

# Human capital and AI in industry 4.0. Convergence and divergence in social entrepreneurship in Russia

Human capital  
and AI in  
industry 4.0

565

Elena G. Popkova

*Moscow State Institute of International Relations (MGIMO), Moscow,  
Russian Federation, and*

Bruno S. Sergi

*Harvard University, Cambridge, Massachusetts, USA and  
University of Messina, Messina, Italy*

Received 15 September 2019

Revised 8 October 2019

18 November 2019

Accepted 9 December 2019

## Abstract

**Purpose** – The purpose of this article is to determine the future proportion and variants of usage of human intellect and artificial intelligence (AI) in entrepreneurship of industry 4.0 that fits social entrepreneurship the most. It could be convergence (simultaneous utilization during the same entrepreneurial processes with the emphasis on unique features by the terms of the competition) or divergence (usage during different business processes by the terms of labor division).

**Design/methodology/approach** – The authors determine the influence of usage of human capital and AI on the efficiency of social entrepreneurship. The authors identify the perspective directions of usage of AI in social entrepreneurship and evaluate the readiness and interest in the implementation of these directions of concerned parties. The authors also model the optimal proportions and the variant of usage of human intellect and AI in social entrepreneurship in the conditions of Industry 4.0 in the future (until 2030).

**Findings** – It is found that social entrepreneurship will use the opportunities of Industry 4.0 for optimization of its activities until 2030, but will refuse from full automatization, using human intellect and AI at the same time.

**Originality/value** – The most perspective directions of application of AI at social companies are a collection of social goods and services, marketing studies and promotion of social goods and services. Neither convergence nor divergence of human and artificial intellectual capital does not fully conform to the interests of concerned parties. The most preferable (optimal) variant of usage of human intellect and AI in social entrepreneurship in the Industry 4.0 is human intelligent decision support.

**Keywords** Intellectual capital, Digital personnel, AI, Social entrepreneurship

**Paper type** Research paper

## 1. Introduction

Intellectual capital is of the utmost importance for the functioning and development of entrepreneurship. It plays two key roles. The first one consists in independent usage of intellectual capital for creation and translation of corporate knowledge and information and for development of innovations – promoting innovative ideas and offering technologies. Intellectual capital is a valuable and unique non-material asset for any company, which defines its competitiveness in the target market. The second role of intellectual capital is connected to managing other forms of capital (material, financial, etc.) for creation of goods and services. Intellectual capital of a company determines the technology of production and labor efficiency.

In the Industry 4.0 system, a new type of intellectual capital appears – artificial intelligence (AI). It is a technology of machine (automatic) processing of information – which is opposed to human intellect (cognitive activities of human). At present, capabilities of AI are not that



**JEL Classification** — A13, D71, E22, E24, J24, L31, L33, M14, O15, O35

The research was performed with financial support from the Russian Fund of Fundamental Research within the scientific project No. 18-010-00103 A.

Journal of Intellectual Capital

Vol. 21 No. 4, 2020

pp. 565-581

© Emerald Publishing Limited

1469-1930

DOI 10.1108/JIC-09-2019-0224

large, but it is constantly improving. It is probable that by 2028–2030 AI will have equal capabilities with human intellect – or will even surpass it. Thus, there appears a scientific and practical problem of determining the variants of usage of human intellect and AI in entrepreneurship of Industry 4.0 in the future.

A lot of commercial companies' strategies of development for the mid-term envisage full automatization based on cyber-physical systems of Industry 4.0 (the Internet of Things [IoT] under control of AI). Based on this, they plan to raise their competitiveness, reducing the influence of the "human factor" on production and ensuring the guarantee of quality of their products. Fully automatized industrial companies will be able to gain more advantages from the "scale effect," increasing the resource effectiveness of their activities.

At the current stage (2019) of digital modernization, these companies set high demand for digital personnel as owners of prominent human intellect (high level of qualification in the profession) and digital competencies. This creates stimuli for investments into education from employees in the labor market in expectation of expanded possibilities for employment, career building and receipt of high income. However, the demand (at least, such high demand) for digital personnel could be temporary and peculiar only for the current stage of digital modernization of companies. Later on, in the course of implementation and development of breakthrough digital technologies at the stage of mass automatization (in the mid-2020s), this tendency might be replaced by a wave of dismissals and growth of unemployment.

When studying the future of intellectual capital in the conditions of Industry 4.0, it is necessary to pay attention to social entrepreneurship – non-profit entrepreneurship that implements socially important initiatives (e.g., in the sphere of environment protection, fighting poverty). On the one hand, it cannot stay aside of the tendency of comprehensive digitization (which is initiated and supported by the state, in particular) and it is interested in increasing the effectiveness of its activities. On the other hand, social entrepreneurship envisages active social interaction in which humans could not be replaced by AI.

In addition to this, high level of corporate social responsibility contradicts the idea of hiring of digital personnel for their further dismissal – as in this case, while solving certain social problems a social company will cause and aggravate other social problems (unemployment and growth of poverty). Based on this, we offer hypothesis  $H_0$  that social entrepreneurship will be using the opportunities of Industry 4.0 for optimization of its activities but will refuse from full automatization, using human intellect and AI at the same time.

This research aims at verification of the offered hypothesis and determination of the proportion and variant of usage of human intellect and AI in entrepreneurship of Industry in the future that fits social entrepreneurship the most – this could be convergence (simultaneous usage during the same entrepreneurial processes with the emphasis on unique features by the terms of competition) or divergence (usage during different business processes by the conditions of labor division). For this, three research issues are solved:

- (1) Determining the influence of activity of usage of human intellect and AI on efficiency of the activities of social entrepreneurship;
- (2) Determining the perspective directions of usage of AI in social entrepreneurship and evaluating the readiness and interest in implementation of these directions of concerned parties;
- (3) Modeling the optimal proportion and variant of usage of human intellect and AI in social entrepreneurship in Industry 4.0 in the future (until 2030).

We are involved here in analyzing the period until 2030 being it equally far enough away to determine notable changes connected to the mass distribution of AI and not too remote to

build precise forecasts and scenarios (it would be harder to forecast under a more extended situation until 2050).

## 2. Literature review

The new Industry 4.0 phenomenon is studied in detail in the existing scientific literature, including [Li \(2018\)](#), [Moeuf et al. \(2018\)](#), [Müller et al. \(2018\)](#), [Qi and Tao \(2018\)](#), [Xu et al. \(2018\)](#). [Liu et al. \(2019\)](#) present an intellectual demonstration production system based on the IoT in the context of Industry 4.0. [Ghadimi et al. \(2019\)](#) write that during management of supply chains in Industry 4.0, it is possible to use intellectual sustainable selection of supplier with the multi-agent technology. [Muñoz and Capón-García \(2019\)](#) perform mathematical modeling of the process of intellectual decision support in Industry 4.0.

[Peres et al. \(2018\)](#) point out that the economy is on the path to intellectual collection and analysis of data in real time for Industry 4.0. [Han \(2018\)](#) suggests using intellectual robots for automatic transmissions and management of engineering machines in Industry 4.0. [Beisheim et al. \(2018\)](#) think that digital production and virtual commissioning of intellectual plants and systems of the industrial level 4.0 are possible with the usage of the project languages based on graphs. [Popkova \(2019\)](#) notes that there are preconditions for formation and development of Industry 4.0 in the condition of the knowledge economy.

[Popkova et al. \(2019\)](#) present a model of state management of economy based on the IoT. [Popkova and Sergi \(2018\)](#) elaborate on the influence of Industry 4.0 and other innovations on socioeconomic development in Russia and note the contradiction of the digital economy as a socioeconomic environment for transition to Industry 4.0 – it consists in difficulty of simultaneous achievement of the complexity, diversity and rationality. [Popkova et al. \(2018a\)](#) study the transformation processes in a media-system in the conditions of Industry 4.0.

Perspectives of creation and usage of AI in entrepreneurship are studied in detail in the existing scientific works. [Palhares et al. \(2019\)](#) suggest using AI in industrial systems. [Duan et al. \(2019\)](#) think that AI should be used for decision making in the age of Big Data. [Lowe \(2019\)](#) thinks that AI is an alternative to other current systems of statistical accounting.

[Osório and Pinto \(2019\)](#) point out that information provision of the systems of autonomous transport vehicles could be increased, uncertainty could be reduced, and manageability could be increased due to usage of AI. [Mrówczyńska et al. \(2019\)](#) write that AI could be used as a tool for supporting the local policy of sustainable development. [Popkova and Parakhina \(2019\)](#) offer to control the global financial system based on AI, as it opens new opportunities but also has some limitations.

The consequences of mass distribution of AI and total automatization for humans (digital personnel) are considered indirectly in certain studies at the verge of the economic theory (educational economics and labor economics) and social sciences (philosophy, law and psychology). [Perc et al. \(2019\)](#) study the social and legal problems of AI that are connected to the uncertainty as to who will be responsible for its decisions – in particular, its mistakes (e.g., in case of arguable decisions).

[Miller \(2019\)](#) thinks that future interactions between human and AI envisage their close interconnection and cooperation. [Daugherty et al. \(2019\)](#) point out that AI allows diversifying the activities of companies to a larger extent than human intellectual capital, which creative abilities are higher, but require complex management (motivation and stimulation of labor, time for leisure, etc.). Based on this, the scholars think that in the future there could appear strong competition between human intellect and AI, which result is unpredictable. The scholars suppose that human intellectual capital will be ousted from the system of entrepreneurship by AI.

[Burrell \(2019\)](#) comes to a conclusion that AI influences the human society, “showing the worst and the best aspects.” Based on this, the scholar thinks that under the condition of

competition between human intellect and AI humans will show their best qualities and will unite against AI – however, the applied methods of competitive struggle will not always be fair from the social and legal point of view.

Feng (2019) writes that cognitive abilities of AI (example of studying the literature and creative activities) are high and constantly expand. However, the capabilities of AI are limited and will always be limited, based on which the scholar is sure that competition between human and artificial intellectual capital is impossible (as it contradicts common sense).

Popkova *et al.* (2017) point out that formation and dissemination of AI create new challenges for human capital from the positions of its infrastructural role in the system of entrepreneurship. The scholars suppose that this role could be taken by AI. Ford (2013) writes that AI could lead to a crisis of unemployment. Velayutham and Rahman (2018) note the primary role of human capital in entrepreneurship. Amankwah-Amoah (2018) proves that the flows of human capital in insolvent organizations could be replaced by stable and predictable AI, which will allow improving the financial position of these companies.

The theory and practice of functioning and development of social entrepreneurship in the current economic conditions and its specifics as a special form of entrepreneurship are reflected in scientific works. Agrawal and Hockerts (2019) note that management of conflicts between investors and social companies is a complex task, which reduces the investment attractiveness of social entrepreneurship. Asmussen and Fosfuri (2019) note the necessity for managing corporate social responsibility as a multi-national company, which does not, however, make it a social (commercial) company.

Cho *et al.* (2019) write of the existence of wide opportunities and multiple problems of starting, conducting and developing social entrepreneurship in Bangladesh and Korea. Choi and Chang (2019) think that there's a need for partnership in purchase of resources for a new social company – for ensuring its sustainability. Erpf *et al.* (2019) think that there's a need for clustering of social companies for strengthening their market positions. Frumkin (2013) comes to the conclusion that non-profit management of social entrepreneurship reduces its competitiveness in the markets, which include commercial and non-commercial companies (e.g., markets of medical and educational services).

Grant and Palakshappa (2018) are sure that there could be a “push” for a social company – i.e. its “movement towards social responsibility,” which will allow popularizing the practice of “fair trade.” Mason *et al.* (2019) think that social companies function in quasi-markets. Naseem *et al.* (2019) point out that risk management stimulates effective participation in the practices of corporate social responsibility and effectiveness of activities of companies in the Asia-Pacific region.

Popkova *et al.* (2017) note wide perspectives of usage of social marketing in economic criminology in the conditions of the forming innovative economy. Popkova *et al.* (2018b) prove that there are perspectives of development of social advertising in Russia. Popkova and French (2017) note an important role of social marketing and public relations (PR) in the context of globalization and integration of entrepreneurship. Raza *et al.* (2019) state that the obligation on corporate social responsibility of small and medium companies and organizational competitive differentiation are under pressure from interested parties and thus should be oriented at the market and take into account the socioeconomic effects of the context.

Stecker (2014) is sure that a revolution of the non-commercial sector through social entrepreneurship takes place. Tan and Yoo (2015) think that true intentions of social entrepreneurship are not necessarily characterized by the non-profit nature, which complicates the procedure of classification of companies according to the criterion of their goals. Tong *et al.* (2018) point out that selection of the buyers of multi-national companies stimulates the dissemination of the practice of corporate social responsibility to suppliers in developing countries. Tykkyläinen (2019) notes that growth of social companies is connected to various threats.

Yin and Chen (2019) point out the necessity of multi-purpose management of a social company (based on the data from China). Zhu and Lai (2019) present an original opinion on social capital from Chinese suppliers. The scholars note the perspectives of optimization of the supply and sales chains due to expansion of the practices of corporate social responsibility by multi-national companies. Zoysa and Takaoka (2019) perform empirical analysis of the indicators of corporate social responsibility of small and medium companies in regional Japan. Goebel (2019) presents drivers for voluntary reports on intellectual capital, based on the theory of agency.

Thus, the performed literature overview on the set topic showed that the influence of digital modernization of economy (entrepreneurship, in particular) in Industry 4.0 on social entrepreneurship is not studied sufficiently. The perspective directions of usage of AI in social entrepreneurship and the optimal proportion and variant of usage of human intellect and AI in social entrepreneurship in Industry 4.0 in the future (until 2030) are still uncertain. These gaps in the system of economic knowledge determine the field for this research.

### 3. Methodology

When determining the influence of activity on usage of human intellect and AI on the efficiency of the activities of social entrepreneurship, the method of correlation analysis is used in this work. The connection between the indicators of quality of life, calculated by Numbeo within Quality-of-life index (mid-year) is determined – namely, quality-of-life index (integral indicator) and private indicators – purchasing power index, safety index, health care index, cost of life index, property price to income ratio, traffic commute time index, pollution index and climate index, with the indicators of the level of development of human intellectual capital (employee training) and artificial (automatization) intellectual capital (use of Big Data and analytics), calculated by the IMD's World Global Competitiveness Ranking.

The logic of the analysis consists in determining the differences in significance of human and artificial intellectual capital for provision of growth of quality-of-life today. As the indicators of quality of life are measured in points (the more the better) and the indicators of World Global Competitiveness Ranking in positions (the lower the better), we are interested in reverse connection between these indicators. Therefore, the influence of the indicators of the level of development of human and artificial intellectual capital on each indicator of quality of life will be stronger if the negative value of the correlation coefficients ( $r^2$ ) is low.

Positive values of correlation coefficients will mean the negative influence of the indicators of the level of development of human and artificial intellectual capital on quality of life. The research is performed on the basis of statistical data for 2018. The research objects are top-nine countries with the highest quality of life according to Numbeo and Russia.

The mathematical sense of the offered hypothesis  $H_0$  is that the share of AI in the optimal structure of intellectual capital of social companies, according to the interested parties, should not exceed 50 percent. For verifying the offered hypothesis  $H_0$ , we use the method of expert evaluation. We conducted consultations with social entrepreneurs, their employees, and consumers, based on which the values were assigned to the corresponding indicators. For systemic presentation of the current level of automatization and perspectives of usage of AI in social entrepreneurship until 2030, we perform a survey of readiness and interest in implementation of these directions among all interested parties: social entrepreneurs, employees social of companies and consumers of their goods and services. The special forms for each separate category of interested parties are developed (Tables I–III).

The offered forms could be used for sociological surveys. However, we have not conducted a survey – instead, we used the database “Social entrepreneurship of Russia. 2018,” which was prepared by the fund of regional social programs “Our future” and answered the questions from the forms in Tables I–III, based on positions of interested parties. For

**Table I.**  
Form for survey for  
social entrepreneurs

Question			Answer
What is the level of automatization of your company as of now?			points 1–10
To which level are you ready to raise the level of automatization of your company until 2030?			points 1–10
Do you have sufficient investments (possibility of attracting them) for purchase of AI?			points 1–10
Please evaluate the perspectives of usage of AI in each business process separately:	Conduct of marketing studies (determining the society's needs for social goods and services)		points 1–10
	Promotion of manufactured social goods and provided social services among target audience (advertising)		points 1–10
	Collection of orders for social goods and services		points 1–10
	Attraction of investments (crowdfunding)		points 1–10
	Attraction of employees and volunteers (crowdsourcing)		points 1–10
	Production of social goods and provision of social services		points 1–10
	What is the optimal proportion of human intellect and AI for your company until 2030?		
Please state the share of AI			
Which variant of the combination of human intellect and AI is preferable for your company until 2030?	Convergence (simultaneous usage during the same entrepreneurial processes with emphasis on unique features by the terms of competition) Divergence (usage during different business processes by the conditions of labor division) Intellectual decision support by human	Risk of dismissal	choosing from three variants of answer
Source(s): Developed and compiled by the authors			

modeling of optimal proportion and variant of usage of human intellect and AI in social entrepreneurship in Industry 4.0 in the future (until 2030) we use the method of logical analysis.

4. Results

4.1 The influence of activity of usage of human intellect and AI on the efficiency of activities of social entrepreneurship

The initial statistical data that characterize the quality of life and the level of development of human and artificial intellectual capital in 2018 in the selection of countries are shown in Table IV. Countries that have the highest quality of population's life are not peculiar for high level of development of human and artificial intellectual capital in 2018. A preliminary visual analysis of the data of Table I allows supposing that cross-correlation will be vivid (in most cases negative and below 0.1) but moderate (below 0.9).

As shown in Table III, the highest quality of population's life (integral indicator – quality-of-life index) is peculiar for Denmark (196.47 points) and Switzerland (195.06 points). The level of development of human intellectual capital (Employee training) in Denmark is the highest in the world (1st position); it is also high in Switzerland (4th position). The level of development of artificial intellectual capital (Use of big data and analytics) in Denmark is rather high (7th position in the world), and it is moderate in Switzerland (24th position in the world). In Russia, quality of life is the lowest in the selected countries (104.05 points); the same is true for the level of development of human (41st position) and artificial (58th position) intellectual capital. The calculated cross-correlation between the studied indicators is shown in Figure 1.

**Table II.**  
Form for survey of  
employees of social  
companies

Question	Answer
How actively do you use digital technologies in a social company?	points 1–10
To which level are you ready to raise the activity of application of digital technologies in a social company?	points 1–10
Do you have sufficient competencies for usage of AI?	points 1–10
Please evaluate your readiness to use AI in each business process separately:	Conducting marketing studies (determining the society's needs for social goods and services) points 1–10 Promoting the manufactured social goods and provided social services among the target audience (advertising) points 1–10 Collection of orders for social goods and services points 1–10 Attraction of investments (crowdfunding) points 1–10 Attraction of employees and volunteers (crowdsourcing) points 1–10 Production of social goods and provision of social services points 1–10
What is the optimal share of AI (automatization) for your company until 2030?	%
Which variant of combination of human intellect and AI is preferable for your company until 2030	Convergence (simultaneous usage during the same entrepreneurial processes with emphasis on the unique features by the terms of competition) Risk of dismissal Choosing from three variants of answer Divergence (usage during different business processes by the conditions of labor division) Intellectual decision support by human

**Source(s):** Developed and compiled by the authors**Table III.**  
Form for survey of  
consumers of social  
entrepreneurs

Question	Answer
What is the level of automatization of social companies as of now?	points 1–10
To which level are you ready to raise the level of automatization of social companies until 2030?	points 1–10
Do you have sufficient knowledge and devices for communications with AI?	points 1–10
Please evaluate your readiness and interest in contact with AI in each business process of social companies separately:	Feedback (wishes and offers) points 1–10 Social advertising points 1–10 Filing orders for social goods and services points 1–10 Fundraising points 1–10 Employment and volunteering points 1–10 Receipt of social goods and social services points 1–10
What is the optimal proportion of human intellect and AI for social companies until 2030? Please state the share of AI	%
Which variant of communication with social companies is preferable for you until 2030	Digital communications with human Digital communications with AI Digital communications at your discretion – with human or AI Choosing from three variants of answer

**Source(s):** Developed and compiled by the authors

**Table IV.**  
Indicators of quality of  
life and the level of  
development of human  
and artificial  
intellectual capital  
in 2018

Country	Quality-of-life index	Purchasing power index	Safety index	Health care index	Cost of life index	Property price to income ratio Points 1–200	Traffic commute time index	Pollution index	Climate index	Employee training		Use of big data and analytics
										$x_1$	$x_2$	
	$y_1$	$y_2$	$y_3$	$y_4$	$y_5$	$y_6$	$y_7$	$y_8$	$y_9$			Position
Denmark	196.47	110.69	75.28	79.22	73.88	7.52	29.60	20.79	82.29	1		7
Switzerland	195.06	108.78	77.25	75.27	72.18	7.88	30.62	11.57	62.79	4		24
Finland	189.73	118.09	57.30	76.82	73.39	7.68	35.66	23.15	94.20	11		30
Australia	188.12	92.03	76.85	65.66	97.22	6.41	19.49	15.65	68.81	38		23
Netherlands	186.41	98.04	71.46	75.63	75.22	7.52	29.42	27.34	87.56	9		17
Germany	184.30	111.99	65.40	73.58	66.57	9.42	30.39	28.42	82.80	3		41
New Zealand	183.07	97.59	59.11	73.71	73.01	8.51	30.72	23.49	95.46	44		43
Sweden	180.52	112.75	52.79	69.41	70.11	9.61	30.04	17.45	73.58	10		9
Norway	179.78	98.00	66.49	74.36	104.49	8.61	27.24	20.29	71.37	5		14
Russia	104.05	43.69	58.30	57.64	38.59	11.09	45.25	63.49	42.82	41		58

**Source(s):** Compiled by the authors based on [https://www.numbeo.com/quality-of-life/rankings\\_by\\_country.jsp](https://www.numbeo.com/quality-of-life/rankings_by_country.jsp) (accessed 20 August 2019) and <https://www.imd.org/wcc/world-competitiveness-center-rankings/world-competitiveness-ranking-2019/> (accessed 20 August 2019)



As shown in Figure 1, cross-correlation between most indicators is negative, which shows a significant contribution of development of human and artificial intellectual capital into increase of population's quality of life. However, the correlation between the level of development of human and artificial intellectual capital and property price to income ratio ( $y_6$ ), traffic commute time index ( $y_7$ ), and pollution index ( $y_8$ ) is positive – so it is of no interest for use in the context of this research.

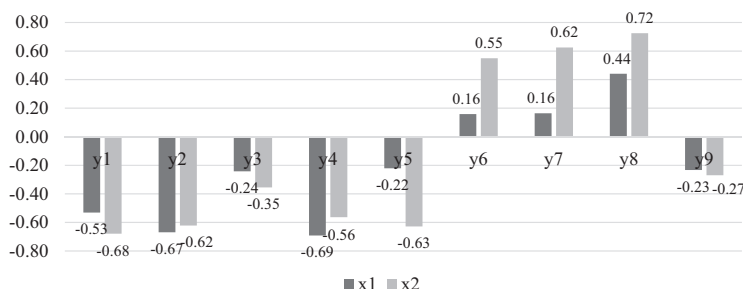
Correlation between quality-of-life index ( $y_1$ ) and the level of development of human ( $x_1$ ) intellectual capital is high ( $-0.53$ ), as well as between the level of development of artificial ( $x_2$ ) intellectual capital ( $-0.68$ ). Correlation between purchasing power index ( $y_2$ ) and the level of development of human ( $x_1$ ) intellectual capital is high ( $-0.67$ ), as well as between the level of development of artificial ( $x_2$ ) intellectual capital ( $-0.62$ ). Correlation between safety index ( $y_3$ ) and the level of development of human ( $x_1$ ) intellectual capital is moderate ( $-0.24$ ), as well as between the level of development of artificial ( $x_2$ ) intellectual capital ( $-0.35$ ).

Correlation between health care index ( $y_4$ ) and the level of development of human ( $x_1$ ) intellectual capital is high ( $-0.69$ ), as well as between the level of development of artificial ( $x_2$ ) intellectual capital ( $-0.56$ ). Correlation between cost of life index ( $y_5$ ) and the level of development of human ( $x_1$ ) intellectual capital is moderate ( $-0.22$ ), and correlation between cost of life index and the level of development of artificial ( $x_2$ ) intellectual capital is high ( $-0.63$ ). Correlation between climate index ( $y_9$ ) and the level of development of human ( $x_1$ ) intellectual capital is moderate ( $-0.23$ ), as well as between the level of development of artificial ( $x_2$ ) intellectual capital ( $-0.27$ ).

Large differences between the influence on the indicators of quality of life and the level of development of human and artificial intellectual capital are not observed. Therefore, both studied types (human and artificial) of intellectual capital have approximately equal strong positive (stimulating its growth) influence on population's quality of life. This means that now social companies require accessibility and quality of intellectual capital – regardless of its type. However, the performed conclusion is true only with the current level of automatization of business processes of social entrepreneurship. In the course of increase of the level of automatization the significance of human and artificial social capital for provision of the results of activities of social companies (expressed in increase of quality of life) could (and probably will) change.

#### 4.2 Perspective directions of usage of AI in social entrepreneurship and assessment of the concerned parties' readiness and interest in implementation of these directions

The following six perspective directions of usage of AI in social entrepreneurship are distinguished. First direction: automatization of marketing studies. Usage of AI will allow for



Source(s): calculated and compiled by the authors

**Figure 1.**  
Cross-correlation  
between the indicators  
of quality of life and  
level of development of  
human and artificial  
intellectual capital  
in 2018

quick and precise segmentation of the markets of social goods and services and determination of the position of a social company in these markets, as well as its competitiveness and perspectives of development. AI could be used for determining changes in the needs and preferences of consumers.

An additional advantage of AI within this direction is the possibility to reduce expenditures for marketing studies. Under the condition of low cost of AI, its application will allow – in the long-term – for full-scale (with full coverage of the markets) marketing studies with small marketing budget. However, this requires solving a technical problem of collection and analysis of digital data on the state of the markets of social goods and services. Its possible solution could be digital questionnaires for consumers (online surveys).

Second direction: automatization of promotion of social goods and services (advertising and PR). Usage of AI enables wide social advertising and PR of social goods and services within the target audience and in the society on the whole. This could be marketing in social networks (e.g. Instagram) or messages in mobile apps (e.g. Viber or WhatsApp).

AI could independently determine the list of recipients of messages and form individual messages with bulk mailing – different salutation (name) with sample information messages, which could be different for people of different age, sex, territory of residence and social status. Unlike the impersonal bulk mailing that is performed now, intellectual (individualized) mailing of AI will be target focused – they will be treated not as spam but as personal offers.

Third direction: automatization of collection of orders for social goods and services. Implementation of AI will allow reducing personnel (sellers) and collecting the orders 24/7. At the same time, there's a problem of deciphering the information that is collection from the consumers. AI could treat the received information incorrectly, which will lead to failure of the order, and the social company will produce unnecessary product or provide unnecessary service. This problem could be partially solved by collecting orders through filling the sample online forms. However, this requires special skills and experience with consumers. The process of placement of orders will become labor intensive, as it requires a lot of attention for correct completion of forms. Consumers require digital devices, special apps and Internet access.

Fourth direction: automatization of attraction of investments (crowdfunding). Based on AI, it is possible to create and promote charity funds, select potential benefactors and communicate with them. Fifth direction: automatization of attraction of employees and volunteers (crowdsourcing). AI could help with selection and attraction of volunteers and employees for the social company and compare and select the best of them according to the set criteria. At the same time, most of characteristics of volunteers are qualitative (e.g. responsibility, compassion, desire to help people) and cannot expressed quantitatively.

Sixth direction: automatization of production of social goods and services. Usage of AI could accelerate business processes and raise efficiency. Automatization of industrial production on the basis of AI is possible – but provision of services – moreover, social – causes certain doubts. A lot of social companies, apart from goods and services, provide psychological support, which cannot be demanded from AI.

The results of the performed sociological survey, which show the perspectives of implementation of the above directions according to concerned parties, are shown in [Figures 2–6](#).

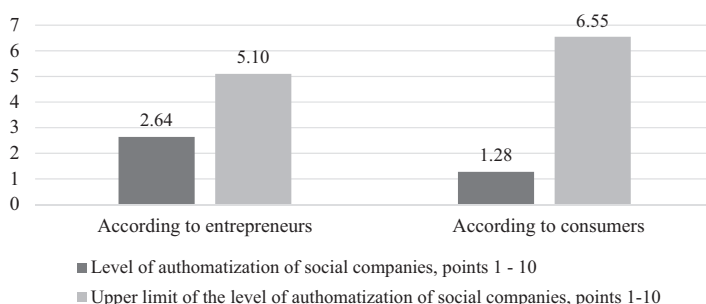
As shown in [Figure 2](#), the level of automatization of social companies – according to entrepreneurs – is low (2.64 points). According to consumers, it is even lower (1.28 points). This could be explained by the fact that internal business processes of social companies are subject to automatization. The upper limit of the level of automatization of social companies, according to entrepreneurs, constitutes 5.10 points out of 10 – i.e. 51 percent. According to consumers, this limit is at the level of 6.55 points (65.5 percent). It is probably caused by public

support for digital modernization of entrepreneurship and experience of receipt of digital goods and services from commercial companies, while social entrepreneurs know the specifics of their companies better and realize that the perspectives of their automatization are not that high as with commercial companies.

As it is seen from Figure 3, activity of usage of digital technologies by the employees of social companies is low (3.19 points), but it is higher than the estimate level of automatization – according to entrepreneurs – by 1.21 times and, according to consumers, by 2.49 times. The upper limit of readiness of social companies' employees to raise the activity of application of digital technologies is evaluated by them at 6.34 points, which is by 1.24 higher than the estimated upper limit of automatization according to entrepreneurs, but lower by 0.97 according to consumers.

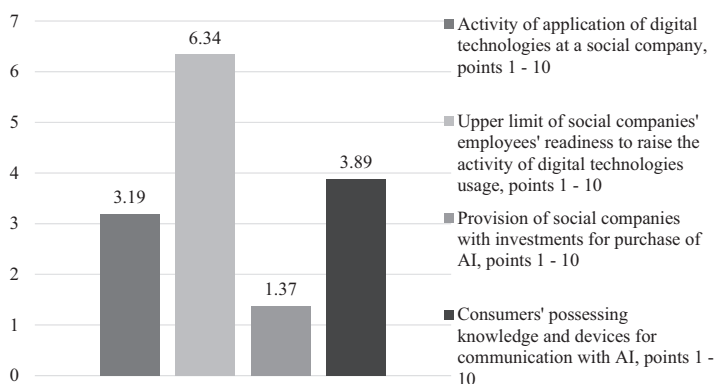
At the same time, actual readiness of interested parties for implementation of AI is low. Owners of social companies note the deficit of investments (1.37 points), and consumers note the lack of knowledge and devices for communication with AI (3.89 points).

Figure 4 shows the perspectives of implementing the directions of application of AI at social companies, according to various interested parties. On average, the most perspective direction is collection of orders for social goods and services (5.07 points). It is followed by marketing studies (4.97 points), promotion of social goods and services (4.95 points), attraction of employees and volunteers (4.83 points) and attraction of investments (4.70 points). The last position is occupied by production of social goods and services (4.05 points). On the whole, the perspectives of



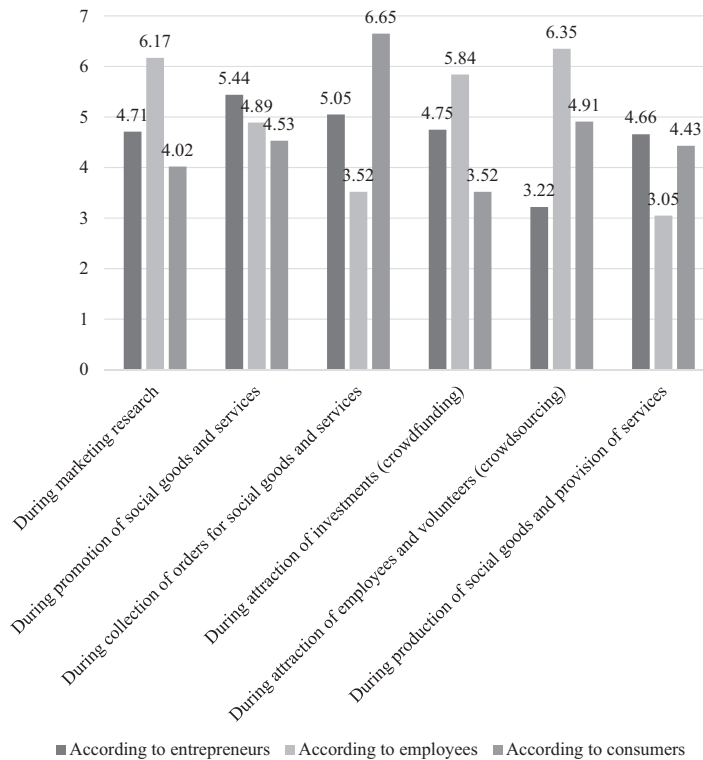
Source(s): calculated and compiled by the authors

**Figure 2.**  
The current level of  
automatization of  
social companies and  
perspectives of its  
growth



Source(s): calculated and compiled by the authors

**Figure 3.**  
The current  
application of digital  
technologies by social  
companies and growth  
perspectives



**Figure 4.**  
Perspectives of  
implementing the  
directions of  
application of AI at  
social companies

**Source(s):** calculated and compiled by the authors

implementing the distinguished directions of application of AI at social companies – according to all interested parties – constitute 4.76 points  $(5.07 + 4.97 + 4.95 + 4.83 + 4.70 + 4.05)/6$ . This means that AI is in high demand in social entrepreneurship – in all possible directions of its application; however, it cannot and should not oust human intellect, which remains the leading production factor in the activities of social companies.

As shown in Figure 5, according to consumers, the optimal share of artificial intellectual capital at social companies constitutes 47.54 percent; according to employees – 32.93 percent; according to entrepreneurs – 51.86 percent.

As shown in Figure 6, while realizing the risk of dismissal, employees (6.80 points) and owners (4.56 points) of social companies use AI for intellectual decision support. Consumers also consider this variant to be perspective (\*3.44 points), but prefer convergence of human and artificial intellectual capital (5.54 points) – i.e. their competition with the possibility to choose human or AI for digital communications.

*4.3 The optimal proportion and variant of usage of human intellect and AI in social entrepreneurship in industry 4.0 until 2030*

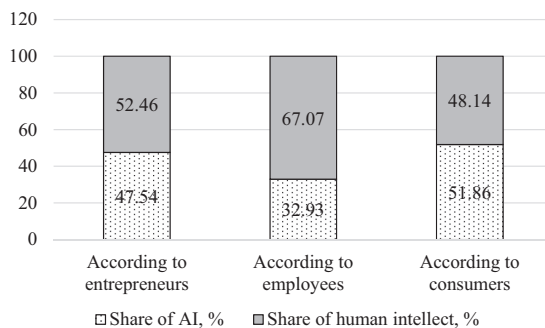
In Industry 4.0, digital modernization could be intellectual (during usage of human and artificial intellectual capital in different proportions) and non-intellectual (based on automatization). According to this, we determined the variants of usage of human intellect

and AI in social entrepreneurship in the conditions of Industry 4.0 in the future, until 2030 (Figure 7).

As shown in Figure 7, we distinguish two levels of company's digital modernization: level of automatization (from manual labor to full automatization) and level of integration of human intellect and AI (from divergence to convergence). Commercial companies will probably be located in the sectors of the presented graphs: industrial companies – in the upper and lower right sectors, and companies of the service sphere – in the upper and lower left sectors.

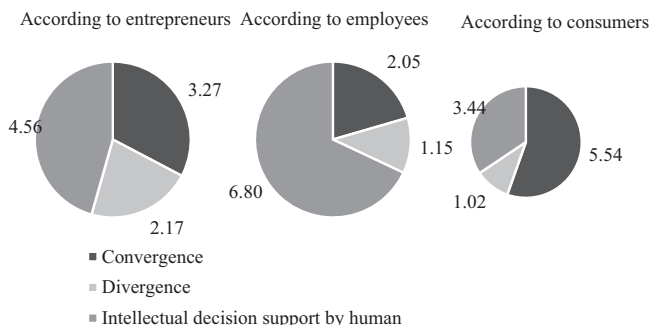
According to the results of the performed research, social companies will be at the crossing of axes  $x$  and  $y$  – i.e. at the zero zone. The optimal proportion of the combination of human intellect and AI in social entrepreneurship in the conditions of Industry 4.0 in the future (until 2030) constitutes 44.11 percent. Neither competition nor cooperation of human and artificial intellectual capital is in high demand in social entrepreneurship. Instead, according to the interested parties, the optimal variant of their integration with the activities social of companies is intellectual decision support.

This variant of integration of human and artificial intellectual capital is implemented by most commercial companies. Social companies are to the left of the zero zone on the  $x$ -axis. The interested parties will probably realize the advantages from automatization, which are gained in the activities of commercial companies, and the objective limitations of the possibilities of automatization of social companies. Intellectual decision support in the activities of social companies envisages automatization of certain business processes (e.g. marketing) under human management and control.



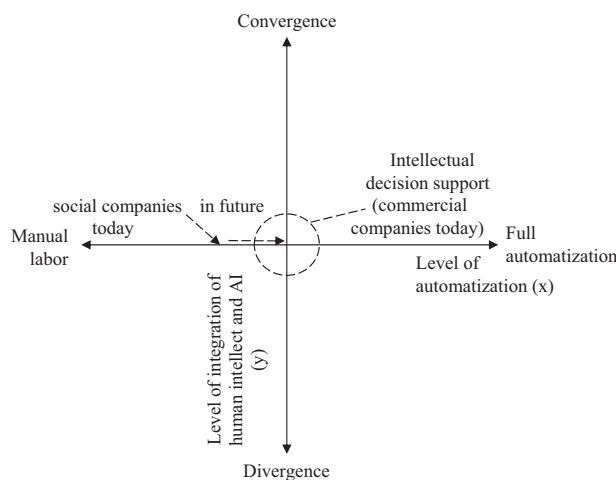
Source(s): calculated and compiled by the authors

**Figure 5.**  
The optimal structure  
of intellectual capital of  
social companies  
according to interested  
parties



Source(s): calculated and compiled by the authors

**Figure 6.**  
Methods of combining  
human intellect and AI  
at social companies



Source(s): developed and compiled by the authors

**Figure 7.**  
Variants of company's  
digital modernization

## 5. Conclusion

The results of this article proved the offered hypothesis  $H_0$  and provided proofs that the specifics of social companies do not allow for automatization in the scale and rate with that commercial companies would like. At the same time, social companies can improve their activities based on AI and create additional advantages for all interested parties. Digital modernization of social companies based on AI is desirable and accessible – but it should consider the specifics of social entrepreneurship. Human and artificial intellectual capital is equally crucial for social companies. Growth of the level of automatization will lead to a slight extension of the value of AI. The current level of automatization of social companies in Russia, according to the interested parties, varies from 1.28 points out of 10 (according to consumers) to 3.19 points out of 10 (according to employees) and is low on the whole. The perspectives of further automatization of social companies, according to the interested parties, vary from 5.10 points out of 10 (according to entrepreneurs) to 6.55 points out of 10 (according to consumers) and are moderate on the whole – the share of AI should not exceed 44.11 percent in the structure of intellectual capital (less than 50 percent, which confirms the offered hypothesis  $H_0$ ).

The most perspective directions of application of AI at social companies include a collection of orders for social goods and services and marketing studies and promotion of social goods and services. Neither convergence nor divergence of human and artificial intellectual capital does not fully conform to the interests of the concerned parties. The most preferable (optimal) variant of usage of human intellect and AI in social entrepreneurship in Industry 4.0 until 2030 is human intellectual decision support. Although the research has been based on the Russian case, the universal character of social entrepreneurship and the absence of scientific proofs of precise specifics (national peculiarities) of digitization allow us extending the obtained findings and recommendations to other countries of the world.

## Note

1. <http://soindex.ru/> (accessed 20 August 2019).

---

## References

- Agrawal, A. and Hockerts, K. (2019), "Impact investing strategy: managing conflicts between impact investor and investee social enterprise", *Sustainability (Switzerland)*, Vol. 11 No. 15, pp. 41-57.
- Amankwah-Amoah, J. (2018), "Human capital flows in failing organizations: an integrated conceptual framework", *Journal of Intellectual Capital*, Vol. 19 No. 4, pp. 732-746.
- Asmussen, C.G. and Fosfuri, A. (2019), "Orchestrating corporate social responsibility in the multinational enterprise", *Strategic Management Journal*, Vol. 40 No. 6, pp. 894-916.
- Beisheim, N., Kiesel, M. and Rudolph, S. (2018), "Digital manufacturing and virtual commissioning of intelligent factories and industry 4.0 systems using graph-based design languages", *Advances in Transdisciplinary Engineering*, Vol. 7, pp. 93-102.
- Burrell, L. (2019), "Artificial intelligence brings out the worst and the best in us", *MIT Sloan Management Review*, Vol. 60 No. 2, pp. 18-26.
- Cho, S., Sultana, R. and Kwon, S. (2019), "Social enterprise and sustainable development in Bangladesh and Korea: opportunities and challenges", *Asian Social Work and Policy Review*, Vol. 13 No. 2, pp. 189-198.
- Choi, Y. and Chang, S. (2019), "Resource acquisition partnership of nascent social enterprise for sustainability", *International Journal of Entrepreneurship*, Vol. 23 No. 2, pp. 8-29.
- Daugherty, P.R., Wilson, H.J. and Chowdhury, R. (2019), "Using artificial intelligence to promote diversity", *MIT Sloan Management Review*, Vol. 60 No. 2, pp. 10-12.
- Duan, Y., Edwards, J.S. and Dwivedi, Y.K. (2019), "Artificial intelligence for decision making in the era of Big Data—evolution, challenges and research agenda", *International Journal of Information Management*, Vol. 48, pp. 63-71.
- Erpf, P., Tekula, R. and Neuenschwander, J. (2019), "Clustering social enterprises: an empirically validated taxonomy", *Social Enterprise Journal*, Vol. 15 No. 3, pp. 397-420.
- Feng, T. (2019), "Cognitive function of artificial intelligence literature", *IOP Conference Series: Materials Science and Engineering*, Vol. 573 No. 1, pp. 12-26.
- Ford, M. (2013), "Could artificial intelligence create an unemployment crisis?", *Communications of the ACM*, Vol. 56 No. 7, pp. 37-39.
- Frumkin, P. (2013), "Between nonprofit management and social entrepreneurship", *Public Administration Review*, Vol. 73 No. 2, pp. 372-376.
- Ghadimi, P., Wang, C., Lim, M.K. and Heavey, C. (2019), "Intelligent sustainable supplier selection using multi-agent technology: theory and application for Industry 4.0 supply chains", *Computers and Industrial Engineering*, Vol. 127, pp. 588-600.
- Goebel, V. (2019), "Drivers for voluntary intellectual capital reporting based on agency theory", *Journal of Intellectual Capital*, Vol. 20 No. 2, pp. 264-281.
- Grant, S. and Palakshappa, N. (2018), "Social enterprise push or corporate social responsibility pull? The mainstreaming of fair trade", *International Journal of Nonprofit and Voluntary Sector Marketing*, Vol. 23 No. 4, pp. e1625-e1639.
- Han, Y. (2018), "Automatic transmission and control of engineering machinery intelligent robots for industry 4.0", *IPPTA: Quarterly Journal of Indian Pulp and Paper Technical Association*, Vol. 30 No. 6, pp. 775-781.
- Li, L. (2018), "China's manufacturing locus in 2025: with a comparison of 'Made-in-China 2025' and 'Industry 4.0'", *Technological Forecasting and Social Change*, Vol. 135, pp. 66-74.
- Liu, Y., Li, Z., Wang, Z., ..., Xing, Y. and Zeng, P. (2019), "Design of the intelligent manufacturing demonstration system based on IoT in the context of industry 4.0", *IOP Conference Series: Earth and Environmental Science*, Vol. 252 No. 5, pp. 5-20.
- Lowe, D. (2019), "'Artificial intelligence', or statistics?", *Significance*, Vol. 16 No. 4, p. 7.
- Mason, C., Roy, M.J. and Carey, G. (2019), "Social enterprises in quasi-markets: exploring the critical knowledge gaps", *Social Enterprise Journal*, Vol. 15 No. 3, pp. 358-375.

- Miller, A. (2019), "The intrinsically linked future for human and Artificial Intelligence interaction", *Journal of Big Data*, Vol. 6 No. 1, pp. 38-42.
- Moëuf, A., Pellerin, R., Lamouri, S., Tamayo-Giraldo, S. and Barbaray, R. (2018), "The industrial management of SMEs in the era of Industry 4.0", *International Journal of Production Research*, Vol. 56 No. 3, pp. 1118-1136.
- Mrówczyńska, M., Sztubecka, M., Skiba, M., Bazan-Krzywoszańska, A. and Bejga, P. (2019), "The use of artificial intelligence as a tool supporting sustainable development local policy", *Sustainability (Switzerland)*, Vol. 11 No. 15, pp. 41-99.
- Müller, J.M., Buliga, O. and Voigt, K.-I. (2018), "Fortune favors the prepared: How SMEs approach business model innovations in Industry 4.0", *Technological Forecasting and Social Change*, Vol. 132, pp. 2-17.
- Muñoz, E. and Capón-García, E. (2019), "Intelligent mathematical modelling agent for supporting decision-making at industry 4.0", *Advances in Intelligent Systems and Computing*, Vol. 865, pp. 152-162.
- Naseem, T., Shahzad, F., Asim, G.A., Rehman, I.U. and Nawaz, F. (2019), "Corporate social responsibility engagement and firm performance in Asia Pacific: the role of enterprise risk management", *Corporate Social Responsibility and Environmental Management*, Vol. 2 No. 1, pp. 34-45.
- Osório, A. and Pinto, A. (2019), "Information, uncertainty and the manipulability of artificial intelligence autonomous vehicles systems", *International Journal of Human Computer Studies*, Vol. 130, pp. 40-46.
- Palhares, R.M., Yuan, Y. and Wang, Q. (2019), "Artificial intelligence in industrial systems", *IEEE Transactions on Industrial Electronics*, Vol. 66 No. 12, pp. 9636-9640.
- Perc, M., Ozer, M. and Hojnik, J. (2019), "Social and juristic challenges of artificial intelligence", *Palgrave Communications*, Vol. 5 No. 1, pp. 10-21.
- Peres, R.S., Dionisio Rocha, A., Leitao, P. and Barata, J. (2018), "IDARTS—towards intelligent data analysis and real-time supervision for industry 4.0", *Computers in Industry*, Vol. 101, pp. 138-146.
- Popkova, E.G. (2019), "Preconditions of formation and development of industry 4.0 in the conditions of knowledge economy", *Studies in Systems, Decision and Control*, Vol. 169, pp. 65-72.
- Popkova, E.G., Egorova, E.N., Popova, E. and Pozdnyakova, U.A. (2019), "The model of state management of economy on the basis of the internet of things", *Studies in Computational Intelligence*, Vol. 826, pp. 1137-1144.
- Popkova, E.G. and French, J. (2017), "The role of social marketing and PR in the context of globalization and integration of modern entrepreneurship", *Theoretical and Practical Issues of Journalism*, Vol. 6 No. 2, pp. 204-217.
- Popkova, E.G., Grechenkova, O.Yu and Boris, O.A. (2017a), "The prospects of using social marketing in economic criminology in the conditions of an emerging innovative economy", *Russian Journal of Criminology*, Vol. 11 No. 2, pp. 280-288.
- Popkova, E.G., Morozova, I.A. and Litvinova, T.N. (2017b), "New Challenges for Human Capital from the Positions of its Infrastructural Role in the System of Entrepreneurship", *Human Capital: Perspectives, Challenges and Future Directions*, Nova Science Publishers, New York (USA), pp. 257-275.
- Popkova, E.G., Morozova, I.A. and Litvinova, T.N. (2018a), "Transformational processes in the media system under industry conditions 4.0: future outlines and perspectives (reflections on the article by Alexander P. Sukhodolov, DSc. In Economics, Professor and Irina A. Kuznetsova, PhD in Engineering, Associate Professor 'Designing the mass media as a homeostatic system by means of automation engineering: Basic concepts, structure, components')", *Theoretical and Practical Issues of Journalism*, Vol. 7 No. 1, pp. 145-154.
- Popkova, E.G., Litvinova, T., Mitina, M.A. and French, J. (2018b), "Social advertising: a Russian perspective", *Espacios*, Vol. 39 No. 1, pp. 17-26.
- Popkova, E.G. and Parakhina, V.N. (2019), "Managing the global financial system on the basis of artificial intelligence: possibilities and limitations", *Lecture Notes in Networks and Systems*, Vol. 57, pp. 939-946.



- Popkova, E.G. and Sergi, B.S. (2018), "Will industry 4.0 and other innovations impact Russia's development?", in Sergi, Bruno S. (Ed.), *Exploring the Future of Russia's Economy and Markets: Towards Sustainable Economic Development*, pp. 51-68, Emerald Publishing, Bingley, UK.
- Qi, Q. and Tao, F. (2018), "Digital twin and big data towards smart manufacturing and industry 4.0: 360 degree comparison", *IEEE Access*, Vol. 6, pp. 3585-3593.
- Raza, J., Liu, Y. and Usman, M. (2019), "Corporate social responsibility commitment of small-to-medium enterprises and organizational competitive differentiation: stakeholder pressure, market orientation, and socioeconomic context effects", *Journal of Public Affairs*, Vol. 19 No. 2, pp. e1897-e1905.
- Stecker, M.J. (2014), "Revolutionizing the nonprofit sector through social entrepreneurship", *Journal of Economic Issues*, Vol. 48 No. 2, pp. 349-358.
- Tan, W.-L. and Yoo, S.-J. (2015), "Social entrepreneurship intentions of nonprofit organizations", *Journal of Social Entrepreneurship*, Vol. 6 No. 1, pp. 103-125.
- Tong, X., Lai, K.-H., Zhu, Q., . . . , Chen, J. and Cheng, T.C.E. (2018), "Multinational enterprise buyers' choices for extending corporate social responsibility practices to suppliers in emerging countries: a multi-method study", *Journal of Operations Management*, Vol. 63, pp. 25-43.
- Tykkyläinen, S. (2019), "Why social enterprises pursue growth? Analysis of threats and opportunities", *Social Enterprise Journal*, Vol. 15 No. 3, pp. 376-396.
- Velayutham, A. and Rahman, A.R. (2018), "The value of human capital within Canadian business schools", *Journal of Intellectual Capital*, Vol. 19 No. 4, pp. 836-855.
- Xu, L.D., Xu, E.L. and Li, L. (2018), "Industry 4.0: state of the art and future trends", *International Journal of Production Research*, Vol. 56 No. 8, pp. 2941-2962.
- Yin, J. and Chen, H. (2019), "Dual-goal management in social enterprises: evidence from China", *Management Decision*, Vol. 57 No. 6, pp. 1362-1381.
- Zhu, Q. and Lai, K.-H. (2019), "Enhancing supply chain operations with extended corporate social responsibility practices by multinational enterprises: social capital perspective from Chinese suppliers", *International Journal of Production Economics*, Vol. 213, pp. 1-12.
- Zoysa, A.D. and Takaoka, N. (2019), "Corporate social responsibility performance of small and medium enterprises in regional Japan: an empirical examination", *Social Responsibility Journal*, Vol. 2 No. 1, pp. 57-65.

**Corresponding author**

Elena G. Popkova can be contacted at: [elenapopkova@yahoo.com](mailto:elenapopkova@yahoo.com); [E.Popkova@inno.mgimo.ru](mailto:E.Popkova@inno.mgimo.ru)

Reproduced with permission of copyright owner. Further reproduction prohibited without permission.