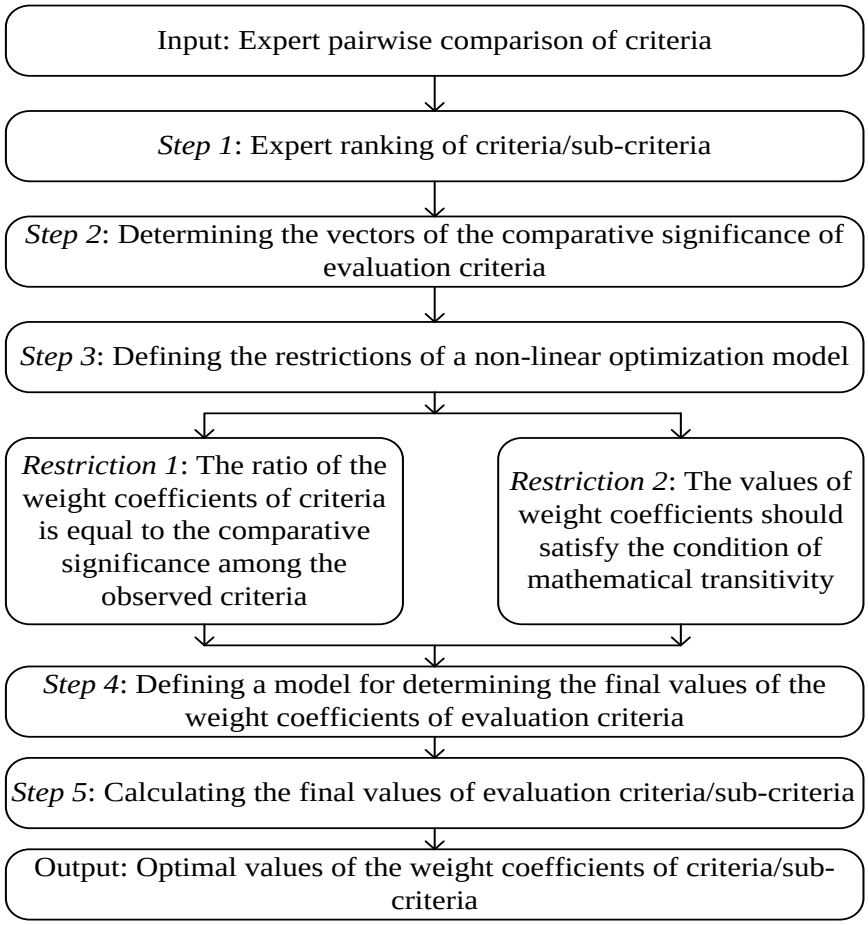


*Fig. 2. Steps of FUCOM method*

In Figure 2, we can see that the algorithm consists of five steps that are clearly explained.

Here we assume that there are $n$ evaluation criteria which are denoted as $wj$, $j = 1,2, ..., n$ and that their weight coefficients should be determined. The FUCOM method requires decision-makers to determine the impact of criterion $i$ on criterion $j$.

The MARCOS method is based on defining the relationship between alternatives and reference values (ideal and anti-ideal alternatives). On the basis of the defined relationships, the utility functions of alternatives are determined and compromise ranking is made in relation to ideal and anti-ideal solutions. Decision preferences are defined on the basis of utility functions. Utility functions represent the position of an alternative with regard to an ideal and anti-ideal solution. The best alternative is the one that is closest to the ideal and at the same time furthest from the anti-ideal reference point. The MARCOS method is performed through the following steps [34]:

*Step 1*: Formation of an initial decision-making matrix. Multi-criteria models include the definition of a set of $n$ criteria and $m$ alternatives. In the case of group decision-making, a set of $r$ experts should be formed to evaluate alternatives according to the criteria. In the case of group decision-making, expert evaluation matrices are aggregated into an initial group decision-making matrix.

*Step 2*: Formation of an *extended* initial matrix. In this step, the extension of the initial matrix is performed by defining the ideal (*AI*) and anti-ideal (*AAI*) solution.

$$X = \begin{array}{c} \\ AAI \\ A_1 \\ A_2 \\ \dots \\ A_m \\ AI \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \dots & C_n \end{array} \\ \begin{bmatrix} x_{aa1} & x_{aa2} & \dots & x_{aan} \\ x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{22} & \dots & x_{mn} \\ x_{ai1} & x_{ai2} & \dots & x_{ain} \end{bmatrix} \end{array} \quad (1)$$

The anti-ideal solution (AAI) is the worst alternative, while the ideal solution (AI) is an alternative with the best characteristic. Depending on the nature of the criteria, AAI and AI are defined by applying Equations (2) and (3):

$$AAI = \min_i x_{ij} \quad if \ \ j \in B \quad and \quad \max_i x_{ij} \quad if \ \ j \in C \quad (2)$$

$$AI = \max_i x_{ij} \quad if \ \ j \in B \quad and \quad \min_i x_{ij} \quad if \ \ j \in C \quad (3)$$

where *B* represents a benefit group of criteria, while *C* represents a group of cost criteria.

*Step 3*: Normalization of the extended initial matrix (*X*). The elements of the normalized matrix $N = \left[ n_{ij} \right]_{m \times n}$ are obtained by applying Equations (4) and (5):

$$n_{ij} = \frac{x_{ai}}{x_{ij}} \quad if \ \ j \in C \quad (4)$$

$$n_{ij} = \frac{x_{ij}}{x_{ai}} \quad if \ \ j \in B \quad (5)$$

where elements $x_{ij}$ and $x_{ai}$ represent the elements of the matrix *X*.

*Step 4*: Determination of the weighted matrix $V = \left[ v_{ij} \right]_{m \times n}$. The weighted matrix *V* is obtained by multiplying the normalized matrix *N* with the weight coefficients of the criterion $w_j$, Equation (6).

$$v_{ij} = n_{ij} \times w_j \quad (6)$$

*Step 5*: Calculation of the utility degree of alternatives *Ki*. By applying Equations (7) and (8), the utility degrees of an alternative in relation to the anti-ideal and ideal solution are calculated.

$$K_i^- = \frac{S_i}{S_{aai}} \quad (7)$$

$$K_i^+ = \frac{S_i}{S_{ai}} \quad (8)$$

where $S_i$ (*i*=1, 2, ..., *m*) represents the sum of the elements of the weighted matrix *V*, Equation (9).

$$S_i = \sum_{i=1}^{n} v_{ij} \quad (9)$$

*Step 6*: Determination of the utility function of alternatives $f(K_i)$. The utility function is the compromise of the observed alternative in relation to the ideal and anti-ideal solution. The utility function of alternatives is defined by Equation (10).

$$f\left(K_i\right)=\frac{K_i^+ + K_i^-}{1+\frac{1-f\left(K_i^+\right)}{f\left(K_i^+\right)}+\frac{1-f\left(K_i^-\right)}{f\left(K_i^-\right)}}; \tag{10}$$

where $f\left(K_i^-\right)$ represents the utility function in relation to the anti-ideal solution, while $f\left(K_i^+\right)$ represents the utility function in relation to the ideal solution. Utility functions in relation to the ideal and anti-ideal solution are determined by applying Equations (11) and (12).

$$f\left(K_i^-\right)=\frac{K_i^+}{K_i^+ + K_i^-} \tag{11}$$

$$f\left(K_i^+\right)=\frac{K_i^-}{K_i^+ + K_i^-} \tag{12}$$

*Step 7*: Ranking the alternatives. Ranking the alternatives is based on the final values of utility functions. It is desirable that an alternative has the highest possible value of the utility function.

***Case study***

This paper considers making the best decision on selecting a distribution channel for a particular company. The research for the purpose of this paper has been carried out in a company classified as a small business since it employs 26 workers. The company was founded in 1956 and it has not changed the main activities of its business since then. The company carries out production, classified as mixed agricultural production, where the products are divided into three groups. The first group consists of four products in the field of crop production (wheat, corn, soybeans and rapeseed), the second group also consists of four products in the field of seed production (maize seed, wheat seed, barley seed and triticale seed) and the third group consists of one product in the field of animal husbandry (beef cattle). Crop production is carried out on approximately 500 ha, which represents a large land surface and a large annual crop yield. At any moment, the company has about 400 head of beef cattle, which is also a large amount of production. The company also processes 1000 tons of small grain seeds over one production period, which covers a period of one year.

Production is carried out on the territory of the municipality of Derventa, while products are marketed both domestically and abroad. Therefore, the company represents one of the major exporters of these agricultural products. So far, the company has been selling its products exclusively directly to consumers. This type of selling causes distribution costs reaching their maximum, i.e., the company has no additional funds to invest in distribution.

For this reason, the company intends to find a new distribution method to reduce the costs and invest that money in improving the production.

## Forming a Multi-Criteria Model

In order for the company to make the best decision on selecting a distribution channel, it was formed a team of experts that consisted of three executives from a company for distribution of agricultural products, all three from BiH, and three foreign professors in the field of marketing specifically engaged in distribution as a narrow field of their interest. They evaluated alternatives by all criteria based on the following scale of values shown in Table 1.

*Table 1. Linguistic scale for the evaluation of alternatives depending on the type of criteria*

| For Criteria | Linguistic Scale |
|---|---|
| **1** | Very Poor – VP |
| **2** | Poor – P |
| **3** | Medium – M |
| **4** | Good – G |
| **5** | Very Good – VG |

All members of the expert team are familiar with the current situation in the company, as well as its needs and requirements, and based on that, they evaluated the criteria and alternatives presented in Tables 2 and 3. Table 2 defines the criteria by which the experts evaluated the alternatives.

*Table 2. The criteria for selecting a distribution channel*

| | Criteria | Characteristics and description of the criteria |
|---|---|---|
| **$C_1$** | Product characteristics | The basic features and characteristics of the products; durable products – longer distribution channels, less durable products – shorter distribution channels. |
| **$C_2$** | Financial situation of the company | The number of financial resources that the company is ready to allocate to the distribution channels and the funds determine the channels; more money – shorter distribution channels, less money – longer distribution channels. |
| **$C_3$** | Consumer habits | The practice of purchasing certain products; consumer goods – longer distribution channels; special products – shorter distribution channels. |
| **$C_4$** | Costs | The price per unit of distributed product; high price – shorter distribution channels, low price – longer distribution channels. |
| **$C_5$** | Geographic concentration | The geographic locations where the company sells its products; higher concentration – shorter distribution channels, lower concentration – longer distribution channels. |
| **$C_6$** | Width of the product assortment | The number of various product lines offered by the manufacturer for sale to consumers; wide assortment – shorter distribution channels, narrow assortment – longer distribution channels. |

Table 3 provides a description of the alternatives that were evaluated by the experts according to the criteria set out in Table 2. Each alternative is defined individually in the table for the purpose of their easier review.

*Table 3. Defining the alternatives*

| | Alternatives | Characteristics and description of the alternatives |
|---|---|---|
| **$A_1$** | Manufacturer-Consumer | The manufacturer sells the product directly to the consumer. |
| **$A_2$** | Manufacturer-Retailer-Consumer | The manufacturer sells the goods to a retailer and the retailer sells the goods to end consumers. |
| **$A_3$** | Manufacturer-Wholesaler-Retailer-Consumer | The manufacturer sells the goods to a wholesaler, the wholesaler to a retailer and the retailer eventually sells the goods to end consumers. |
| **$A_4$** | Manufacturer-Agent-Consumer | Agents do not take ownership of the goods but sell the goods to the buyers on behalf of the manufacturer, so they work in their own name and on behalf of others. |
| **$A_5$** | Manufacturer-Broker-Consumer | Brokers work for a fixed period of time until an agreement is reached between the manufacturer and the consumer, they do not take any risks, work on the commission from the sales price. They work in the name and on behalf of others. |
| **$A_6$** | Manufacturer-Auction House-Consumer | Auction houses have the task of bringing together the manufacturer and the buyer in one place and arranging public bidding. They work on the commission from the sales price. |
| **A7** | Manufacturer-Commissioner-Consumer | The commissioners take the goods from manufacturers and sell the goods at the best price to consumers; they work on commission and settle their costs. |

The evaluation of the alternatives by the criteria was performed based on the scale previously presented in Table 1. Ratings of the alternatives are shown in Tables 4 and 5.

Table 4 shows the ratings of the alternatives by the criteria using the scale from 1 to 5 from Table 1.

*Table 4. Evaluation of the alternatives by criteria*

| | **$E_1$** | | | | | | **$E_2$** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ |
| **$A_1$** | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 2 | 2 | 2 | 3 | 2 |
| **$A_2$** | 3 | 2 | 3 | 3 | 2 | 3 | 4 | 4 | 5 | 4 | 3 | 4 |
| **$A_3$** | 4 | 3 | 2 | 2 | 3 | 4 | 5 | 4 | 3 | 5 | 4 | 3 |
| **$A_4$** | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 2 |
| **$A_5$** | 5 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 1 | 4 | 3 | 4 |
| **$A_6$** | 5 | 5 | 3 | 4 | 3 | 5 | 3 | 2 | 2 | 4 | 2 | 4 |
| **$A_7$** | 5 | 5 | 4 | 5 | 5 | 5 | 2 | 2 | 1 | 3 | 3 | 3 |
| | **$E_3$** | | | | | | **$E_4$** | | | | | |
| | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ |
| **$A_1$** | 3 | 1 | 1 | 1 | 2 | 1 | 5 | 4 | 1 | 3 | 5 | 2 |
| **$A_2$** | 3 | 4 | 5 | 4 | 4 | 5 | 3 | 5 | 2 | 4 | 3 | 2 |
| **$A_3$** | 4 | 4 | 4 | 5 | 3 | 4 | 4 | 5 | 2 | 5 | 2 | 2 |
| **$A_4$** | 2 | 2 | 1 | 2 | 2 | 2 | 4 | 5 | 3 | 5 | 2 | 3 |
| **$A_5$** | 3 | 2 | 1 | 4 | 2 | 3 | 4 | 5 | 3 | 5 | 2 | 3 |
| **$A_6$** | 2 | 2 | 1 | 4 | 2 | 3 | 5 | 4 | 3 | 5 | 1 | 2 |
| **$A_7$** | 3 | 2 | 1 | 4 | 2 | 3 | 4 | 4 | 2 | 5 | 1 | 3 |
| | **$E_5$** | | | | | | **$E_6$** | | | | | |
| | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ |
| **$A_1$** | 3 | 5 | 1 | 4 | 2 | 3 | 4 | 5 | 2 | 4 | 3 | 1 |
| **$A_2$** | 3 | 3 | 4 | 3 | 4 | 2 | 4 | 4 | 2 | 5 | 2 | 3 |
| **$A_3$** | 4 | 3 | 1 | 3 | 4 | 5 | 3 | 4 | 1 | 5 | 1 | 2 |
| **$A_4$** | 2 | 5 | 4 | 5 | 2 | 1 | 3 | 4 | 2 | 5 | 1 | 2 |
| **$A_5$** | 2 | 5 | 4 | 5 | 1 | 3 | 3 | 4 | 1 | 5 | 2 | 2 |
| **$A_6$** | 4 | 4 | 3 | 4 | 1 | 4 | 4 | 5 | 2 | 5 | 2 | 3 |
| **$A_7$** | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 5 | 3 | 5 | 2 | 1 |

Table 5 shows the ratings of the alternatives according to the criteria set by the decision-makers using the linguistic scale from Table 1. Table 5, therefore, represents the ratings from Table 4, but in this case, the ratings are presented descriptively.

*Table 5. Evaluation of the alternatives by criteria using the linguistic scale*

| | **$E_1$** | | | | | | **$E_2$** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ |
| **$A_1$** | G | M | M | G | M | M | G | P | P | P | M | P |
| **$A_2$** | M | P | M | M | P | M | G | G | VG | G | M | G |
| **$A_3$** | G | M | P | P | M | G | VG | G | M | VG | G | M |
| **$A_4$** | M | P | M | P | M | P | M | M | P | P | P | P |
| **$A_5$** | VG | G | G | G | G | G | P | M | VP | G | M | G |
| **$A_6$** | VG | VG | M | G | M | VG | M | P | P | G | P | G |
| **$A_7$** | VG | VG | G | VG | VG | VG | P | P | VP | M | M | M |
| | **$E_3$** | | | | | | **$E_4$** | | | | | |
| | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ |
| **$A_1$** | M | VP | VP | VP | P | VP | VG | G | VP | M | VG | P |
| **$A_2$** | M | G | VG | G | G | VG | M | VG | P | G | M | P |
| **$A_3$** | G | G | G | VG | M | G | G | VG | P | VG | P | P |
| **$A_4$** | P | P | VP | P | P | P | G | VG | M | VG | P | M |
| **$A_5$** | M | P | VP | G | P | M | G | VG | M | VG | P | M |
| **$A_6$** | P | P | VP | G | P | M | VG | G | M | VG | VP | P |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **$A_7$** | M | P | VP | G | P | M | G | G | P | VG | VP | M |
| | | | **$E_5$** | | | | | | **$E_6$** | | | |
| | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ |
| **$A_1$** | M | VG | VP | G | P | M | G | VG | P | G | M | VP |
| **$A_2$** | M | M | G | M | G | P | G | G | P | VG | P | M |
| **$A_3$** | G | M | VP | M | G | VG | M | G | VP | VG | VP | P |
| **$A_4$** | P | VG | G | VG | P | VP | M | G | P | VG | VP | P |
| **$A_5$** | P | VG | G | VG | VP | M | M | G | VP | VG | P | P |
| **$A_6$** | G | G | M | G | VP | G | G | VG | P | VG | P | M |
| **$A_7$** | G | G | G | G | M | M | M | VG | M | VG | P | VP |

## Evaluation of the Criteria by the Steps of the Fucom Method

The members of the expert team compared the criteria by significance. Then, they rated how much the significance of the best criterion was greater compared to the others by applying a scale of 1-9. The ratings of the criteria by the expert team members are shown in Table 6.

*Table 6. Evaluation of the criteria*

| | **C2** | **C1** | **C4** | **C6** | **C3** | **C5** |
|---|---|---|---|---|---|---|
| **DM1** | 1 | 2 | 2.1 | 3 | 4 | 4.3 |
| | C2 | C4 | C6 | C1 | C3 | C5 |
| **DM2** | 1 | 1.2 | 2 | 2.6 | 3 | 3 |
| | C1 | C6 | C2 | C4 | C5 | C3 |
| **DM3** | 1 | 1.5 | 2.2 | 2.2 | 4.3 | 6.8 |
| | C2 | C4 | C1 | C3 | C6 | C5 |
| **DM4** | 1 | 1.5 | 2 | 3 | 4 | 4.6 |
| | C4 | C2 | C1 | C3 | C6 | C5 |
| **DM5** | 1 | 1 | 3 | 3.1 | 4 | 5 |
| | C4 | C2 | C1 | C6 | C3 | C5 |
| **DM6** | 1 | 2 | 4 | 4.5 | 5 | 6 |

Table 6 shows that the first decision-maker identified Criterion 2, i.e., the financial situation of the company, as the most significant criterion, and C5, i.e., geographic concentration, as the least significant. Further, the table shows that the second decision-maker also marked the financial situation of the company as the most significant criterion, and the geographic concentration as the least significant, as well as the first decision-maker. The third decision-maker indicated that product characteristics as the criterion for selecting a distribution channel are the most significant criterion, and that consumer habits are the least significant criterion. The fourth and fifth decision-makers, as well as the first and second decision-makers, considered that the most significant criterion for selecting a distribution channel was the financial situation of the company, but the fifth decision-maker also indicated that the costs were as significant as the financial situation of the company. According to them, the least significant criterion was geographic concentration. The sixth decision-maker identified costs as the most significant criterion and geographic concentration as the least significant criterion for selecting a distribution channel.

After all the steps of the FUCOM method, the results of the evaluation of the criteria are obtained, as shown in Table 7. The table is accompanied by a graphic representation of the results where it is easier to see which criterion is the most significant and the least significant for the decision-makers.

*Table 7. Results of the evaluation of the criteria by the FUCOM method*

| | | DM1 | DM2 | DM3 | DM4 | DM5 | DM6 | Wj |
|---|---|---|---|---|---|---|---|---|
| **C1** | Product characteristics | 0.179 | 0.114 | 0.338 | 0.168 | 0.107 | 0.107 | 0.169 |
| **C2** | Financial situation of the company | 0.358 | 0.295 | 0.154 | 0.337 | 0.322 | 0.214 | 0.280 |
| **C3** | Consumer habits | 0.090 | 0.098 | 0.050 | 0.112 | 0.104 | 0.086 | 0.090 |
| **C4** | Costs | 0.171 | 0.246 | 0.154 | 0.225 | 0.322 | 0.428 | 0.257 |
| **C5** | Geographic concentration | 0.083 | 0.098 | 0.079 | 0.073 | 0.064 | 0.071 | 0.078 |
| **C6** | Width of product assortment | 0.119 | 0.148 | 0.226 | 0.084 | 0.080 | 0.095 | 0.125 |
| | | | | | | | SUM | 1.000 |

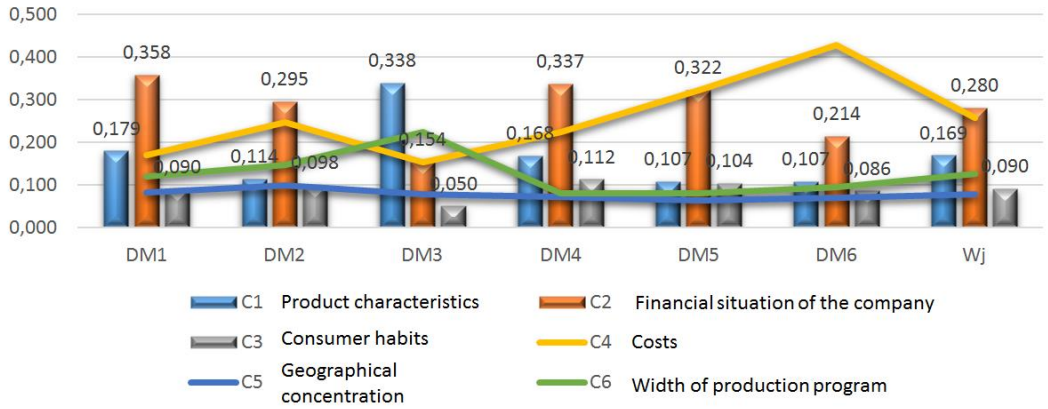


*Fig. 3. A graphic representation of the evaluation results of the criteria by the FUCOM method*

Table 7, as well as Figure 3, shows that the first decision-maker estimates that the financial situation of the company is the most important in selecting a distribution channel (0.358). The first decision-maker considers geographic concentration to be the least significant criterion when selecting a distribution channel (0.83). The second decision-maker also rates the financial situation of the company as the most significant criterion when selecting a distribution channel (0.295). The second decision-maker rates consumer habits and geographic concentration equally, and considers the two criteria to be the least significant when selecting a distribution channel (0.98). The third decision-maker considers product characteristics to be the most significant criterion when selecting a distribution channel (0.338). The third decision-maker considers consumer habits to be the least significant criterion (0.050). The fourth decision-maker rates that the financial situation of the company is the most significant criterion when selecting a distribution channel (0.337). The least significant criterion for the fourth decision-maker when selecting a distribution channel is geographic concentration (0.073). The fifth decision-maker considers the financial situation of the company and the costs to be the most significant criteria compared to other criteria (0.322), while the width of product assortment is the least significant criterion when selecting a distribution channel (0.080). According to the sixth decision-maker, the most significant criterion when selecting a distribution channel is the costs (0.428). The least significant criterion when selecting a distribution channel according to the sixth decision-maker is geographic concentration (0.071). The table and the graph show that, according to the decision-makers, the financial situation of the company is the most significant criterion when selecting a distribution channel; four decision makers (DM1, DM2, DM4 and DM5) rated this criterion as the most important (0.280). The costs as a criterion are in the second position with a slightly lower score (0.257). The least significant criterion, when considering the overall

score, is geographic concentration, and even five members of the expert team (DM1, DM2, DM4, DM5 and DM6) rated it as the least significant (0.079).

*Table 8. Extended initial decision matrix*

| CRITERIA | C11 | C12 | C13 | C14 | C15 | C16 |
|---|---|---|---|---|---|---|
| **Anti-ideal** | 2.749 | 2.904 | 1.513 | 2.798 | 1.698 | 1.817 |
| **A1** | 3.772 | 2.904 | 1.513 | 2.798 | 2.854 | 1.817 |
| **A2** | 3.302 | 3.525 | 3.260 | 2.040 | 2.884 | 2.994 |
| **A3** | 3.957 | 3.772 | 1.906 | 1.513 | 2.570 | 3.141 |
| **A4** | 2.749 | 3.260 | 2.289 | 2.000 | 1.906 | 1.906 |
| **A5** | 2.994 | 3.659 | 1.906 | 1.414 | 2.140 | 3.086 |
| **A6** | 3.659 | 3.420 | 2.182 | 1.587 | 1.698 | 3.360 |
| **A7** | 3.360 | 3.420 | 2.140 | 1.513 | 2.376 | 2.720 |
| **Ideal** | 3.957 | 3.772 | 3.260 | 1.414 | 2.884 | 3.360 |

Applying Equation (4), the normalized values of the cost criterion are obtained, for example:

$$n_{ij} = \frac{x_{ai}}{x_{ij}} \quad if \quad j \in C \quad \Rightarrow \quad n_{14} = \frac{1.414}{2.798} = 0.505$$

The normalized values of the benefit criterion are obtained by applying Equation (5):

$$n_{ij} = \frac{x_{ij}}{x_{ai}} \quad if \quad j \in B \quad \Rightarrow \quad n_{11} = \frac{3.772}{3.957} = 0.953$$

and a complete normalized matrix is shown in Table 9.

*Table 9. Normalized matrix*

| CRITERIA | C11 | C12 | C13 | C14 | C15 | C16 |
|---|---|---|---|---|---|---|
| **Anti-ideal** | 0.117 | 0.216 | 0.042 | 0.130 | 0.046 | 0.068 |
| **A1** | 0.161 | 0.216 | 0.042 | 0.130 | 0.077 | 0.068 |
| **A2** | 0.141 | 0.262 | 0.090 | 0.179 | 0.078 | 0.112 |
| **A3** | 0.169 | 0.280 | 0.053 | 0.241 | 0.070 | 0.117 |
| **A4** | 0.117 | 0.242 | 0.063 | 0.182 | 0.052 | 0.071 |
| **A5** | 0.128 | 0.272 | 0.053 | 0.257 | 0.058 | 0.115 |
| **A6** | 0.156 | 0.254 | 0.060 | 0.229 | 0.046 | 0.125 |
| **A7** | 0.143 | 0.254 | 0.059 | 0.241 | 0.064 | 0.102 |
| **Ideal** | 0.169 | 0.280 | 0.090 | 0.257 | 0.078 | 0.125 |

The next step is to extend the normalized matrix using Equation (6) by multiplying all the values of the normalized matrix by the values of the criteria. The extended normalized matrix is shown in Table 10.

*Table 10. Extended normalized matrix*

| CRITERIA | C11 | C12 | C13 | C14 | C15 | C16 |
|---|---|---|---|---|---|---|
| **Anti-ideal** | 0.695 | 0.770 | 0.464 | 0.505 | 0.589 | 0.541 |
| **A1** | 0.953 | 0.770 | 0.464 | 0.505 | 0.989 | 0.541 |
| **A2** | 0.834 | 0.935 | 1.000 | 0.693 | 1.000 | 0.891 |
| **A3** | 1.000 | 1.000 | 0.585 | 0.935 | 0.891 | 0.935 |
| **A4** | 0.695 | 0.864 | 0.702 | 0.707 | 0.661 | 0.567 |
| **A5** | 0.757 | 0.970 | 0.585 | 1.000 | 0.742 | 0.918 |
| **A6** | 0.925 | 0.907 | 0.669 | 0.891 | 0.589 | 1.000 |
| **A7** | 0.849 | 0.907 | 0.656 | 0.935 | 0.824 | 0.809 |
| **Ideal** | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

Using Equations (7), (12), the final results in Table are obtained by the MARCOS method.

The results are obtained as follows:

Applying Equation (10), all values (by rows) for the alternatives are summed as follows:

$$S_{AAI} = 0.117+0.216+0.042+0.130+0.046+0.068=0.619$$

The values for the remaining alternatives are obtained similarly.

Using Equation (8), the utility degrees in relation to the ideal solution are calculated. Example:

$$K_1^- = \frac{0.694}{0.619} = 1.121$$

while applying Equation (9), the utility degrees in relation to the ideal solution are obtained, e.g.:

$$K_1^+ = \frac{0.694}{1.000} = 0.694$$

The utility function in terms of the anti-ideal solution is obtained by applying Equation (12) as follows:

$$f(K_1^-) = \frac{K_1^+}{K_1^+ + K_1^-} = \frac{0.694}{0.694 + 1.121} = 0.382$$

While the utility function in terms of the ideal solution is obtained by applying Equation (13) as follows:

$$f(K_1^+) = \frac{K_1^-}{K_1^+ + K_1^-} = \frac{1.121}{0.694 + 1.121} = 0.618$$

Finally, the utility function of alternative A1 is obtained by applying Equation (11):

$$f(K_1) = \frac{K_1^+ + K_1^-}{1 + \frac{1-f(K_1^+)}{f(K_1^+)} + \frac{1-f(K_1^-)}{f(K_1^-)}} = \frac{0.694 + 1.121}{1 + \frac{1-0.618}{0.618} + \frac{1-0.382}{0.382}} = \frac{1.815}{1 + 0.618 + 1.619} = \frac{1.815}{3.237} = 0.561$$

The final results obtained by the MARCOS method are shown in Table 11.

*Table 11. Ranking the alternatives*

| **Ai** | **Si** | | | | | | |
|---|---|---|---|---|---|---|---|
| **AAI** | 0.619 | Ki- | Ki+ | f(K$^-$) | f(K$^+$) | f(Ki) | Rank |
| **A$_1$** | 0.694 | 1.121 | 0.694 | 0.382 | 0.618 | 0.561 | **7** |
| **A$_2$** | 0.861 | 1.392 | 0.861 | 0.382 | 0.618 | 0.696 | **5** |
| **A$_3$** | 0.929 | 1.502 | 0.929 | 0.382 | 0.618 | 0.751 | **1** |
| **A$_4$** | 0.727 | 1.176 | 0.727 | 0.382 | 0.618 | 0.588 | **6** |
| **A$_5$** | 0.883 | 1.427 | 0.883 | 0.382 | 0.618 | 0.714 | **2** |
| **A$_6$** | 0.871 | 1.408 | 0.871 | 0.382 | 0.618 | 0.705 | **3** |
| **A$_7$** | 0.863 | 1.395 | 0.863 | 0.382 | 0.618 | 0.698 | **4** |
| **AI** | 1.000 | | | | | | |

In Table 11, the alternatives are ranked using all seven steps of the MARCOS method.

Ideal and anti-ideal solutions are obtained, the values of 1.000 and 0.619, respectively. The alternative with the utility function value closest to the ideal solution value is the best alternative and is ranked first. In this research, it is alternative A3, i.e., Manufacturer-Wholesaler-Retailer-Consumer, with the utility function value of 0.751. The worst-ranked alternative is the alternative with the utility function value closest to the value of the anti-ideal solution, and here it is alternative A1, i.e., Manufacturer-Consumer, with the utility function value of 0.561.

## Sensitivity analysis

In order to verify the results, we compared the results obtained by the MARCOS method with the results obtained by other multi-criteria decision-making methods. Therefore, in this section of the paper, a sensitivity analysis of the obtained results is performed by the MARCOS method. The results of the analysis are shown in Table 12 and Figure 4.

*Table 12. A sensitivity analysis of the results obtained by the MARCOS method*

| | MARCOS | | SAW | | ARAS | | WASPAS | |
|---|---|---|---|---|---|---|---|---|
| **A1** | 0.561 | 7 | 0.694 | 7 | 0.686 | 7 | 0.681 | 7 |
| **A2** | 0.696 | 5 | 0.861 | 5 | 0.862 | 4 | 0.857 | 5 |
| **A3** | 0.751 | 1 | 0.929 | 1 | 0.921 | 1 | 0.925 | 1 |
| **A4** | 0.588 | 6 | 0.727 | 6 | 0.724 | 6 | 0.724 | 6 |
| **A5** | 0.714 | 2 | 0.883 | 2 | 0.877 | 2 | 0.877 | 2 |
| **A6** | 0.705 | 3 | 0.871 | 3 | 0.867 | 3 | 0.867 | 3 |
| **A7** | 0.698 | 4 | 0.863 | 4 | 0.859 | 5 | 0.861 | 4 |

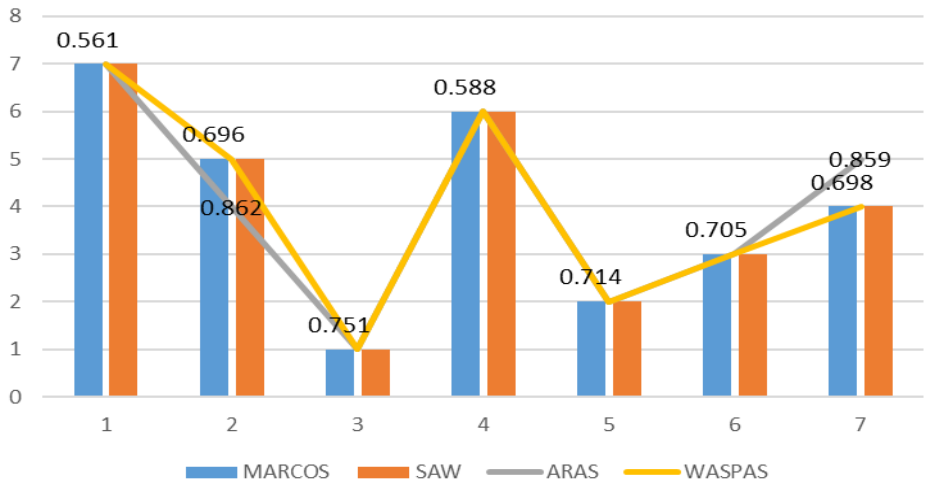


*Fig. 4. A graph of the sensitivity analysis*

A sensitivity analysis compared the ranking results obtained by the new MARCOS method and three other methods: SAW MacCrimmon [35], ARAS, Zavadskas & Turskis [36] and WASPAS, Zavadskas *et al*., [37]. The first column of Table 12 lists the ranking results of the alternatives obtained by the MARCOS method. The second column contains the ranking results obtained by the SAW method. The third column contains the results obtained by the ARAS method. The fourth column contains the results obtained by the WASPAS method.

Comparing the results obtained by the last three methods it can be noticed that the results are generally the same, which means that we can with high probability claim that the results obtained are accurate. The table and figure show that there is a slight deviation in ranking by

the ARAS method compared to the other three methods. By this method, alternatives A2 and A7 has changed their positions, i.e., alternative A2 is ranked fourth by this method and alternative A7 as fifth. It is the only difference we can see using all four methods. All other methods show identical ranking results. Thus, by applying all four methods, A1 alternative, i.e., direct sales to consumers, is ranked as the worst alternative, i.e., it is in the seventh place.

Alternative A3, i.e., sales via a wholesaler and then retailer, is the best alternative according to the results obtained by all four methods. That is, alternative A3 is ranked first according to all the methods. Therefore, the results obtained by the MARCOS method represent accurate and reliable results. If the company wants to make the best decision about selecting a distribution channel, it can rely on the results obtained by this method. According to the results of this research, the best decision of the company on selecting a distribution channel would be the decision to use alternative A3 as the distribution channel.

## Conclusion

The research in this paper was carried out in a company engaged in mixed agricultural production, i.e., crop production, seed production and animal husbandry. The company performs its production at one place, while marketing the products domestically and abroad.

So far, the company has used only one distribution channel and it is direct sales to consumers. However, this method of selling creates huge costs. At present, the company has no additional funds to invest in this distribution channel, and the current budget for this activity has reached their maximum. The company expressed the need and request to conduct the research that would contribute to decide on selecting the best distribution channel. In order to reach the best decision, experts in this field were hired. The expert team consisted of six experts who, on the basis of a questionnaire sent to each of them, evaluated the criteria for the selection of a distribution channel and ranked distribution channels according to each criterion.

Based on the application of the FUCOM method, the criteria were evaluated, and using the MARCOS method, the alternatives, i.e., distribution channels, were ranked according to experts' rates. Applying the method, the worst-ranked alternative was alternative A1, i.e., direct sales to consumers. The method showed that alternative A3, i.e., the sale of products via a wholesaler and a retailer, is the best-ranked method. This channel of distribution would be a much better alternative than the current way of selling products directly to consumers.

Therefore, the company should replace direct sales by selling through intermediaries, in this case wholesale and retail trade. In this way, the company would sell its products to end consumers with some financial savings. This method of selling would also provide other benefits that this channel of distribution brings in relation to direct sales.

In regard to this paper, it remains for future researchers to address the savings that the company would make if it decides on selecting the recommended distribution channel. Certainly, future research may also refer to investing the savings in the development of production and further growth of the company.

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**Article history:**
Received 23 April 2020
Accepted 26 Juny 2020

# PART III
# SOCIO-ECONOMIC CHALLENGES FACING AGRICULTURE AND RURAL AREAS

SCIENTIFIC REVIEW

# BASIC ASPECTS OF RURAL SOCIAL INFRASTRUCTURE DEVELOPMENT

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## Abstract

The social infrastructure of rural areas is of particular importance when considering issues of both an economic and social nature. Both production and non-production rural areas necessitate the availability of social facilities. The main purpose of social infrastructure facilities nowadays and in the past of rural and urban areas development is to meet the needs of the population. At the same time, social infrastructure defines the basis for the level and quality of life of civil society. Its condition is an indicator of the territorial development and provides opportunities for innovative development and investment attraction. For many years now, the rural social infrastructure has been in poor condition in Russia. Problems are observed in the living conditions of citizens, in elements of residential properties improvement, undeveloped system of medical and educational services, unavailability of cultural and leisure facilities, and so on. Due to such a negative state of the rural social sphere, problems arise with the demographic situation and the production sphere in terms of the inability to attract highly qualified personnel. The Program for the Sustainable Development of Rural Territories developed by the Government of Russia holds back the general, intensively negative situation, and is fundamentally changing it in some regions of the country. The paper presents the results of the implementation of the main Program directions and gives some recommendations on its further implementation and development of the rural social infrastructure.

*Keywords: rural sphere, infrastructure, rural areas, socio-economic development, program*

**JEL: R11**
**UDC: 338.431**
**COBISS.SR-ID 28651785**

## Introduction

The development of rural areas is currently important and is determined by the considerable attention on the part of state authorities from the standpoint of socio-economic development of those areas. A well-known fact is that social infrastructure and its development form the general status and development status of a particular rural territory, as well as the level and quality of life of its population. Therefore, the priority aspect in the rural development is the development of social infrastructure, in particular within the framework of housing and communal services, social and cultural facilities and social services [4]. The development of these components of the rural social infrastructure will lead to a more

complete satisfaction of the rural residents' needs which are an elementary norm of life: good working and living conditions, education, recreation, medical care, etc. [2].

The formation of social infrastructure is almost directly related to the development of the working environment. Almost all business entities engaged in agricultural production as part of industrial and economic activities are located in close proximity to rural territories.

Therefore, there is a close relationship between the development of social and industrial infrastructure.

Along with this, one cannot fail to note the role of the Russian state in managing the agricultural sector and the socio-economic development of rural areas. This is evidenced by the availability of program-targeted management of the agricultural sector of the economy until 2025, within the frameworks of which there are implemented:

- Support in the form of governmental grants and subsidies to agricultural producers;
- Technical and technological modernization of business entities in agriculture;
- Activation of land policy, the purpose of which is the rational use of agricultural land and maintaining land fertility;
- Other measures [6].

The implementation of many program-targeted tools is aggravated by a shortage of highly qualified and professionally trained personnel. Some agricultural producers have a negative impact on the state of economic activity through a shortage not only of highly qualified personnel, but also of the workforce as a whole [13]. All this negatively and conclusively affects the social component of rural development.

It can be stated that social infrastructure in the system of social reproduction and regional economic grow this of great importance. However, it is practically impossible to talk about social infrastructure as a whole due to its heterogeneity. In particular, rural areas are mostly characterized by underdeveloped social infrastructure. The reasons for such conditions in rural areas are often the following: remoteness from regional centres, i.e., their peripheral nature; the absence or scarcity of facilities in the service sector; lack of transport accessibility to various services – educational, medical, domestic, cultural, etc.

## Research Methodology

Consequently, all this gives a clear understanding of the need to solve extremely acute and important tasks at the scientific and practical level for the development of rural infrastructure.

This scientific research was carried out using traditional methods – monographic, expert assessment, comparative analysis, statistical, etc. The main social indicators, which are the main indicators of the development of rural infrastructure, were analyzed.

## Research Results

Currently, the term "infrastructure" is understood as a whole system of interrelated industries and activities that are not related to production, but designed to service the manufacturing sector (material production) and contribute to the scientific, technical and social development of territories [10]. Many scientists reduce the author's hypothesis to the difference between social infrastructures for the production and non-production sectors (Fig. 1) [5].

Based on the classification of social infrastructure facilities outlined in Figure 1, it should be noted that all of them, despite the division into production and non-production purposes, are interconnected and partially interchangeable. Considering the affiliation of the subject under study (social infrastructure) to the agrarian sector and rural territories, it should be noted that it is influenced by a number of factors that are characteristic only of rural

territories. First of all, these are cultural features, as well as traditions and customs of the population [7].

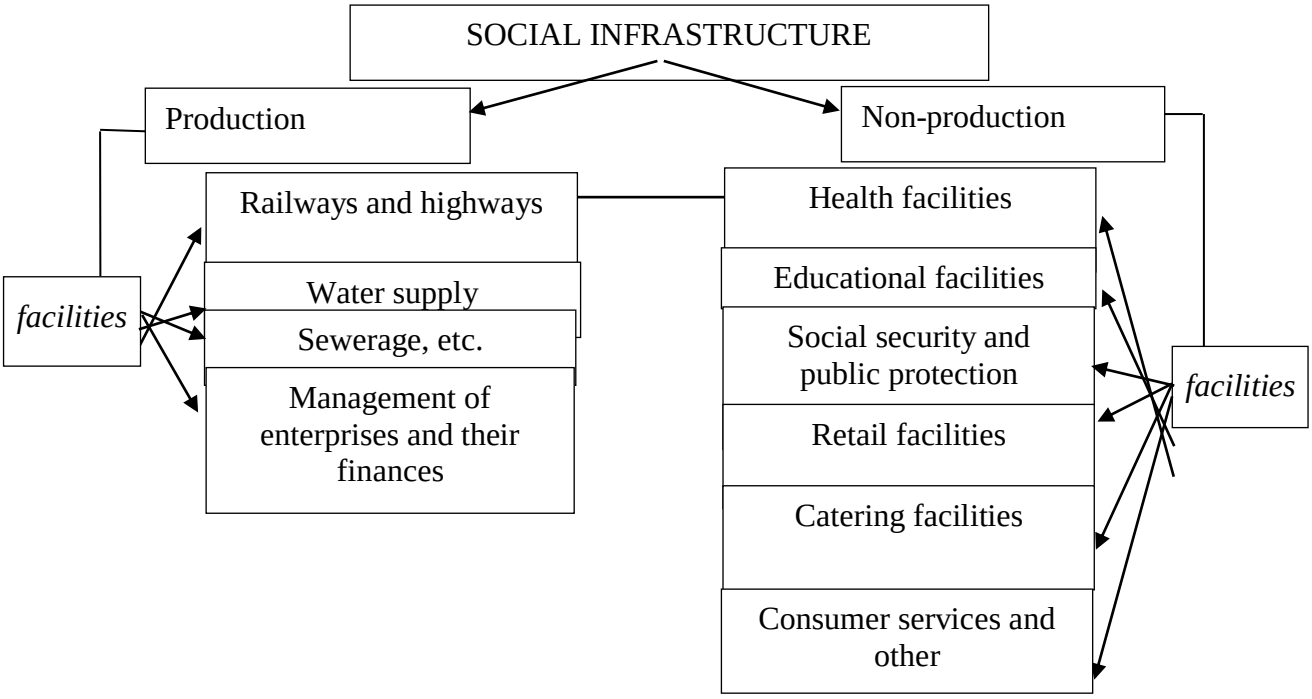


*Fig. 1. Key elements of social infrastructure*

Along with these factors, one should consider other features that are relevant at the present time, peculiar to rural areas, and cannot belong to urban territories [11]. For example, in rural areas there is a low population and negative demographic dynamics in relation to migration flows. Also, rural areas are characterized by a low degree of improvement of households, and the number of social services is limited. It is important to consider that the characteristic feature of rural area residents is permanent employment, which is due not only to social work, but also to household management.

However, in determining its functional significance, a social infrastructure is single and has a universal sense of impact [1]. The most significant functions of social infrastructure should be divided into three main blocks.

1st block: Creating a favourable environment for the population by protecting their health and information and advisory services.

2nd block: Training of highly qualified personnel due to formation of public awareness of the attractiveness and significance of labour in rural areas and agriculture, as well as the provision and attraction of scientific developments (projects), and the provision of business services.

3rd block: Reproduction of the working-age population. Within the framework of this block, the distribution and exchange of material goods and the provision of the required consumer services for the population are ensured.

One way or another, but the above social infrastructure functions directly and indirectly confirm the presence of a strong relationship between production and social infrastructure. In Russia, the development of rural social infrastructure sectors is related to almost 40 million residents of Russia (Figure 2).

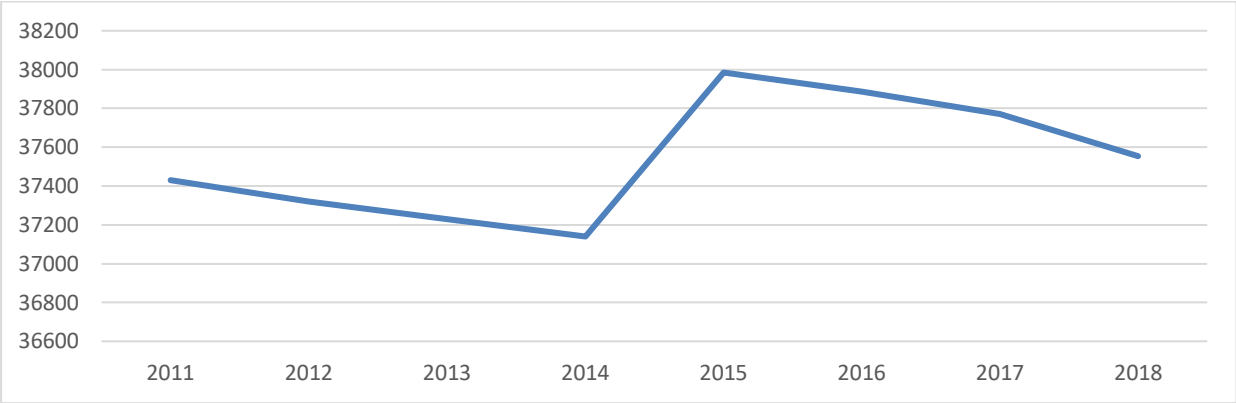


*Fig. 2. The rural population of Russia, thousand people*

Thus, according to Figure 1, it can be noted that for the period of 2018, the share of the rural population among the total number of citizens of the Russian Federation is 25% and over the past four years has a decline. So, for example, the number of villagers has been decreased by 218.5 thousand persons over the last reporting period. The main reasons for this negative situation are:

- Natural decline;
- Administrative-territorial transformations;
- Migration outflow.

Along with this analytical material, it is also seen that in the period from 2014 to 2015 there was a sharp increase in the number of rural residents, which is explained by the incorporation of the Republic of Crimea into Russia.

Of the total number of rural residents, 47% (17777 thousand people) belong to the economically active population, of which 92% are employed, while their age ranges from 15 to 72 years, and the remaining 8% belongs to the category of unemployed. Regarding the latter category, it should be noted that approximately 25% of the total number of unemployed villagers are parasites, as they are not ready to proceed with it, subject to its availability and do not attempt to search for it.

Currently, against the background of the general negative social situation in the rural areas, it is important to note that some reasons for the migration of the population from rural areas are associated with low incomes in the agricultural sector of the economy (Table 1).

*Table 1. Per capita disposable income of households in urban and rural areas, roubles **

| Indicators | Years | | | | | | | | Absolute deviation of 2018 to 2011, +/- |
|---|---|---|---|---|---|---|---|---|---|
| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | |
| *At current prices* | | | | | | | | | |
| Village | 11745 | 13320 | 14191 | 15802 | 16639 | 16971 | 18309 | 19190 | +7445 |
| City | 18291 | 20405 | 23645 | 25347 | 25466 | 26719 | 27206 | 29557 | +11266 |
| *In prices of the base 2011* | | | | | | | | | |
| Village | 11745 | 12499 | 12507 | 12507 | 11664 | 11288 | 11880 | 11943 | +198 |
| City | 18291 | 19147 | 20839 | 20062 | 17851 | 17772 | 17652 | 18394 | +103 |

** Per one household member*

Based on the data in Table 1, it can be noted that a serious gap between the size of the incomes of rural and urban residents is 1:1.33. Meanwhile, the nominal size of income is growing both in residents of that and another category of locality, but if we consider the most significant indicator of real incomes from a socio-economic point of view that can improve the level and quality of life in terms of consumption, we can note a practically negative

situation. In rural areas, real incomes increased slightly – for eight years only by 198 roubles, and for urban residents, it decreased by 639 roubles.

Of course, it is impossible to improve the level and quality of life with income alone. That is why it is important to consider what is the state of the social sphere facilities in Russian hinterland, and how accessible they are to the population. According to Rosstat, we should note a positive trend (up 10%) for the last 8 years in relation to housing, that is 1.004.200.000 $m^2$, to the level of 2018 while about 72% are individual houses, 27% apartment buildings, and the remaining share is in other residential units including dormitories. It is important to note that the increase in the total housing stock in rural areas is proceeding more rapidly than in the city, which is primarily due to individual housing construction, mainly of the wooden type.

This positive situation easily changes in the representation of the state of housing improvement with the help of significant social infrastructure facilities (Figure 3).

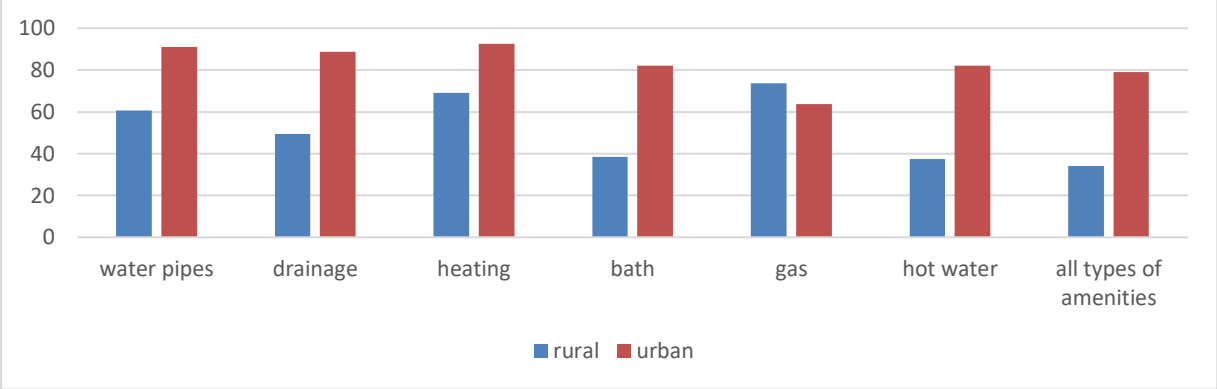


*Fig. 3. Provision with types of housing improvement of urban and rural residents in 2018, %*

Housing in rural areas is improving due to the implementation of the federal target program "Sustainable development of rural territories for 2014-2017 and for the period until 2020" (hereinafter the Program). Currently, this program is somewhat reorganized and included as a subprogram in the State Program for the development of agriculture [3, 12].

In both urban and rural areas, the problem with pre-school educational institutions remains urgent. In particular, over the past eight years, their number in rural areas has decreased by 18% (3,5 thousand units). Within the framework of public-private partnerships and against the background of grant support, a private form of preschool educational institutions is developing, but their number is still small and amounts to only 0.5% (108 organizations) with a total number of 6065 pupils. Along with this, statistics also show a decrease in the number of middle-level educational institutions, the main reason for this, for the most part, is the process of enlargement (association). The situation with regard to schools remains critical, as evidenced by elementary statistics indicating an acute shortage of schools. Thus, on average 18 schools are accounted per 100 villages in Russia. Today, more and more propaganda are being conducted on the need to form a digital economy, familiarity with the elements of which should be provided in schools. Meanwhile, in Russian secondary schools there is an availability of access to the Internet as the basis of information resources at the level of 85%, and only half of educational institutions have their own websites.

Along with education, the health problem remains unresolved in rural areas. Rosstat notes the more intensive dynamics in the reduction of local medical and obstetrical stations (MOSs), by 1288 units from 2012 to 2018. Hospitals of medical districts are of predominant significance, but their number was also declining, by 234 hospitals in the period of 2012-2018.

On the whole, the education and medicine fields in rural areas are problematic not only in terms of providing facilities themselves, but also in terms of personnel potential, the deficit of

which sometimes is the main problem in a particular locality. Along with primary needs, the villagers also need social and cultural enrichment. In rural areas, more than 37,8 thousand cultural and leisure facilities are currently operating. If compared to 2012, this figure was equal to 38,5 thousand units. However, it should be noted that the restructuring of the Program funds allowed the situation in the field of culture in the rural areas since 2015 to change, when the number of studied facilities was reduced to 535.4 thousand units. It should be noted that the total number of employees of these organizations during the Program period has decreased, but the number of key specialists in cultural and leisure activities is growing dynamically and makes up 70,9% of the total labour force in 2018, against 45,6% in 2012.

The planned implementation of the directions of the Program for Sustainable Development of Rural Areas makes it possible to maintain throughout the entire period of its activity the field of physical education and sports through the construction of new sports facilities, including plane open sports facilities at the level of 19.2 thousand units and 65 thousand units respectively. The attention of the state and the Government regarding the implementation of this direction of the Program and the promotion of a healthy lifestyle in rural areas make it possible to involve an increasing number of rural residents in sports due to the availability of sports facilities for social infrastructure. For example, in 2018, in rural areas there were 32,5% of residents who are constantly involved in sports, while in 2012 this value was only 20% [9].

Funds allocated from budgets of different levels for the implementation of the Program are quite voluminous, but require more and more control over their use, as well as the quality of the results of socio-economic development in rural areas (Table 2).

*Table 2. Financing the main directions of the Program in 2014-2018 [8]*

| Program Directions | Actually, financed funds, million roubles | | | |
|---|---|---|---|---|
| | Total | including | | |
| | | federal budget | the budgets of the subjects of the Russian Federation | extrabudgetary sources |
| Improving the living conditions of residents in rural areas | 75481,96 | 19947,4 | 21507,09 | 34027,47 |
| Gasification in rural areas | 12715,55 | 5193,62 | 6267,21 | 1254,72 |
| Water supply development | 13596,44 | 5911,99 | 7053,14 | 631,31 |
| Development of a network of educational organizations | 8595,28 | 3057,94 | 5516,24 | 21,1 |
| Development of a network of medical and obstetrical stations | 2853,12 | 816,45 | 1901,73 | 134,94 |
| Development of a network of plane sports facilities in rural areas | 1459,28 | 625,75 | 789,68 | 43,85 |
| Development of a network of cultural and leisure facilities | 1542,91 | 873,7 | 668,99 | 0,22 |
| Road network development | 45503,76 | 25273,72 | 20204,2 | 25,84 |
| Implementation of projects for the construction of compact housing sites | 8517,93 | 4176,99 | 4142,43 | 198,51 |
| Grant support for local citizens' initiatives | 1374,77 | 370,68 | 610,97 | 393,12 |

## Conclusions and Proposals

Based on the data in Table 2 and in general on the results of the target Program, it can be stated that the Program focuses on the relationship between the economy and the social sphere in rural areas. Firstly, the development of social infrastructure gives attractiveness to the rural areas, the desire to live and work there, which means that the production sector minimizes or eliminates the problem with an acute shortage of qualified specialists. Secondly, the objects of social infrastructure themselves create an image and an opportunity for rural areas to be innovative and investment attractive. Thirdly, it is an opportunity to create more jobs for the population. The following strategic measures to improve social infrastructure should be:

- Continue to provide rural settlements with modern paved roads;
- Create a comfortable and at the same time optimal transport connection with other objects of social infrastructure;
- Provide ubiquitous telephone communications and Internet resources;
- Improve the condition of housing and provide it with all necessary communal amenities;
- Everywhere to ensure the accessibility of institutions of medicine, education, cultural and leisure type, etc.

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**Article history:**
Received 15 November 2020
Accepted 16 December 2020

SCIENTIFIC REVIEW

# THE IMPORTANCE OF THE QUALITY OF THE AGRICULTURAL PRODUCT FOR SUSTAINABLE SUCCESS OF AGRICULTURAL HOLDING

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## Abstract

Small farms, which are mostly owned by natural persons, characterize the agricultural sector of Serbia. In order for a family farm business or holding to be successful, the following factors can be distinguished: the yield and quality of the products achieved, the prices generated for the products, and, of course, the decisions that are made in order to make the management of the farm more efficient. Given that consumers of agricultural products around the world are demanding increasing product quality, farms should work to improve competitiveness based on quality. The subject of this paper is the importance of the quality of the products for the sustainable success of agricultural holdings in the Republic of Serbia. The main goal of this paper is to provide new knowledge in the field of quality of agricultural products of agricultural holdings with the aim of achieving sustainable success.

*Keywords: quality, sustainable success, agricultural holding*

**JEL: Q10, L15**
**UDC: 658.562:631**
**COBISS.SR-ID 28652041**

## Introduction

The agricultural sector in the Republic of Serbia has a very high economic and social significance, since it has a substantial share in creating the gross domestic product and employing a large number of people. Agricultural holdings are created on agricultural land and imply private ownership of the land and other means of production [21]. In 2016, agriculture accounted for 11.9% of the GDP, which is largely the result of a fertile soil and quality natural conditions for agricultural production. According to the Statistical Office of the Republic of Serbia, 680,000 people are employed in agriculture, or 21% of the total workforce in the country. In 2016, agriculture and food production accounted for 19.4% of Serbia's total exports and generated a surplus of $1.4 billion, $130 million more than in 2015 (mainly due to increased exports of processed fruit and vegetables). According to the results of the agricultural census in the Republic of Serbia in 2012 (the new census was in October 2018) 631,552 agricultural holdings were registered in Serbia, while the agricultural land used amounted to an area of 3.44 mil. ha. Family farms are dominant in the agricultural sector, accounting for 99.5% of the total number of agricultural holdings and 82.2% of the agricultural land used (SORS, 2013).

According to the data of the Ministry of Agriculture (Forestry and Water Management of the Republic of Serbia), agricultural and food products have a stable share in the foreign trade exchange of Serbia, which they have maintained during 2017, with the participation of this category of products in imports increasing by 1.7 percentage points, while their participation in export decreased by 2.4 percentage points (the Republic of Serbia, the Ministry of Agriculture, Forestry and Water Management) (2018).

The data show that agriculture is one of the key economic activities of the Republic of Serbia. Livestock farming, together with crop farming, is an essential branch of agriculture in RS [1]. The increased net value of agricultural products improves indigenous investment in this sector [15].

According to the Law on Agriculture and Rural Development of the Republic of Serbia (Law on Agriculture and Rural Development of the Republic of Serbia, Art. 16), a family farm or agricultural holding is the basic form of organization of agricultural production. In the said Law, an agricultural holding is defined as a production unit where an agricultural enterprise, an agricultural cooperative, an institution or another juristic person, entrepreneur or farmer carries out agricultural production, while a family farm or holding is considered to be an agricultural holding where an individual/farmer carries out agricultural production, together with the members of his household. The Ministry of Agriculture (Forestry and Water Management of the Republic of Serbia) on the basis of the Decree on the Register of Agricultural Holdings (Off. Gazette of the Republic of Serbia, no. 45/04) from May 2004, administers the registration procedure for agricultural holdings. This register is managed by the Ministry of Finance (the Treasury Department) with the aim of improving agricultural production, increasing productivity and competitiveness.

The successful business of family farms depends on a large number of factors, but the following are the most significant: the yield and quality of their products, the prices of their products, and, of course, the decisions made in order to manage the farm more efficiently [2].

Nowadays, consumers of agro-food products around the world are demanding a better quality of products, which represents a major market challenge. Achieving quality in today's conditions requires the development of a competitiveness strategy that is based on innovation and quality.

## Theoretical framework

In addition to constantly adapting to the conditions of a dynamic market and constant business improvements, today's business conditions require high-quality products from the organizations. Ensuring maximum product quality at minimal cost has become the goal of all today's organizations as quick and constant changes in today's markets alter the relationship with quality and require companies to satisfy customers in the best possible way. If we start from the definition of a product as a result of business activities, we could say that a product is the method by which each company adjusts its capabilities and available resources with the needs and requirements of the customers in a bid to satisfy them [3]. As a term, quality is used often in everyday life, and everyone has a good idea of what is good and what is poor quality [4].

Quality has now been given a prime place among the indicators of the market performance of an organization before a number of calculable parameters such as productivity, profitability, liquidity, capacity utilization, etc. Quality of service is of great importance to organizations aiming at achieving stability and success in the markets [16]. Figure 1. shows a symbolic view of the evolution of the approach from controlling and managing to improving quality and innovations in relation to product performance, process, and organization results.

Quality has an important role in setting and defining the strategy of the organization and it is the basis for achieving competitiveness and better positioning on the market. Product quality is a multi-dimensional concept that includes the following: 1. functionality, 2. reliability, 3. sustainability, 4. accuracy, 5. easy handling, 6. fixability and other properties that determine the ability of the product to satisfy a particular consumer need [6], [7], [8].

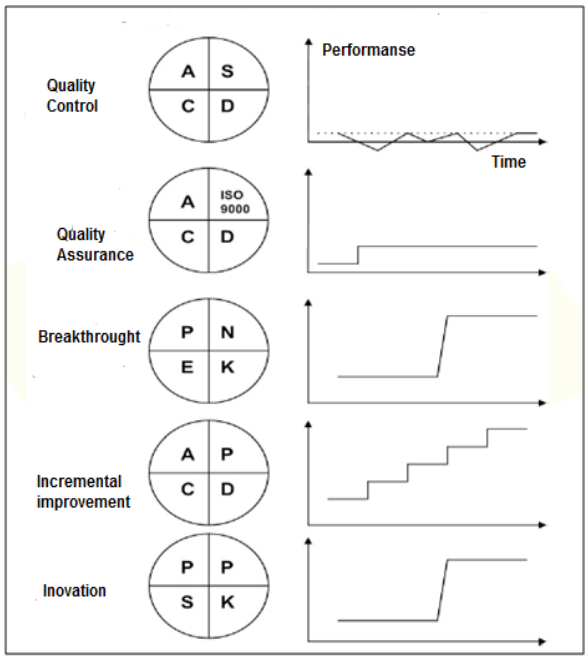


*Fig. 1. Evolution from management to quality improvement and innovation. [5]*

In addition to the characteristics of the product, the satisfaction of people within the organization, good interpersonal communication, communication of the organization with product users and all other stakeholders are important for quality improvement, and ensuring the satisfaction of society and the community is also important. In addition to the above, the innovation of products and processes, and constant investment in employees, their education, and training are important. Education is a very important topic addressed by a large number of authors [17], [18], [19], [20]. It can be noticed that training and education are of great importance for achieving both product quality and work processes and lead the organization towards sustainable success. (figure 2).

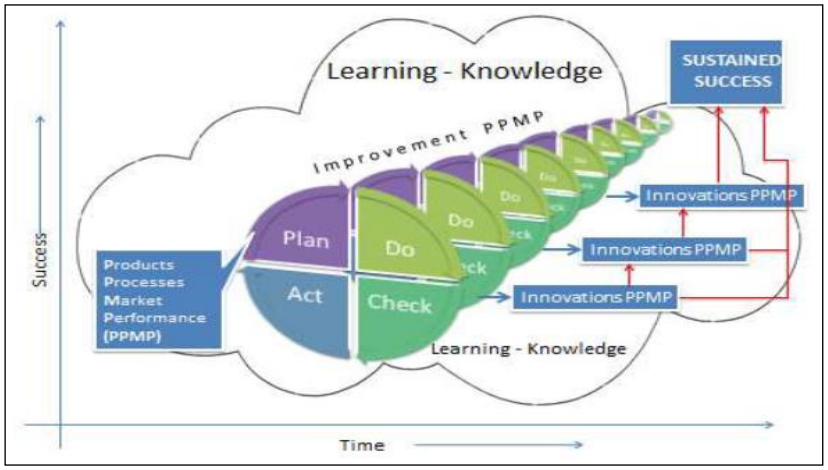


*Fig. 2. Learning, knowledge and innovations lead to sustainable success*
*Source: Adapted [9]*

Analysis and thorough understanding of the situation, good management, and continuous improvement and learning are the basis of the sustainable success of any organization.

Owners of agricultural holdings, in order to achieve the sustainability of their agricultural holdings, must have a perspective based on long-term planning, to analyze the environment of the organization, to identify all stakeholders, and to work to meet the needs and expectations of customers. In addition to effective management, long-term planning, and continuous improvement of agricultural holdings performance, in order to ensure sustainable success, agricultural holdings should work to understand the environment facing the agricultural holding, take an appropriate approach to agricultural holdings reforms, be innovative, constantly meet the needs and expectations of costumers and all stakeholders. The combination of sustainability and innovation is necessary for the realization of new combinations, which can lead to an innovative process that addresses the current sustainability challenges. Nidumolu *et al*., described sustainability as a key driver of innovation in the 21st century [10].

In the development of agriculture, family farms or holdings represent the main organizational form of agriculture as a socially attractive way of agricultural production, especially the reconciliation of the increase in agricultural production with concern for the natural and sociocultural environment (Vos, Zegar, 2002; Ploeg, 2009). Of the total number of agricultural holdings, 99.5% are family farms (628,552). The average economic size of agricultural holdings in the Republic of Serbia in 2012 amounts to EUR 5,939, and according to the organizational-legal form per family farm, it amounts to EUR 4,990 and EUR 204,755 by sector of legal entities and entrepreneurs.

It could be said that Serbia's agriculture is characterized by small agricultural holdings with fragmented plots of land mostly owned by individuals. Private farms dominate in agriculture in Serbia and use more than 90% of agricultural land, while the remaining 10% of agricultural land is used by state/public enterprises and cooperatives [11]. According to the Law on Agriculture and Rural Development of the Republic of Serbia (Agricultural and Rural Development Act of the Republic of Serbia), an *agricultural holding* is a production unit where an agricultural enterprise, agricultural cooperative, institution or other legal entity carries out agricultural production, while a *family farm* is an agricultural holding where a farmer, together with members of his household, carries out agricultural production.

*Table 1. Agricultural production – 2015-2017 indices*

| **Crop production** | | | | | **Livestock breeding** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture total | All | Crop farming | Fruit growing | Viticulture | All | Cattle breeding[1] | Pig breeding | Sheep breeding[2] | Poutry breeding[3] |
| **Chain indexes – previous year=100** | | | | | | | | | |
| 92,0 | 87,3 | 83,4 | 105,0 | 139,3 | 103,5 | 100,5 | 103,8 | 102,8 | 102,6 |
| 109,0 | 119,5 | 124,7 | 102,2 | 85,5 | 98,3 | 99,3 | 104,5 | 89,1 | 95,1 |
| 88,1 | 76,5 | 71,9 | 94,7 | 113,5 | 101,5 | 100,3 | 100,7 | 107,4 | 102,1 |
| **Base indexes – 2015=100** | | | | | | | | | |
| 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 |
| 109,0 | 119,5 | 124,7 | 102,2 | 85,5 | 98,3 | 99,3 | 104,5 | 89,1 | 95,1 |
| 96,0 | 91,5 | 89,7 | 96,8 | 97,0 | 99,7 | 99,5 | 105,2 | 95,6 | 97,1 |

[1]-*Increase of cattle and cow's milk production*

[2]-*Increase of sheep, wool and ewe's milk production*

[3]-*Increase of poutry and eggs production*

The agricultural sector of the Republic of Serbia has not yet reached its full capacity on the world market, as the results we can see are still below those that are realistically possible based on Serbia's agricultural resources.

The Strategy for Agriculture and Rural Development of the Republic of Serbia for the 2014 -2024 period (Off. Gazette of the Republic of Serbia, no. 85/2014) points to the fact that "the market for agricultural and food products is one of the most competitive markets, where very often, in front of producers, especially those who export food to the market of EU member states, there are additional requirements for the application of certain standards, initiated primarily by large retail chains, but also by consumers." For the above reasons, there is a need to harmonize the production and marketing of food products with the requirements defined by the standards of food safety and quality (GLOBALG.AP, BRC, IFS, ISO series, Halal, Kosher, etc.) (the Agricultural and Rural Development Strategy of the Republic of Serbia for the 2014-2024 period).

As today's customers demand products that guarantee better taste and higher quality, there has been a "turn towards quality" trend in the agri-food sector in Europe, where there is also increasing movement from the industrial world (with a large number of standardized quality conventions and the logic of mass production) to "domestic production" where quality rules are embedded in trust and tradition, and products and forms of economic organization are diverse, localized and ecological [12].

In order to improve the physical and economic performance of small and medium-sized agricultural holdings in Serbia (which dominate in the structure of total farms by providing stable and high sources of income of the holding and becoming more competitive on the domestic and foreign markets), it is necessary for farmers to engage more actively on removing the internal constraints, or the development of the internal capacities of the holdings in the following areas: (a) education, acquisition of new knowledge and skills, greater awareness; (b) fostering an entrepreneurial and competitive spirit; (c) greater application of innovations in production and operations, which are not significantly related to financial resources; (d) changes in mindset and mentality in the direction of a real insight into the mistakes, problems, opportunities, needs for association, importance of investments in products with higher stages of processing, introduction of quality standards, improvement of product quality, and similar [13].

## The methodological postulates of the research

In the time of a global crisis, it is important to encourage the development of agriculture through the development of its own competitiveness in order for it to be built on quality and the development of new ideas. Consumers of agricultural products around the world demand an increasing quality of products, which presents an increasing market challenge. Creating a quality product in today's market conditions demands developing a competitive strategy based on innovation and quality. Innovations in agriculture, just like in every other sector, are the main motor behind the growth of productivity [14].

Based on the findings presented in the literature review, based on the available literature (domestic and foreign), and based on specialized works in this field (Vilallobos, Garcia, Avila, 2017; Faure *et al*., 2018, Vogl, Kummer, Schunko, 2016; Alston, 2010; Alston *et al*., 2010; OECD, 2009; OECD, 2010c; OECD, 2010d; Stads, Beintema, 2012; Fuglie, 2012) a selection of questions for the poll have been selected.

The questions were created and in accordance to the ISO 9001:2015 and ISO 9004:2009 standards. Based on the analysis of the previous theoretical analysis a Basic system model has been created – The quality level of agricultural products significantly affects the level of sustainable success of individual family agricultural holdings.

Expert research was conducted on a sample of 60 experts on the territory of the Republic of Serbia (university professors, colleges, employees in public administrations at the position

of agricultural advisers, staff employed at institutes relevant to the field of research) in the period from 1 July to 1 September, 2018.

## Empirical research and discussion

The reliability of the theoretical model and questionnaire was analyzed by 60 experts from the following areas: quality and the sustainable success of agricultural holdings. The reliability of the set model can be determined or checked in two ways: based on the recommendations for the identification of factor loadings, and based on the rules and guidelines for internal consistency.

An analysis of the profile of the respondents was carried out, the reliability of the elements of the system model was established, and the benefits and justification of the research, the factor analysis of the model, and the correlation and regression analysis of the model were calculated.

Of the twenty quality components analyzed (Q1. An agricultural holding follows information regarding all stakeholders; Q2. An agricultural holding follows information regarding the requests of stakeholders; Q3. An agricultural holding reexamines the information regarding all stakeholders; Q4. An agricultural holding reexamines the information regarding all stakeholder requests; Q5. An agricultural holding secures that all the stakeholder requests are determined; Q6. An agricultural holding secures that all the stakeholder requests are understood; Q7. An agricultural holding secures that all the stakeholder requests are constantly met; Q8. An agricultural holding is focused on user satisfaction; Q9. A policy of quality is established in an agricultural holding; Q10. There is an allocation of responsibility in an agricultural holding; Q11. An agricultural holding plans risk-related measures; Q12. An agricultural holding plans opportunity-related measures; Q13. An agricultural holding sets aims of quality; Q14. An agricultural holding keeps documented information about its products; Q15. An agricultural holding maintains the satisfaction of the users of its products; Q16. An agricultural holding produces high quality products; Q17. Customers consider products from agricultural holdings dependable; Q18. An agricultural holding has set ways of external communication; Q19. An agricultural holding has set ways of external communication; and Q20. An agricultural holding sets and selects improvement opportunities) we have proven that the most influential on the sustainability of the agricultural holding are: Q4, Q5, Q6, Q9, Q10, Q14 and Q16. An agricultural holding keeps documented information about its products (Table 2). The first 5 components have characteristic values above 1.0000: 5.2050, 2.01864, 2.1116, 1.7051, 1.3474, 1.2295 and 1.0446.

Following the analysis, we can conclude that the level of quality of the agricultural product of an agricultural holding itself affects the development of possibilities of sustainable success of an agricultural holding.

Based on the research we can conclude that there exists a big influence of quality on the sustainable success of agricultural holdings in the Republic of Serbia. In order to achieve a sustainable level of success of agricultural holdings in the Republic of Serbia, it is necessary to conduct constant education programs for the farmers about the importance of quality as well as encourage the aspiration for business practice and the importance of investing in improving quality and improving the process of production. The support of the state and the department ministry has a crucial role, through the support for introducing new technologies in agricultural holdings, subsidizing the necessary materials for agricultural holdings, providing the necessary funding for constant education of agricultural holding owners and exchanging the practices with farmers from the surrounding countries.

*Table 2. Factor Analysis Eigenvalues for the 'Quality' element*

| Number | Eigenvalue | Percent | 20 40 60 80 | Cum Percent |
|---|---|---|---|---|
| 1 | 5,2050 | 26,025 | | 26,025 |
| 2 | 2,1864 | 10,932 | | 36,957 |
| 3 | 2,1116 | 10,558 | | 47,515 |
| 4 | 1,7051 | 8,525 | | 56,040 |
| 5 | 1,3474 | 6,737 | | 62,777 |
| 6 | 1,2295 | 6,148 | | 68,925 |
| 7 | 1,0446 | 5,223 | | 74,148 |
| 8 | 0,9538 | 4,769 | | 78,917 |
| 9 | 0,8004 | 4,002 | | 82,919 |
| 10 | 0,7218 | 3,609 | | 86,528 |
| 11 | 0,5904 | 2,952 | | 89,480 |
| 12 | 0,4686 | 2,343 | | 91,823 |
| 13 | 0,4099 | 2,049 | | 93,872 |
| 14 | 0,3579 | 1,790 | | 95,662 |
| 15 | 0,2562 | 1,281 | | 96,943 |
| 16 | 0,2019 | 1,009 | | 97,952 |
| 17 | 0,1468 | 0,734 | | 98,686 |
| 18 | 0,1155 | 0,577 | | 99,264 |
| 19 | 0,0937 | 0,469 | | 99,732 |
| 20 | 0,0536 | 0,268 | | 100,000 |

Besides the previously stated, by setting the goals and politics of quality, determining and understanding the demands of the customer, fulfilling their demands, and establishing communication with them with the goal of achieving feedback about the quality of the product we could, without a doubt, achieve the sustainability of holdings in the Republic of Serbia. The innovative business of individual agricultural holdings could be achieved by following the modern solutions in agriculture through the improvement of production by using innovation. Innovative behavior and business of individual agricultural holdings through the establishment of a quality customer relationship and the development of quality also affects the achievement of sustainable success of individual agricultural holdings by fulfilling the expectations coming from its surroundings and through the establishment of strategies based on the needs if interested parties.

Based on the information we can conclude that for agricultural holdings to succeed, the responsible Ministry and the government need to increase the subsidies for agricultural holdings dedicated to the investment in improving quality. With the establishment of a system of continuous training for the owners of agricultural holdings, where they could be acquainted with the latest achievements in the field of agriculture, new technologies, exchange the experience with the farmers from other countries, they could be helped in establishing a system which would be sustainable in the long term.

## Conclusion

Improving the quality of agricultural holdings can be achieved by supporting new ideas, collecting ideas from external sources by encouraging business partners to create innovations, and through a well-defined strategy for introducing quality and quality management methods.

The quality components of agricultural holdings influence the factors of improving sustainability through set strategies, knowledge development, financial management for sustainable success, incentives for the inclusion of innovation, and creative behavior.

Based on the results of the research conducted and the review of literary sources, the starting model has been confirmed that the level of the quality of agricultural products has a significant impact on the level of sustainable success of individual farms. The business of the farms through establishing a quality relationship with the buyers and developing one's own quality influences the farm to achieve sustainable success by fulfilling expectations that arise from the environment, and through setting strategies based on the needs of interested parties.

In order to improve the sustainability of individual farms a system needs to be set up, in which to run the development of new ideas with a clearly defined strategy of quality implementation and quality management. It is crucial to develop knowledge and creativity and continuously monitor the events in agriculture, as it is the only way of securing the sustainability of modern individual farms.

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**Article history:**
Received 26 September 2020
Accepted 15 November 2020

# PART IV
# FINANCE AND MANAGEMENT ACCOUNTING SYSTEM IN AN UNSTABLE ECONOMY CONDITION

SCIENTIFIC REVIEW

# IMPLEMENTATION OF SOCIALLY RESPONSIBLE BUSINESS TRANSACTIONS IN TRADING COMPANIES

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## Abstract

Trade companies are becoming aware of their role in society and the local community.

Socially responsible business transaction means a positive approach to the relationship with the community, its problems and events. It has become recognized among the customers and the company's management. Companies have carried out volunteering and various humanitarian activities to engage themselves in social activities and to increase their reputation towards their customers, suppliers and employees. Factors that have influenced to the development of socially responsible business transactions are: globalization, the transition to a knowledge society, consumer care, civil society activities, environmental problems and other. Trading companies that operate in line with the concept of socially responsible business transactions, when they implement this type of business, they can achieve a numerous benefit, from strengthening of the corporate image, and from competitiveness to the environmental awareness. Socially responsible business transaction also maintains cooperation between businesses, civil society and public administration and as such creates a positive image of social responsibility and contributes to the development of the local community. For the purpose of this paper a research was conducted on a representative sample of trading companies with the aim of gaining insight whether such companies do promote socially responsible business transactions and what kind of activities in such form these companies use.

*Keywords: socially responsible business transaction, trade companies, positive approach, humanitarian activities, research*

**JEL: M14**
**UDC: 658:339**
**005.35**
**COBISS.SR-ID 28652553**

## Introduction

The very concept of corporate social responsibility involves the contribution of the company to the community and the quality of life within it, alongside with the ethical, legal and economic responsibility of doing business. Corporate social responsibility in management attracts customers because this concept creates a positive image of the overall company's business. In this way the efforts of the company are aimed to improve the society and the community in which it operates. By using the socially responsible business, the concerns and activities for the wider community become a part of the business strategy of the

company, and it also provides an opportunity for collaboration between businesses and non-profit organizations. Orientation to the consumer's, the opening of new markets and the impact of non-profit organizations influence the development of this conception of business.

In the paper, research has been conducted on 32 trading companies in Republic of Croatia with the aim of finding out how much they carry out socially responsible business activities, what activities they carry out and whether they think that socially responsible business activities have a positive impact on the business and image of the company. There are quoted examples of the concept of the corporate social responsibility in the business practices of some companies (Coca Cola HBC, Konzum JSC, and Ericsson Nikola Tesla JSC) that are cited.

## The socially responsible business concept

The Corporate Social Responsibility (CSR) is the concept of how company behaves across the entire spectrum of its business with regard to the wider community and aligns its behaviour on the market with the needs of the company.

More recently, it has increasingly been written about importance of a company as a socially responsible subject, so the socially responsible behaviour has become as a part of business strategies, because in this way a greater competitiveness and better perception of the company in public is sought to be reached. Corporate social responsibility not only applies to the large multinational businesses, but is also increasingly concerned with the importance of including this concept of business alongside with the small and medium-sized enterprises.

Any business entity that cares about how it has been perceived by the public, maintain serious approach to this concept because it wants to put on a positive image of themselves on the general public.

The goal of CSR can also be sensitivity towards the wider social community, in such a way that part of the profitability of the company is reflected to the improvement of the quality of life of entities outside the company.

In the literature, there are numerous definitions and explanations of what CSR is, but it can be observed that the starting point for defining is to shape the entire management of a business entity in a way that contributes to the benefit of the wider community.

Definitions of corporate social responsibility have evolved through its evolution, so the term is now used interchangeably with the terms of "social responsibility", "sustainable development" and "corporate citizenship" [1].

Social responsibility represents a concept in which a business entity voluntarily decides to contribute to a better society and a cleaner environment when interacting with other stakeholders [2]. Furthermore, it is quite certain that a business entity primarily needs to meet its basic objectives and justify its stability on the market and as a result justify its purpose of existence, and then to satisfy the expectations not only of its internal but also ones originated from the external environment.

In favour of this way of thinking it is determined that there exists a continuous strive for a better positioning of the company and also to maximize its profits, and also the businesssubjects that are improving businesses, and apart from improving their position they also contribute to the overall wealth and well-being of a society as a whole [3].

The whole CSR practice began as a way of managing risks in large multinational companies, which were exposed to attacks due to their environmental or employee policies.

As a result, they have adopted proactive behaviour, that is, practices that were pre-declared (and could be verifiable) as sensitive to the environment and the communities in which they operate. The essence of CSR business making is that it goes above and beyond of what the law prescribes in relation to the environment and society. Another important determinant is

the establishment of dialogue and genuine collaboration between businesses and organizations in the non-profit sector (CSR Good Croatia) [4].

Today, it is increasingly stressed that not only understanding the importance of socially responsible behaviour is important, but also managing socially responsible businesses, which actually enters the field of management and can no longer be left to mere chance.

The group of authors also talks about socially responsible behaviour limits, explaining that all types of organizations, public and private, have their mission, strategy, policy and set goals. On the other hand, these organizations have limited resources to achieve these goals.

Moreover, organizations have a field of activities that are more or less defined and it is not possible to pretend for them to act outside their own responsibilities [5].

As a result of a new way of thinking about the work and connection of business subjects with the community and measuring inclusion, the Croatian Chamber of Commerce annually invites representatives of the small, medium, large and public businesses to participate in the questionnaire. Questionnaires were published individually for small, large and medium-sized enterprises and public companies. Businesses entities that, by certain criteria, operated positively in terms of business performance and, therefore the socially responsible behaviour index is shown. The completion of the CSR questionnaire can be accessed by any interested business entity that has previously met certain criteria. The questionnaire consists of a number of questions that are related to socially responsible behaviour. Below are outlined the main questions for the small business. The main questions can consist of a series of sub questions (Table 1) when the assessment of socially responsible practices is undertaken.

*Table 1. Example of a CSR questionnaire for the small businesses*

| | |
|---|---|
| 1 | General company information |
| 2 | Company's focus on economic sustainability |
| 3 | Inclusion of corporate social responsibility (CSR) and sustainable development (SD) in the business strategy |
| 4 | Responsible policies and practices in the work environment |
| 5 | Responsible environmental management policies and practices |
| 6 | Corporate social responsibility in market relations |
| 7 | Socially responsible relationships with the community |
| 8 | Responsible policies for diversity and protection of human rights |

*Source: [12]*

It is quite certain that business entities can no longer be focused exclusively on the achievement of their own internally set goals, as well as the realization that a successful business result is no longer the only evaluation criterion. The existence of questionnaires, monitoring and visibility of the CSR index represents another business model that encourages market players to reflect on and satisfy the wider interests of the community in a way that profits are made in a socially responsible way.

Socially responsible behaviour in today's business environment is increasingly important, especially after the European Commission has defined what are corporate social behaviour, as well as the set guidelines and principles for the implementation of CSR. Businesses are monitored and evaluated to what extent they behave socially responsible. The European Union, by its Directive (2014/95/EU), defines the rules for large companies, their ways of publishing concrete information on social and environmental impacts. The directives, which have been consistently implemented by the Member States of the European Union into national law, came into force in 2017 – such as the case of Germany. Following the publication of conceptual and empirical research that resulted from CSR reporting practices, CSR has attracted the attention of researchers, practitioners and policy maker's in various disciplines.

## Types of Corporate social responsibility

From the literature it can be distinguished several types of CSR and Buble [6] distinguishes the four types of CSR: economic, legal, ethical and community responsibility. Economic responsibility arises from the very purpose of a being a business entity (it refers to making a profit and satisfying a consumer's need). In this context, the short- and long-term goals are met. The long-term goals are to achieve a competitive advantage, which is considered as the economic responsibility of the business entity.

The legal responsibility of the business entity is focused on the laws, that is, their compliance by the state. By regulations are stipulated the relations of general social interest.

In the case of non-compliance with the law the sanctions are imposed, and are mostly often expressed in fines. Furthermore, in the case of the non-compliance with the legal regulations, members of the management are subject to sanctions, because their task is to monitor the legality of the business entity. The ethical responsibility of the business entity is not prescribed, but it is implied. The ethics of the business is assessed in a way when compares wrongdoing versus correct behaviour. Businesses very often have a code of ethical conduct that defines the rules of conduct [3]. Figure 1 shows the types and hierarchy of social responsibility.

The economic responsibility is presented at the first level of the pyramid as the basic economic unit of society, followed by the legal responsibility, ethical responsibility and discretionary responsibility that is solely conceived on a voluntary basis by a business entity.

Through the presented levels of socially responsible behaviour, a business entity should develop each of the presented levels in order to contribute to the benefit of the wider community, to be responsible to it, and to be perceived by the general public as a socially responsible and as desirable actor in the market.

On this way of thinking and implementing of all kinds of CSR contributes to the development of the community as a whole.


*Fig. 1. The hierarchy of the socially responsible behaviour*
*Source: Buble [6]*

*Areas of implementation of Corporate social responsibility*

The main elements of corporate social responsibility are ethical business, responsibility to employees, contribution to society and social issues such as ecology, safety, health, education and the like. This type of business is achieved through the development and implementation of business practices and company activities with the intention or aim of improving the well-

being of the community and the society in which the organization operates, therefore improving the quality of life of employees and creating a positive image of the company in public [7]. Corporate Social Responsibility is becoming part of the corporate competition among the companies. This is demonstrated by today's businesses; whose higher profits are not their only priority. Companies have realized that it is important for their image that they are socially responsible, and at the same time it is the best way to contribute to society in some way. Nowadays we often hear phrase how changes must be implemented and how everyone should be socially responsible, but work should speak for itself. There are a large number of companies in Croatia that implement corporate social responsibility, such as Ericsson Nikola Tesla, Konzum, Jamnica, Coca Cola, Generali Security, AD Plastik, Ina, Janaf and many others. In the following, it will be outlined the areas of corporate social responsibility in some of these aforementioned companies.

From 2010 until 2017 Coca-Cola HBC Croatia has reduced the water consumption to 11% and amount of waste by 50%. Direct discharge of carbon dioxide is reduced by 60%, and then discharge part of carbon dioxide in the value chain was 48%. Total energy consumption per litre of produced beverage in the bottling plant has been reduced by 15% during the last ten years, all of which are seen as concrete indicators of the contribution to society through ecology. Furthermore, Coca-Cola Croatia is also one of the most desirable employers in Croatia that attracts and retains the best employees through a stimulating work environment and a clear and competitive remuneration system, therefore demonstrating responsibility towards their employees. Coca-Cola has a reputation as one of the most socially responsible companies in the world, and thus in Croatia, because they use social engagement as a means of evaluating work. They are often part of a public-private partnerships that aim to further motivate other project partners and, as one of the best examples of this type of partnership is illumination of the Osijek pedestrian bridge as one of the city's trademark symbols, making the city of Osijek even more beautiful and pride to its citizens [8]. In Konzum they understand the principles of sustainable financial performance and success, so they take care of socially responsible business, where environmental protection at the local, regional and national levels is a key consideration. In addition to environmental standards and procedures that all employees in their day-to-day operations need to be familiar with and annual controls on compliance with these standards, Konzum has taken a step further by joining the Green City project, an initiative to sensitize the Croatian public to problems of the environment protection, with particular emphasis to the education of the young people about environmental issues. Children and the youngest have always been the focus of Konzum's socially responsible business, which is best seen by the project "Let's bring children back to the playgrounds". Several years ago, as part of this project there were opened 20 playgrounds, what represent an indicator that the Konzum has been making for the benefit of the community in which it operates [9]. Most companies invest in society by means of repairing the damage that has been done by the others through their irresponsible businesses and they educate people about a healthier lifestyle that is beneficial to society, and Ericsson's priority is investing in the development of technologies that will help society to avoid environmental pollution and other harmful activities which are inflicted by people. In Ericcson believe that investment in scientific development gives people the economic, social and environmental edge. Ericsson has developed a sustainability policy which have its fundamental basis on the usage of product life cycle methodology to determine their significant environmental impacts and assess the environmental impact of ICTs on environment, thus reducing the impact of their business to the environment and to take precautionary measures with regards to the environmental challenges, and also to apply design principles that are acceptable for the environment to ensure continuous improvement in environmental protection from the perspective of the life cycle of products from Ericsson's portfolio etc. [10]. From all the above

said, it can be concluded that there are four areas of corporate social responsibility, namely the market, the working environment, the social community and the environment. Corporate Social Responsibility should provide customers with quality products and services tailored to their requirements, to treat customers justly in all aspects, to make efforts to maintain and enhance customer health and safety of products and services, to ensure respect for human dignity in products offered, placement and advertising, respecting cultural habits and customer identities. In addition to selling, one's own products, purchasing is also important to the company, since the products and services of the suppliers directly affect the quality of the company's products, and it is extremely important to have a stable supplier that delivers a fair number of inputs needed to meet the needs of the end user. Corporate Social Responsibility Businesses are based on a mutually build relationships with suppliers and subcontractors in exchange for quality of delivered products and reliability in delivery, to share information's with suppliers for them to include them in the planning process, pay suppliers on time, encourage and remain loyal to suppliers and subcontractors, who promote agreed corporate social responsibilities and subcontractors which in their businesses promote socially agreed behaviour [11].

## Research methodology and the results

Survey data were collected using the survey questionnaires and it was conducted in November and December of 2019. In the research participated the representatives of middle and upper management from 32 trade companies from the Republic of Croatia. The questionnaire as a survey instrument contain 10 questions related to the knowledge of the concept of corporate social responsibility, its implementation in the company, the actions of socially responsible business used and the influence of corporate social responsibility of trading companies on the company business, and so its acquired image in the public. Before starting the survey, the respondents were become familiar with the research and the subject of the research. The sample is appropriate because only representatives of trading companies were targeted in the sample. In accordance with the set theoretical-methodological approach and the stated problematic, several hypotheses can be carried out:

*$H_1$ – Trading companies carry out CSR activities through humanitarian actions and donations.*

*$H_2$ – Trade companies participate in the organization of sports events and the promotion of sports.*

*$H_3$ – Respondents consider that CSR has a positive impact on the business of the company and the image of the company in public.*

The survey involved 15% of micro-trading enterprises (with less than 10 employees), 19% of small-scale commercial enterprises (with less than 50 employees), 25% of medium-sized commercial enterprises (with less than 250 employees) and 41% of large enterprises (with more of 250 employees). With the concept of corporate social responsibility is familiar 91% of respondents, and 72% of respondents from trade companies' representatives have in their document's items on sustainable responsibility (e.g., in their vision, development strategy in the rulebooks). Total of 50% of respondents have employees in their company who were put in charge of conducting socially responsible business, but 72% of respondents do not report to the media about conducting socially responsible business in their company. Those 72% of respondents did not support a financial donation in 2019, and 54% of respondents did not support a non-financial donation during the same year (donations in the form of products, equipment, voluntary work of employees etc.).

In 2019, the largest number of respondents participated in humanitarian actions (53%) and donations (to hospitals, associations, homes) (53%). In organizing of the sports events and for

the sports promotion in 2019 participated 51% of those polled. Among other CSR activities, respondents participated in: eco-initiatives (31%), scholarships for pupils and students (25%), social education (19%), donations and actions for preserving and care of animals (9%), and participation in financing construction of buildings for the social benefits (playgrounds, promenades, kindergartens etc.) (6%). Among other activities, the respondents as representatives of trading companies did not mention of any other of CSR activities that were carried out in their company. From total number of respondents, 85% of them believe that corporate social responsibility has a positive impact on corporate business and also 87% of respondents believe that corporate social responsibility has a positive impact on corporate image in the public.

## Conclusion

Corporate Social Responsibility (CSR) is one of the components of modern business.

Because they form an integral part of the fabric of the society in which they work, in addition for consideration for positive business and revenues, businesses need to contribute to the community and quality of life. The results of the research conducted for the purpose of this paper indicate the positive impact of trading companies on the concept of corporate social responsibility. Half of the companies that participated in the survey have employees responsible for conducting corporate social responsibility, and more than half of the researched companies have CSR items implemented in their documents. Companies are more supportive of non-financial donations (such as donations in products, equipment, and voluntary work of their employees, etc.). The surveyed companies participated in humanitarian actions in 2019 (53% of them) and made donations to hospitals, associations or homes (53%), thus confirming $H_1$ hypotheses ($H_1$ – *Trade companies carry out CSR activities through humanitarian aid actions and donations*), 51% of *enterprises participated in the organization of sports events and the promotion of sport* in 2019, confirming the $H_2$ hypotheses ($H_2$ – *Trading companies participate in the organization of sports events and the promotion of sports*. Among the other CSR activities, the trading companies that participated in the research carried out ecological initiatives, scholarships for pupils and students, they held educations of social importance, made donations and care for animals, they participated in financing the construction of facilities for social benefits (such as playgrounds, promenades, kindergartners etc.). Respondents believe that CSR has a positive impact on the company's business (85%) and the public company's image (87%), thus confirming the hypothesis $H_3$ (*Respondents consider that CSR has a positive influence on the company's business and image of the company in public*) From all of the above said it follows that corporate social responsibility is accepted in the practice and businesses of trading companies in the Republic of Croatia.

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**Article history:**
Received 3 November 2020
Accepted 8 December 2020

SCIENTIFIC REVIEW

# LIQUIDITY AND SOLVENCY OF HEALTHY AND BANKRUPT ENTITIES: DO FINANCIAL STATEMENTS SHOW ANY DIFFERENCES?

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## Abstract

The aim of this paper is reflected in the analysis of the connection between the financial operations presented in companies' financial statements and the fact whether bankruptcy proceedings have been initiated against the observed companies. Namely, the fundamental indicators of a company's business success, including liquidity and solvency, are of immense significance for all stakeholders, and can also be used to predict the probability whether bankruptcy proceedings will be opened. Bankruptcy authorities make the decision to initiate bankruptcy proceedings, not solely on the basis of the results presented in the financial statements, but predominantly on the basis of the reasons defined by law. However, the question arises whether the fact that bankruptcy proceedings have been initiated correlates with the financial situation as shown in the financial statements. The paper's research sample is made up of the financial reports of two groups of companies, the first group of which includes all the companies in the Republic of Serbia that initiated bankruptcy proceedings in 2019, while the second group consists of randomly selected "healthy" companies. By applying two variables, i.e., liquidity and solvency, we are witnessing a difference in the results of the healthy versus the bankrupt companies. Healthy companies are largely liquid and solvent (47%), but it can be noticed that a number of healthy companies have problems with liquidity. Bankrupt companies are faced with a high liquidity risk, while a small number of them face the problem of insolvency.

*Keywords: financial performance, current ratio, debt ratio, risk*

**JEL: G21**
**UDC: 657.422**
**659.233**
**COBISS.SR-ID 28653065**

## Introduction

The analysis of healthy and bankrupt companies' operating activitiesusing financial reports has long been the authors'prime focus. The initial research mainly centered on the prediction for initiating bankruptcy proceedings, i.e., assessing the probability of bankruptcy. Taking into consideration the costs of the procedure and the high probability of loss of value (capital), the goal of these researches is evident. A large number of studies [1], [2], [3] indicate that it is possible to quite successfully predict the initiation of bankruptcy proceedings much earlier

(three years) before it actually takes place, on the basis of publicly disclosed financial statements. In keeping with the initial models that are based ondata from legal entities in the United States, different models were developed later on using data from other countries, industries, sectors, time periods and which therefore cannot be generalized [4].

However, the initiation of bankruptcy proceedings in a legal entity will depend primarily on the legal regulations of the state in which it performs economic activity. It may happen that the same legal entity is able to perform its economic activitysmoothly in one economic environment, whereas at the same time it would face bankruptcy proceedings in another. In that sense, the legal reasons for initiating bankruptcy proceedings are of tremendous importance, because the bankruptcy judge, based on them, considers whether they are fulfilled on a specific legal entity and decides to initiate bankruptcy proceedings. For instance, some of the most common reasons for initiating bankruptcy proceedings defined in the legal regulations around the globe include: difficulty to settle liabilities as they become due (ability to pay solvency test), the assessment of balance sheet solvency (balance sheet solvency test) and the issue of legal entity's capital adequacy (the capital adequacy solvency test) [5]. The provisions of the Law on Bankruptcy of the Republic of Serbia define the following reasons: over-indebtedness, permanent insolvency, pending insolvency; and failure to comply with the adopted reorganization plan or if the reorganization plan was put into effect in a fraudulent or unlawful manner [6]. However, if we observe and analyze the company's operating activitiesbased on published financial statements, which should demonstrate a realistic picture of its performance, we can see that some companies meet the reasons for initiating bankruptcy proceedings from the legal point of view, while performing their activities unhindered. Naturally, we can have a reverse situation, i.e., that the observed legal entity goes into bankruptcy, and that the financial statements show that its operating activities are not endangered. There are various explanations as to why such situations are possible, including: misleading and falsified financial statements, strategic bankruptcy, inadequate legal regulations, inefficiency of judicial bodies, the policy of "sparing" strategically important companies and others. However, the operating activities of the company as observed through its published financial statements should indicate the fact that the company is undergoing bankruptcy proceedings, despite the previously listed exceptions.

The aim of this paper is to check whether the aforestated is true when it comes to companies from the Republic of Serbia. The contribution of this paper is reflected in the application of research results in future research related to predicting the initiation of bankruptcy proceedings in the Republic of Serbia and the countries with similar economic characteristics. Namely, the basic premise of these researches is the correlation between the financial situation in the company from the aspect of legal regulations in the field of bankruptcy proceedings and the presentation of its operations in financial statements. The next part of the paper contains an overview of the relevant literature, while the subsequent two parts present the methodology and research results. At the end of the paper, conclusions will be made and directions for future research presented.

## Literature Review

The review of the relevant literature can be divided into several parts, first of all, papers dealing with predicting the probability forinitiating bankruptcy proceedings, then indicators for assessing the liquidity and solvency of healthy and bankrupt companies; and papers dealing with the analysis of factors influencing companies' emerging from bankruptcy. The first paper from the first group dates back to 1930 and is in fact a report made by the Bureau of Business Research (BRR). Until 1965, research was very similar [7], [8], [9], [10].

However, the idea that the simultaneous analysis of multiple financial indicators can increase the predictive power of bankruptcy was developed by Professor Beaver [11].

Subsequent research was quite similar to the aforementioned and was done for different countries as well as for different industrial sectors [1], [12], [13]. In nearly all research, the conclusion is that an increase in indebtedness leads to an increase in the probability of initiation of bankruptcy proceedings, while liquidity is negatively correlated.

When it comes to research from the Republic of Serbia, which relates to the assessment of solvency and liquidity of legal entities, we may conclude that the solvency and liquidity of companies is quite endangered [14], [15]. The same authors state in another study that the amount of debt-to-equity ratio of Serbian companies is significantly above the reference value of 1 and ranges between 2.01, 2.48, 3.01 and 1.96, for the period 2008-2011 [14].

As regards research related to the factors that influence companies exiting the bankruptcy process, the authors point out that companies that do not recover have a significant amount of liabilities, including discretionaryaccruals. In addition, companies that improve their position through reorganization are mainly those that were large legal entities before the bankruptcy was initiated, and at the same time solvent [16], [17].

## Research methodology

The paper research is founded on companies' financial statements for 2018 as a reporting period. The research sample can be divided into two parts, i.e., the companies that are bankruptcy debtors, where the bankruptcy procedure was initiated in the period from 01/01 to 31/12/2019 and healthy companies (where bankruptcy proceedings have not been initiated yet). Data on the bankruptcy proceedings initiatedduring the observed period were downloaded from the official website of the Republic of Serbia Agency for Licensing Bankruptcy Trustees. In the course of the observed period, there were a total of 448 bankruptcy proceedings. Nevertheless, bearing in mind that financial reporting varies depending on the size of the legal entity, the research focused on small, medium and large legal entities. There was a total of 209 such legal entities and therefore the initial sample of bankrupt companies was reduced to that number. In keeping with the aforesaid, the same number of (healthy) legal entities in which no bankruptcy procedure was initiated (209 legal entities) were selected randomly. Financial reports were obtained for the sampled companies so that they corresponded to the observed reporting period after which financial indicators were calculated based on which it is possible to assess the companies' liquidity and solvency.

This research will use the ratio number Acid test for the purpose of assessing liquidity. In relation to the current ratio, which is most frequently used in research to predict the probability for initiatingbankruptcy proceedings, the Acid test shows a more realistic picture of the company's liquidity because it excludes the value of goods, finished products, work in progress and materials the company has in stock. Namely, it takes a significantly longer period of time for these funds to become money in relation to receivables or securities that the company may own. Bankruptcy debtors usually have a very small amount of money at their disposal, and on the other hand, they can have a significant value of stocks that are obsolete and that should have been taken out of stock. Therefore, we can expect that the acid ratio will give a much more realistic picture of the liquidity of companies and will be used as a basic indicator in this paper. Authors Bryan, Tiras, & Wheatley (2002) conclude that inventories of bankrupt business entities turn slower and that the current ratio will be less likely to be a proper conduct of liquidity level of those entities. The expected value of this ratio is 1 and this limit will be used to classify companies into those that are (liquid) capable of settling short-term liabilities in the short period of time without jeopardizing further operating activities and those that are unable to do so (illiquid). The basic prerequisitesto ensure the solvency of a

company include an adequate amount of capital and an assessment of the risk level of the company's assets [18]. The most frequently used ratio number for assessing solvency is the debt ratio. This number represents the ratio between the total liabilities of the company and its total assets, i.e., the company's property. Even though there are no difficulties in calculating this ratio, its interpretation can be problematic because there is no generally accepted limit to its value, as is the case with the acid ratio. Therefore, in this study, solvent and non-solvent companies will be distinguished by debt ratio of 0.75 (75%). It aforementioned was determined based on the research conducted by the authors Stanisic, Radojevic, Mizdrakovic and Stanic in 2012, using the sample of 53,996 companies from Serbia [19]. That research showed that there was a significant increase in the percentage of bankrupt entities when the debt ratio stood between 0.7 and 0.8.

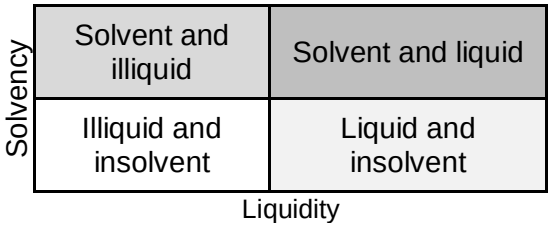


*Fig. 1. Correlation between Liquidity and Solvency*

The expected position of healthy business entities is a quadrant that shows liquid and solvent legal entities, whereas when it comes to bankrupt legal entities, they are expected to be primarily illiquid and insolvent (although they can be found in other quadrants, depending on the reason why the procedure was initiated).

## Research results

The results of the research are shown in the graphs below. Figure 2 shows both groups of observed companies, where the largest number of them (36.36%) is in the first quadrant (152 out of 418). This means that these legal entities have a liquidity problem, but in the long run they have enough funds to settle their long-term payables. The rest of the companies are mostly in the third quadrant (28.7%) and they are both illiquid and insolvent companies that should be undergoing bankruptcy proceedings. When we separate legal entities according to whether they are undergoing bankruptcy proceedings or not, we get a clearer picture of their financial position.

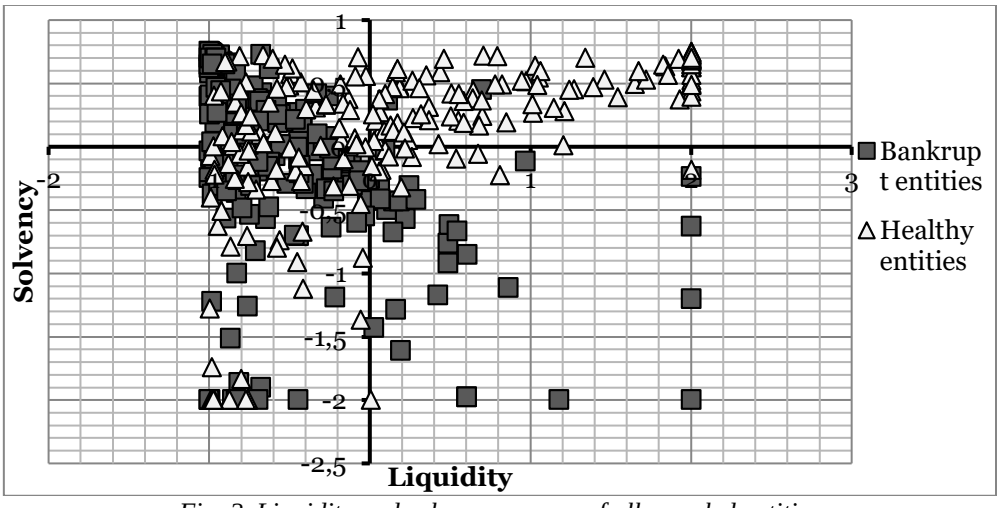


*Fig. 2. Liquidity and solvency groups of all sampled entities*
*Source: Authors' data*

Based on the conducted analysis, it can be concluded that almost half of healthy legal entities (99 out of 209) are located in the expected quadrant – the quadrant of liquid and solvent companies. Based on Figure 3, 46% of healthy companies have liquidity-related problems, while 28% of healthy companies have problems maintaining long-term liquidity.

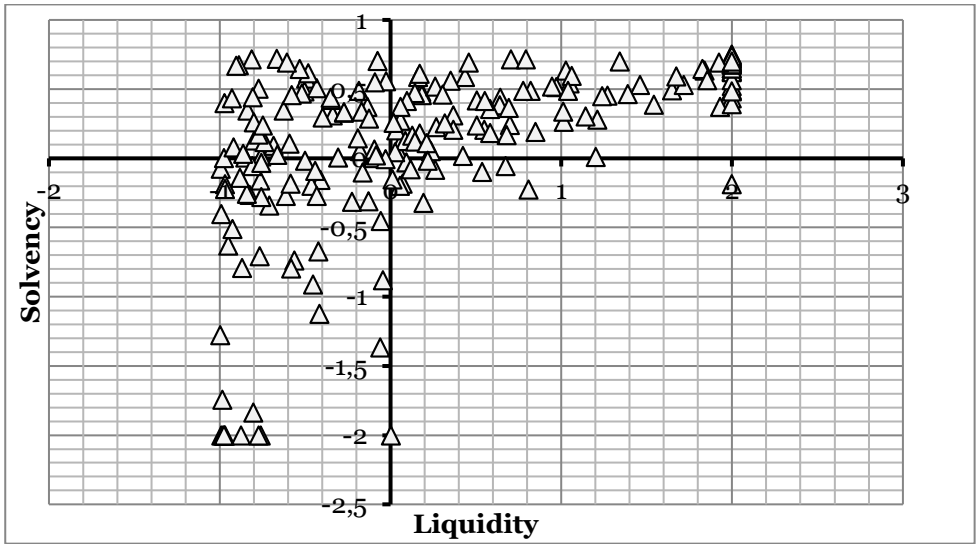


*Fig. 3. Liquidity and solvency of healthy entities*
*Source: Authors' data*

The results of the research show a certain deviation from the set assumptions when it comes to bankrupt companies. In this group of companies, the largest share belongs to solvent legal entities that have liquidity problems (48%). When we analyze bankrupt companies, only two, which is less than 1% of those sampled, are liquid and not over-indebted (Figure 4). It can be assumed that these are companies that have decided to initiate bankruptcy proceedings for strategic reasons (avoidance of court disputes, settlement of obligations, etc.).

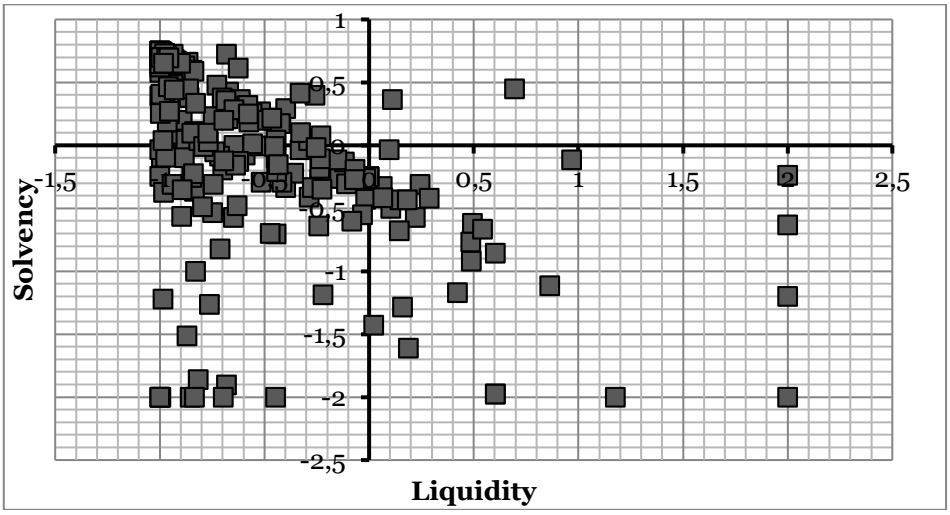


*Fig. 4. Liquidity and solvency of bankrupt entities*
*Source: Authors' data*

## Conclusion

The subject of this paper was the financial statements of 418 companies, which for the sake of the analysis were divided into two groups, with equal participation of companies in each group. Based on the conducted research and the presented results, it can be noticed that the

data presented in the financial statements of the companies undergoing bankruptcy indicate the initiation of a bankruptcy procedure. This is evidenced by the fact that almost 99% of the analyzed companies undergoing bankruptcy proceedings experience problems with liquidity and/or solvency. This information is certainly important from the aspect of future research regarding predictions of the probability of bankruptcy proceedings initiation. The analysis of the financial statements of healthy companies showed that 47.36% of these companies are defined as solvent and liquid. Nevertheless, a significant number (110 of 209) of legal entities in this group are faced with a high risk of liquidity and/or over-indebtedness. The aforestated actually explains the fact that almost all models for predicting the initiation of bankruptcy proceedings are far more precise in classifying bankrupt in relation to healthy companies.

There are two explanations for the previous situation, either the bankruptcy proceedings in the Republic of Serbia are initiated too late, or the financial statements show the first signs that the company is ready for bankruptcy proceedings, much earlier than can be confirmed in court proceedings. The focus of future research could be on making a comparative analysis of companies from different legal systems (those aimed at protecting creditors and those aimed at protecting the bankruptcy debtor) and a detailed analysis of the reasons for initiating bankruptcy proceedings and the financial position shown in the financial statements.

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**Article history:**
Received 22 September 2020
Accepted 5 December 2020

SCIENTIFIC REVIEW

# ANALYTICAL SUPPORT OF THE MANAGEMENT ACCOUNTING SYSTEM IN AN UNSTABLE ECONOMY CONDITIONS

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## Abstract

The globalization of the modern economic system, the scarce nature of the resources used, the depressive and stagnant nature of the current processes, the increasing complexity of the geopolitical situation and the deterioration of the environmental situation, etc. predetermine a serious transformation of the functions of accounting services and the role of accounting in the modern management system.

In these conditions, the need to study the impact of environmental factors on the nature of the enterprise activity and the mechanism for the development and adoption of managerial decisions are especially relevant. It is indisputable that the accounting organization system in a crisis situation should be different from its management in a sustainable development environment; this determines the need to improve managerial accounting methodology in conditions of unpredictability and instability of the external environment.

An analysis of the specialized literature suggests that there are insufficient studies of many aspects concerning the methodological content of the anti-crisis model of managerial accounting, the construction of its categorical apparatus, and the provision of a managerial accounting model in crisis processes in the economy, etc., which predetermined the choice of the topic of our study.

*Keywords: economic crises, business entities, anti-crisis management accounting, analysis, information support*

**JEL: M41**
**UDC: 657.422**
**005.332:338.12**
**COBISS.SR-ID 28657417**

## Introduction

A characteristic feature of the processes in reforming the accounting system in the Russian Federation is its focus on rapprochement with generally accepted international standards with the emphasis on financial, tax and management reporting. Among the most pressing problems with regard to the development of the conceptual and applied foundations of the current methodology for management accounting in Russian business structures, we want to highlight

the transformation of the methodology and objects for management accounting in an unstable economy.

When speaking about the crisis-functional relationship between management accounting and other sciences, it should be noted the growing contrast of objects, functions, techniques and methods of management accounting with the corresponding components of control, management, planning, etc. in the context of strategic and operational elements. This situation causes interdisciplinary disunity of management accounting and management accompanied by organizational and infrastructural underdevelopment, and lack of prognostic orientation.

As a rule, the subject matter of most of the works developed by Russian researchers is limited and mainly is focused on certain issues of cost accounting and calculating the actual cost of production. At the same time, many aspects of information support in innovative areas in management are at best considered but fragmentarily. In these conditions, the problem of using KPI technologies, compiling integrated reporting, developing a balanced scorecard from financial and non-financial indicators, etc., remain completely unexplored. Apparently, also for this reason Russian companies operating in world markets are very often faced with the situation when their reporting does not meet the information needs of users due to their inadequate analyticity and relevance.

The high level of discussion nature of various approaches and interpretations regarding the issues under consideration, forming the conceptual design framework of the management accounting, has shaped the focus of our study.

## Research methodology

The basic principles of the institutionalism theory, managerialsystems, including cyclical development, crisis management, managerial accounting, and economic analysis became the theoretical base for the study.

The general scientific methods of cognition, such as system analysis, induction, deduction, comparison, formalization, etc., wereits methodological basis.

The regulatory framework of the Russian Federation in the field of accounting, IFRS, the works of domestic and foreign scientists, etc., served as an information base.

## Research results

Globalization processes in the world economy objectively imply the development of modern tools of scientific, methodological and practical support for the sustainable growth of economic systems, which, undoubtedly, puts them among the most significant tasks in the state power system and in the scientific community. In the today's conditions of increasing competition, economic systems have become more nonequilibrium, which is associated with additional research in the field of monitoring and controlling the economic processes of the exogenous and endogenous environment, affecting the development sustainability of both individual enterprises and socio-ecological and economic systems in general.

A feature of the modern system of accounting and analytical support is its focus on accounting and analysis of internal information. It is clear that in such conditions almost all external information (independent of the activities of enterprises) falls outside the scope of mandatory accounting, which actualizes the unpreparedness of business entities for crisis phenomena. [1, 4, 8]

All this requires that the analysis of the environmentalsituation in the macroeconomic instability conditions become an everyday component of management accounting. It seems to us that this also requires the use of special principles and methods of constructing information for the development and adoption of managerial decisions, different from those that are

applied in conditions of sustainable development. In today's realities, it is no longer impossible not to see that constantly changing economic circumstances can directly affect accounting and the practice of preparing financial statements. It seems to us that accounting cannot be seen as a dogma, as something forever established, because it is constantly influencedby a constantly changing environment.

It should also be noted that, as a rule, the effectiveness of management decisions made in practice depends on how much an accountant-analyst was able to consider the individual characteristics of the enterprise. This provision suggests that the constant use of only one unified approach in the implementation of accounting and analytical actions is not always appropriate and, moreover, can often lead to the adoption of ineffective management decisions. We proceed from the fact that an individual (creative) approach consists in the ability to the fullest extent consider the factors that shape the special aspects of activity of an enterprise.

Researchers note that the management accounting methodology is more dependent on the stage of the life cycle, which involves the use of a wide range of tools to implement the enterprise's strategic plan at the appropriate development stage [12].

Our analysis of the institutional evolutionary theory allowed us to identify environmental factors that influence the algorithm for the development and adoption of effective management decisions and to justify the mechanism for an adequate response to external market and macroeconomic triggers. In this format, the life cycle theory allows to a greater extent to consider the features of the strategic management accounting system.

The life cycle of an enterprise depends on its balance with the financial cycle, on the ability to influence it, and, thereby, steadily and proportionally develop economic systems at the micro level. In these conditions, the management accounting system must be directed to leveling internal contradictions that have the nature of organizational properties, as well as emerging conflicts with external factors when an enterprise moves to the next stage. [15, 17]

To solve the complex of strategic management tasks, portfolio analysis methods, including such as the Boston Consultancy Group matrix, life cycle matrix (ADL), etc. are actively used

A characteristic feature and commonality of these models is the combination of some systemevolvement parameters of different levels such as a company, product, or even a particular sector of the economy.

In our opinion, the strategic goal of any enterprise in the face of increasing competition is the implementation of such a business model that can enable the generation of sufficient added value with any environmental changes. This situation implies the need for structuring the properties of the accounting and analytical system with all kinds of combinations of stages of the enterprise life cycle.

Being a direct factor in the macroenvironment, any stage of the life cycle itself actively forms management accounting models and affects the configuration of the methods used that are generally accepted for the accounting direction under study. In modern economic realities, stable economic growth can only be achieved through effective management of business structures at the micro level, subject to prompt and accurate management decisions. All this is associated with the need to search for effective tools to increase the relevance of the generated information base.

Let us turn to the consideration of macro environment factors affecting the configuration of the used management accounting tools. In recent years, the tendency on transformation of the subject of financial accounting comes into more and more sharp focus. Moreover, if in the past it was determined by the composition of assets and liabilities in the balance sheet, at the present stage the market economy itself determines the subject of accountingunder the influence of cyclical and evolutionary processes. Globalization and structural changes at the

micro level are accompanied by changes in the tools of operational and strategic management at the level of individual business entities. [2, 16, 18]

Traditionally, accounting and analytical work has always been aimed at reflecting only the facts of economic life. At the same time, a complex of macroeconomic factors that are exogenous with respect to a business entity, which is very important for the financial situation of the enterprise, was ignored when making management decisions. It seems to us that this fact cannot be explained by the mere conservatism of the accounting methodology, because macroeconomic processes unequally affect various sectors of the economy, which makes it extremely difficult to monitor and control the financial situation of the enterprise. All this emphasizes once again thata special consideration of the factor of the economy crisis state is relevant.

The study of the essence of the economic crisis impact on the management system allows us to note a number of contradictions in the system of accounting and analytical support.

First of all, it concerns the attitude to costs. Under current conditions, there is a mismatch between the policy of the need to reduce costs due to a lack of own funds and the policy of the need to increase costs to intensify the business activity of enterprises.

Further, the need to establish anti-crisis funds while escalating the financing of current operations is controversial.

It is also possible to note certain contradictions in the choice of priorities in the methods of generating information, in the style and priorities in management, in the stable tendency of the faster growth of financial and economic technologies over accounting and analytical technologies; those factors negatively affect the prognostic potential of the generated information base and thereby strengthen unpredictability in identifying threats and risks of manifestation of economic crises at both micro and macro levels. [3, 11, 14]

To eliminate the above and other contradictions, we need in new effective methodological approaches to the development of relevant data in order to provide information-analytical support for making managerial decisions. Modern accounting methodology is characterized by increasing integration with tools for generating relevant information in systems such as financial management, crisis management, controlling, marketing, economic and mathematical modeling, statistical and econometric analysis, etc. Undoubtedly, all this form an additional synergetic effect in the system strategic management of business structures and thereby expands the subject and functions of management accounting.

In these conditions, in our opinion, the study of the anti-crisis aspect of management accounting becomes even more relevant. Indeed, in conditions of increasing uncertainty and instability of macroeconomic processes, which impedes the stable development of enterprises, it is necessary, first of all, to develop the functions of warning, which anticipate crisis phenomena in the management accounting system.

Experts note that economic crises violate generally accepted and well-established approaches to making managerial decisions through a complex impact on the information support system itself. [7, 10] As an example of such a transformation, we can consider a change in attitude to assets as an economic category. So, if in modern accounting, the composition, methods of valuation and recognition of assets are almost the same as they were fifty years ago, then from the perspective of investments, a number of highly liquid assets influenced by global financial crises (2008, 2014) became less liquid (these include, including, real estate, securities, etc.) in today's realities.

It seems to us that all this should affect the system of accounting and analytical support for the activities of enterprises. So, for example, it is necessary to modify the management accounting system to achieve the proper management of assets, liabilities, income and expenses in the new economic conditions. In addition, it should be noted that in the context under review, many objects of financial accounting are moving into the sphere of

management accounting, direct penetration of the constituent methods of financial and management accounting is performed out.

All this allows us to argue that at the present stage the accounting methodology is subject to pressure from macro environment factors, which, to a significant extent, modifies the tools of management accounting.

Indeed, the development of the post-industrial economy is accompanied by evolutionary processes not only in the system of ongoing business processes, but also by the need to adapt the management accounting technologies used to the specifics and characteristics of crisis phenomena in the economy.

All this suggests that the modern methodology of managerial accounting must be adapted to the functioning of enterprises in the face of increasing competition, quite often accompanied by a fall in traditional markets. The successful conduct of modern business requires learning to diagnose the environment, anticipate its depressive development, which will allow timely identification and subsequent leveling of negative trends for the efficient operation of the enterprise.

An analysis of the works of Russian scientists suggests that almost the majority of the developments are devoted to diagnosing the financial situation of enterprises and, at the same time, the whole set of recommendations for the anti-crisis nature does not go beyond an enterprise.

In fact, it seems to us that the deteriorating financial situation of an economic entity, in our case, is not the cause of the crisis situation, but its consequence, because crisis processes affect not only the finances of an enterprise, but also other areas of its activity, including accounting tools and the order of production and financial activities of an economic entity.

In the conditions of increasing competition and the instability of economic conditions, the system of accounting and analytical support for an enterprise should have some flexibility and adaptability to ensure the use of effective management tools for implementing the strategic plan and operational tasks of the enterprise.

Among these tools, there can be noted a balanced scorecard (developers – D. Norton and R. Kaplan). [6] Its use allows managers to have a balanced view of the main production and financial activity indicators, through which it is possible to reliably evaluate various aspects of the functioning of an enterprise at the same time. Indeed, a set of various financial indicators allows us to see the results of the implemented measures and managerial decisions, but financial indicators alone do not allow us to evaluate the future economic values of an enterprise. Hence, it must be assumed that the process of strategic management of an enterprise also requires the development of a certain array of non-financial indicators, which, together with financial indicators, objectively reflect the actual financial, economic, social and market situation of the enterprise and its ability to implement a given strategy. [13]

Other models of management accounting and strategic management are also very popular abroad, including economic added value model, triple reporting system, strategic position matrix and action assessment, etc.

Among Russian researchers in this area, we may note G. B. Kleiner; he considers the fifteen functions of an enterprise, including anti-crisis stabilizing function. [2]

In general, we must admit that in times of crisis, an analyst should also pay special attention to the state of the external environment, because at the present stage, the financial situation of Russian enterprises to a large extent depends on the influence of external factors.

## Conclusions and proposals

In the course of the study, we analyzed various approaches of the conceptual-theoretical and organizational-methodological substantiation of the management accounting system in an

unstable economy, which allowed us to identify a wide variety of factors which are the basis of the genesis of economic development, and at the present stage have a direct impact on the methodological content of management accounting.

It is proved that the economy cyclical development factor is one of the key ones when considering approaches to the formation of the management accounting concept. This situation indicates the objective need to change user requests for relevant information concerning the development and adoption of effective management decisions in a non-deterministic environment; it is the evidence that economic crises in the economy significantly affect, among others, the improvement of the management accounting methodology.

Using a systematic approach allows us to modify the anti-crisis model of managerial accounting, and also to level out the resulting disorder in the construction of elements of the managerial accounting theory, and thereby to develop effective tools for creating relevant information to work out effective management decisions in the today'sconditions of unstable economy.

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**Article history:**
Received 13 April 2020
Accepted 25 August 2020

SCIENTIFIC REVIEW

# GAMIFICATION AS A TOOL OF COMMERCIAL BANK STAFF ECONOMIC ACTIVITY AND STIMULATING

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## Abstract

Human capital is one of the key factors for an organization's success in modern economic conditions. Its formation and implementation depend on the policy of the enterprise in the field of personnel management. Complexity and ambiguity of intra-personal processes – the carrier of human capital determine the necessity of progressive movement in the direction of research of cause-and-effect relations between managerial decisions, corporate environment, and the reaction of personnel to it in the forms of activity on the transformation of the human capital of a personality into the capital of the same name of organization and created value.

Well-known tools of influence on the mentioned processes consist in the realization of mechanisms formal and informal influence and the creation of conditions for successful stimulation of economic activity. Digitization is the modern trend of economic reality in the behavior of the new generation of personalities of staff. This means the devaluation of the tradition of obedience in response to the priorities of freethinking, determination, uncompromising, creativity and independence, the reference point to "easy", "game" attitude to professional and everyday situations. All this determines the daily habits, interests, properties of reaction to the stimuli of human activity determine the necessity to choose alternative methods of influence from the authoritarian ones. In this regard, the development of the theory and methodology of gamification of the employee's activity in the organization is seen as relevant. The presented article is devoted to the research of gamification's methodology of management in a system of non-material stimulation of commercial bank personnel.

*Keywords: gamification, human capital, personnel management, corporate culture, personnel training, personnel development*

**JEL:M50**
**UDC: 005.963.1:004.4**
**005.42-024.61**
**005.73:336.71**
**COBISS.SR-ID 28658441**

## Introduction

The modern incentive system is not limited by an application of material motivation.

Managers consider market trends and increasingly turn to instruments of non-material stimulation. This is primarily due to the fact that the young generation evaluates the workplace not only as a source of income, but as a platform for self-realization as well. This means that career growth, professional development and realization of potential are in the

foreground. Moreover, non-material motivation makes it possible to increase and strengthen employee's loyalty. All these factors make development and research of the system of non-material motivation relevant.

In this regard there are some works which is done in the purposed subject. Vinichenko *et al*., recognize modern visions about the business gamification by focusing on the gamification application theoretical aspects in various sectors of economy, beside the best practices of gaming techniques application [4]. Also, in other work, gamification success stories identified which have been applied in hospitality and tourism and gamification benefits examined by analyzing the relationship between tourism organizations and three main tourism stakeholders including tourists, tourism employees and local community [5].

## Methods

The methodological basis of the research is systematic, comparative, abstract-logic and economic types of analysis. An algorithm of the presented research is expressed by a chain: system of non-material stimulation of the personnel of PJSC "AK BARS" BANK, problems and prospects – gamification as a way of non-material stimulation of the personnel of PJSC "AK BARS" BANK – an estimation of efficiency of assimilation of methodology of gamification at personnel management of PJSC "AK BARS" BANK.

## Results and Discussion

The system of non-material stimulation of the personnel in PJSC "AK BARS" BANK is based on the following components: corporate culture, personnel training and development, personnel assessment and internal communications development. Employees of various structural subdivisions, departments and other organizational units of the bank are involved in the processes of personnel motivation and stimulation in PJSC "AK BARS" BANK.

According to the data of 2019, the number of employees of PJSC "AK BARS" BANK exceeded 5.5 thousand employees. Most of the personnel of PJSC "AK BARS" BANK are employees younger than 39 years. The total share of this group of personnel in 2019 was 73% [8]. Based on this information it can be assumed that the implemented stimulation policy should be based on modern trends and the introduction of innovations into the motivation process.

The key trends of globalization are mobility, high speed of decision making, business access to the online platform, flexibility. The coming Digital Revolution requires modernization and improvement of business rules, management models, the introduction of innovations, and increased adaptability. Modern companies must transform from the traditional type of organizations to technological ones in this environment. Thus, PJSC "AK BARS" BANK is now moving to the "banking of the future", completing the transformation of the business model from a classic bank to one of the largest financial technology corporations.

However, for a holistic transformation it is necessary to review the full range of processes of PJSC "AK BARS BANK. One of the most important directions of transformation is the sector of human capital as the basic factor of economic activity itself [12]. The necessary condition for the completion of business transformation is the development of digital strategy [3], integrated not only with the strategic goals of the organization and its business strategy, but with HR-strategy as well. Complex impact allows for achieving desired results.

Nowadays, in research circles, considerable attention is being paid to the theory of generations developed in the 90s by American scientists William Strauss and Neil Howe. This theory, based on the psychology of generations formed by habitats, values and events,

highlights the value system that governs the behavior of each generation. Thus, Generation X includes people born in 1961-1981, Generation Y – born in 1982-2004, Generation Z – born after 2005. Most of the personnel of PJSC "AK BARS" BANK are people who belong to Generation Y, the share of this group in 2019 was 73%. Therefore, PJSC "AK BARS" BANK needs to form a system of staff motivation based on the features and values of this generation.

Generation Y or Generation Millenials, as it is called, are virtualized for the reason that high technologies are an integral part of their lives. This generation is focused on quick results, values self-development and self-realization, meaningful tasks and flexibility of approach. Career building in the traditional way is of little interest to them, and status and positions are not the end in themselves. Generation Y considers the opportunity to do what they love to do, drive tasks, work in a team, have an experienced mentor, and maintain a balance between work and personal life which are the most important aspects of their professional development [13]. Also, millenniums value flexible working hours, lack of attachment to the workplace, the informality of communication.

The banking sector has its own specifics, so not all trends in the motivation of millenniums will be reflected in the motivation of bank employees. Thus, for example, the main part of activities in the bank is work with documents, which is strictly regulated and formalized as a rule, as well as communication with clients, which also does not allow an informal style of communication. However, many of the existing trends can be adapted to the peculiarities of this business.

Today, a new trend of millennium management is gaining more popularity, which consists of the use of game elements in non-game processes and which is called the term "gamification". The term was used first by American programmer and inventor N. Peling in 2002, and then by Canadian consultant G. Ziechermann in 2003 [10]. Gamification was understood as the process of applying game thinking and using game dynamics to involve the audience in the process of solving problems.

This term has synonyms now, among which are: gambling, gaming and game mechanics in motivating staff. The term "gambling" was used by the Center for Educational Developments of the Moscow School of Management Skolkovo during one of the presentations. The term "playfulness" meant the use of game approaches to actively involve students in the process of mastering new skills and competencies. The term "playfulness" is not new and has been used by Russian teachers in educational methods for a long time. Fatherland representatives of pedagogy L.S. Vygotsky and G.P. Shchedrovitsky paid special attention to the specifics of the game and game activity in education in their works, noting the high efficiency of this method.

The key feature of gamification is the use of specifics and features of computer games and video games, which allows to achieve greater involvement of Generation Y employees in their professional activities [9].

Gamification is an excellent non-financial motivation tool that can increase employees' efficiency, encourage them to achieve better results and bring the team together. Looking at the gamification, it is necessary to highlight the main features of this tool. The main aspects of gamification should include: dynamics, mechanics, aesthetics and social impact. Dynamics manifests itself in the use of game scenarios that involve users in the process and encourage a quick response to events. Gamification mechanics is represented by the use of game elements of encouragement – virtual awards, statuses, virtual goods. The aesthetics are represented by creating a general impression of the gameplay, creating an emotional atmosphere. Social interaction within the framework of gamification should include the use of various game techniques that can provide active interaction of users.

Within the framework of improvement of the system of non-material stimulation of the personnel of PJSC "AK BARS" BANK proposes to apply IT-technology tools that meet the trends of digitization and the needs of Generation Y employees, which make up 73% of the

bank's personnel. In order to develop the motivation system, it is proposed to improve the corporate portal AkBars Life available at PJSC "AK BARS" BANK and expand the functionality of this tool in the following areas:

1. Creation of a corporate social net;
2. Introduction of chat bots;
3. Achieving transparency of the employee's performance indicators and the efficiency of their work;
4. Introduction of gamification into HR management processes.

Implementation of these measures will improve internal communication processes; improve the interaction between employees of different departments and subdivisions. In addition, the introduction of chat bots will significantly simplify some of the routine processes and will automate some of them. The openness of performance indicators of the employee will allow to develop healthy competition, which will lead to increased productivity. The introduction of gamification into HR management processes will allow making routine processes more interesting and increasing the level of personnel involvement.

The introduction of gamification into staff incentive processes is caused, in particular, by the acute need of the organization for innovations. It is connected with the fact that innovations are the factor of maintenance and increase of competitiveness today [11].

Gamification allows to make the process of generation and introduction of innovations more exciting by increasing the level of involvement of employees in the processes of the organization. Thus, by means of gamification each employee has an opportunity to contribute to the development of the organization and to see the assessment of this contribution from colleagues and management staff. This satisfies the employee's need for recognition, a sense of importance and value for the work performed. In addition, gamification can create a specific culture of employee involvement, turning routine operations and tasks into interesting opportunities.

Introduction of gamification into the personnel motivation system of PJSC "AK BARS" BANK is connected, first of all, with the necessity to consider the features of the generation of millenials occupying the largest share in the structure of the bank's personnel. According to the research of the British sociologist Richard Bartle, the degree of impact of gamification on different generations differs: on generation X –17%, on generation Y – 51%, on generation Z – 32% [1]. Generation Y has the highest susceptibility to gamification methods. Among the personnel of PJSC "AK BARS" BANK there are no employees of Generation Z yet, however, in the coming years the situation will change, as the bank pursues an active policy of attracting young specialists and closely cooperates with universities.

Building an effective policy for managing staff incentives, it is necessary to consider the long-term perspective. This means that the introduction of gamification will be relevant and beneficial for the interaction with staff today and tomorrow.

According to the research conducted by Protection Technologies LLC, which provides business automation services, corporate social nets can improve a number of organizational performances [6]. Simplification of access to information by 77% occurs through the creation of an internal database of contacts of employees, information tape, which includes information from management and employees, the introduction of chat bots. For example, the use of chat bots makes it possible to simplify routine operations, which include obtaining information about the necessary documents package for applying for the vocation or sick pay, information about career opportunities or upcoming events, training programs and evaluation procedures. This saves HR department staff time and staff time spent on communications to find the information they need.

The availability of knowledge from internal experts is increasing significantly thanks to the introduction of a distance learning system and the publication of useful materials by staff. The

48 per cent reduction in communication costs is due to the use of effective online communication in dialogue and chat rooms. Employees are becoming more mobile; communications are faster and more accessible. The 68 per cent reduction in travel costs is due to the elimination of the need to move staff because of improved communications between staff members and the ability to monitor certain tasks in real time. Satisfaction of employees increases due to the use of new and better understood technologies, faster feedback, transparency and availability of information.

The use of a corporate social network will also increase employee productivity when performing standard routine tasks. This is the result of uniform release of time when interacting with e-mail – on average 7.5%, when searching for information – 6%, when working together – 4.5% and the performance of specific tasks – 5%. Thus, productivity at performance of the given operations increases on average on 24,4 %. This is a significant growth, which testifies to the proven effectiveness of the introduction of corporate social network in the staff incentive system.

Simplifying access to information reduces the time required to conduct operations. As a result, there is an increase in the speed of implementation of operations and subsequently increases productivity. On the basis of the data given above it is possible to speak about an increase in productivity of employees on 20-25%. It means that PJSC “AK BARS” BANK will be able to reduce the number of staffs by 1000 staff units, which will lead to savings of the bank's payroll by 65.7 million rubles [7]. The introduction of gamification into the employee incentive system is an important tool of increasing motivation to work by improving a number of indicators.

Above all, gamification helps to increase employee engagement. This is because gaming engagement techniques make the job more engaging, dynamic. Stressful and routine reduce.

Thus, according to LLC “Protection Technologies”, after gamification implementation the average increase in the employee engagement rate is 25%. To date, the level of personnel involvement of PJSC “AK BARS” BANK is 61%, while in PJSC “Sberbank” this indicator in 2018 was 75%. Based on this, we can assume that the increase in this indicator is an urgent task for PJSC “AK BARS” BANK. Thus, as a result of the introduction of gamification, the level of involvement will increase by 25% and will amount to 76.2%.

Introduction of gamification in the process of adaptation of new employees will improve this process qualitatively. Firstly, employees will have an opportunity to get acquainted with the mission, goals and corporate values of the company rather quickly. Secondly, gamification of this process will simplify the process of adaptation in the corporate social net. A newcomer will have an opportunity to get acquainted with all possibilities of the network, and as a reward for passing the program will receive bonus points.

Introduction of gamification in this process will reduce the number of dismissals due to the difficulties with adaptation by 7% – this conclusion was reached by experts of McKinsey Global Institute as a part of the study of social technologies in the economy [2]. Today the staff turnover in PJSC “AK BARS” BANK is 25.6%, and dismissals due to difficulties with adaptation make up 12% of the total number. In 2019 the number of dismissals due to difficulties with adaptation was 167. This figure is quite high, which means that measures should be taken to reduce its value. As a result of the introduction of gamification, this figure may drop to 11.16%. In numerical terms, the number of dismissals due to adaptation difficulties will decrease by 12. The economic effect can be estimated by calculation of funds spent on hiring and dismissal of one employee of PJSC “AK BARS” BANK. The data are presented in the Table 1.

*Table 1. Economic effect of introducing gamification in adaptation of new employees*

| Indicator name | Value |
|---|---|
| Time spent by the recruiter on the recruitment/dismissal of 1 staff member | 65 hours |
| Average wage of a recruiter | 275 rub |
| Time spent by the line manager on the recruitment/dismissal of 1 staff member | 6 hours |
| Average wage of line manager | 424 rub |
| Mentoring supplement | 10.000 rub |
| Training costs for a new employee | 4.500 rub |
| Access to job search sites and CV database | 3.000 rub |
| Cost of hiring 1 staff member | 37.919 rub |
| Reduced number of dismissals due to difficulties with adaptation when implementing gamification | 12 |
| Economic effect of introducing gamification into adaptation processes | 455.028 rub |

Continuous improvement of staff skills in the implementation of gamification is achieved through the fact that employees receive additional motivation to develop their skills and competencies. Management, in its turn, gets the opportunity to manage this process effectively.

Improvement of intra-corporate interaction and improvement of the psychological climate in the team is achieved as a result of the formation of a comfortable social environment, prompt provision of feedback to employees and rapid integration of employees into the ongoing processes.

The creation of the Bank of Ideas as part of the corporate social net will improve the processes of interaction between managers and employees increase the initiative of staff and will simplify the process of submission and proposals for optimizing existing processes in the organization and ideas for implementing new ones. These practices are used by leading organizations around the world and help increase staff involvement in the organization's activities. According to statistics, the introduction of gamification increases the number of proposals submitted by employees by 68% and the number of implemented proposals by 25%. To date, employees of PJSC "AK BARS" BANK submit about 150 proposals per year, of which no more than 10 are implemented. This is an extremely small figure. The introduction of the gamified Ideas Bank will allow to development of initiative and participation in the staff of the organization. Thus, as a result of the introduction of gamification, the number of submitted proposals may increase to 252, and the number of implemented initiatives to 15.

Implementation of a corporate social net with gamified tools is quite costly. However, due to the fact that PJSC "AK BARS" BANK already has a corporate portal AkBars Life, the cost of implementation will be lower. It is expedient to apply to outsourcing and purchase a ready-made solution, which will be installed on the existing server base. The cost of the ready solution is presented in the Table 2.

*Table 2. Program implementation costs, RUR*

| Indicator name | Forecast |
|---|---|
| Cost of the decision per 1 employee | 2 340 |
| Total solution cost | 12 870 000 |
| Cost of setting | 150 000 |
| Total | 13 020 000 |

It is necessary to calculate the economic efficiency to assess the feasibility of implementing the proposed solutions in the processes of stimulating the labor activity of the personnel of PJSC "AK BARS" BANK. For this purpose, the ROI indicator is used. The calculation data are presented in the Table 3.

*Table 3. Cost-effective implementation of corporate social net with gamification tools*

| Category | Costs |
|---|---|
| Reduced search costs as a result of resignations due to difficulties in adaptation | 455.028 rub |
| Savings on bank salary fund | 65.700,000 rub |
| Costs of implementing the program | 13.020,000 rub |
| ROI | 408% |
| Return on investment | 1 year |

Social and economic efficiency of introduction of corporate social network with gamification tools into the system of labor activity stimulation of PJSC "AK BARS" BANK personnel is presented in the Table 4.

*Table 4. Socio-economic efficiency of proposed activities*

| Social effectiveness | Economic efficiency |
|---|---|
| 1. Increasing the level of personnel involvement | 1. Increasing labor productivity |
| 2. Increasing the initiative of staff | 2. Decrease in costs related to staff turnover |
| 3.Increased level of staff satisfaction | 3. Reducing communication and travel costs |

## Summary

Based on the assessment of efficiency of the proposals on development of the system of personnel stimulation of PJSC "AK BARS" BANK, the following conclusions can be made:

1. Introduction of corporate social net will allow to ensure the effectiveness of information flows of the organization, which in its turn, will simplify access to the necessary information by 77%, reduce communication costs by 48%, reduce travel expenses by 68% and increase staff satisfaction level by 56%. It will also promote a sense of ownership of the organization and commitment to corporate values.
2. As a result of implementation of the corporate social net will be increase in productivity by 20-25%. As a result, PJSC "AK BARS" BANK will be able to reduce the number of staffs by 1,000 staff units, which will result in savings of the payroll of 65.7 million rubles.
3. Application of gamification tools in the corporate social net has a long-term perspective, as this toolkit is highly effective in interaction with both Generation Y and Generation Z, which in the near future will constitute a high proportion of the PJSC "AK BARS" BANK personnel.
4. The introduction of gamification will significantly increase the level of involvement of employees of PJSC "AK BARS" BANK. According to statistics, the average growth of this indicator as a result of gaming methods is 25%. Thus, the level of staff involvement will be 76.2%.
5. Application of gamification in adaptation of new employees allows to achieve high efficiency of this process, as well as to reduce the number of dismissals due to difficulties in adaptation of new employees by 7%, which will reduce the cost of personnel search by 455,028 rubles per year.
6. Application of ideas by the Bank within the framework of the gamification of corporate social net will allow to increase initiative and involvement of employees of PJSC "AK BARS" BANK. The number of proposals submitted by employees may increase by 68%, while the number of implemented initiatives may increase by 25%.
7. The total economic effect from the development of proposals may reach about 53 million rubles per year.

## Conclusions

The presented article is devoted to the research of gamification's methodology of management in a system of non-material stimulation of commercial bank personnel.

On the basis of the conducted research, it is possible to make a conclusion that the introduction of the corporate social net into the system of non-material stimulation of the personnel of PJSC "AK BARS" BANK with application of gamification methods can become the catalyst of the organization development and qualitatively improve a number of indicators characterizing the level of motivation and involvement of the personnel.

***Acknowledgements***

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

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**Article history:**

Received 25 May 2020

Accepted 30 Juny 2020

€ 20,00

ISBN 979-12-80225-09-2