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Article

The Influence of Socio-Cultural Factors on Knowledge-Based Innovation and the Digital Economy

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Abstract: The knowledge economy, fostered by knowledge-based innovation, has been linked to entrepreneurial and economic success, especially in OECD countries. Studies have shown the influence of socio-cultural factors on almost every area of economic behavior. However, few studies have attempted to connect these factors to the knowledge economy. Our research bridges this gap. We investigated the impact of socio-cultural factors on knowledge-based innovation, then we also examined whether digitalization impacted knowledge-based innovation, regardless of the influence of socio-cultural factors. Using official data from Russia's statistical office, we developed a correlation regression model using a linear graphical test and Pearson correlation. Our results show that certain socio-cultural factors significantly influenced knowledge-based innovation. We also found that digitalization could mitigate the negative effects of socio-cultural factors. Digitalization had a positive influence on knowledge-based innovation across all regions and socio-cultural characteristics. Our research provides pioneering analysis of the topic within post-Soviet economies and has huge implications for business practice, policy making, and academic research.

Keywords: knowledge economy; knowledge-based innovation; socio-culture; digital economy; digitalization; regions

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1. Introduction

Innovation can be challenging to define, measure, or analyze. Kline and Rosenberg [1] argue that innovation is often characterized by uncertainties and complexities, and any definition of the concept must holistically consider it as a series of changes within a complex system. One of the most comprehensive definitions of innovation was provided by Kahn [2], who defined it as consisting of three different components: "an outcome", "a process", and "a mindset". As an outcome, innovation is concerned with output, product, and organizational improvement. As a process, it deals with the methods or approaches that improve output. As a mindset, it involves internalization by key stakeholders [2]. Nevertheless, innovation is often considered a key driver of the sustainability and socio-economic development of societies [3,4]. For example, innovation is a crucial part of environmental policy [4], it significantly influences economic growth in developed societies [3,5–7], and could promote socio-economic development in developing countries [8]. Furthermore, open innovation, which encourages the use of external ideas to improve internal performance, is credited with transforming conventional business models, improving the delivery of public services, and fostering technological growth, among other benefits [9–14].

Moreover, there has been increasing acceptance of the impact of knowledge-based innovation on economic progress [15–18]. Many empirical studies have shown that we are currently living in a knowledge-based economy and society. Studies have shown the impact of knowledge generation, collaboration, and innovation on the competitiveness and economic growth of OECD countries, and other economies around the world [6,17–21]. A knowledge-driven innovative society can be defined as a system where "activities and decisions across all domains of life are based on knowledge" [22]. Knowledge-based innovation

has risen in prominence in recent decades, in part due to the proliferation of information technology (IT) across all sectors of the economy [22,23]. In particular, the advancement of science and technology is considered central to the innovation systems of countries. As such, several theoretical frameworks such as 'national innovation systems', 'regional innovation systems', the triple helix model, and open innovation have been developed to analyze the role of economic agents in knowledge-based innovation [24–29]. Therefore, it can be argued that the development of modern socio-economic systems is largely oriented towards enhancing the efficiency and productivity of knowledge generation [30,31]. This significantly influences economic growth internationally, nationally, regionally, and within organizations [16,17,21,31,32].

Meanwhile, socio-cultural factors have long been utilized to analyze economic phenomena. Studies have shown differences in the traditional economic approaches of various ethnic groups. For example, Hofstede [33] and House et al. [34] found that Western cultures are more oriented towards individualism and high performance, while other cultures—such as Eastern cultures—often traditionally prefer collectivism, cooperation, and mutuality in their quest for economic growth [35,36]. This is why Western approaches to business tend to prioritize financial progress and value maximization over other goals of economic development [37,38]. Even when other economic metrics are included in the macro or micro outlook, they are often considered secondary to financial outcomes [39]. In contrast, other cultures sometimes prioritize other aspects of economic development over financial drivers [36]. For example, Pio and Waddock [40], drawing from the works of Indigenous scholars, show that Indigenous economic values are usually very different from the Western pursuit of material or financial wealth. Instead, the Indigenous economy prioritizes relationships, reciprocity, responsibility, and redistribution to achieve shared prosperity. A separate study of Aboriginal culture emphasized the importance of cultural factors such as family values, family size, and physical heritage in economic practices [41]. Furthermore, several other studies have discovered the importance of land sustainability, large family sizes, language preservation, and other cultural factors on the economic life of Indigenous and Aboriginal people [42–44]. According to Kuokkanen [44], non-Indigenous people consider profit to be money while natives perceive profit as good life derived from land and sea, and the loss of homeland and culture is synonymous to true poverty.

Therefore, the goal of this research is to examine the impact of socio-cultural factors on knowledge-based innovation, and whether information technology—used interchangeably with digital technologies or digitalization—can influence socio-cultural factors and boost economic development. To analyze knowledge-based innovation we examined a range of factors including the number of patents issued for inventions, the number of utility models obtained, and the number of newly developed advanced technologies. For socio-cultural factors we examined the population in rural and urban areas, and figures for marriage, divorce, birth, and abortion, among others. Using official data from Russia's statistical office [45], this research uses a number of statistical tools including the Durbin–Watson test for autocorrelation, and the Gauss–Markov assumptions for ordinary least squares. Our research differs from other prior studies in several ways. First, we significantly extend the range of academic debate on the knowledge economy by including the influence of socio-cultural and demographic factors in our analysis. While studies examining the economic impact of knowledge-based innovation have grown exponentially in recent years, research linking it to social and cultural factors has remained limited. Our research represents the first major study of its kind in a post-Soviet economy. Second, in our approach we utilize a range of econometric tools and provide exhaustive details, ensuring that our results are entirely objective and reproducible. Finally, our results provide strong implications for business practice, policy making, and academic research, and include actionable suggestions. In the following sections, we include a literature review, methodology, results, discussion, and conclusion.

2. Literature Review

2.1. Knowledge-Based Economy

Contemporary academic research on a knowledge-based economy can be traced back several decades to the analysis carried out by Daniel Bell [30]. Bell [30] and others predicted a future where knowledge replaced capital as the driving force of industrialization, and where intellectual technologies replaced mechanical technologies as a driver of economic growth in a post-industrial society. While arguments persist about the realization of his predictions, there is a broad scholarly consensus on the enormous role of knowledge in modern economic life. According to the OECD, "the knowledge based economy represents the type of economy based directly on the knowledge and information production, distribution and utilization" [19]. Often simply referred to as the knowledge economy, the knowledge-based economy involves the influence of knowledge as the foundation of capital, materials, and production in an economy, or refers to profits and economic growth influenced by the development, generation, sale, acquisition, learning, and storing of knowledge [46]. The growth and prioritization of patent acquisition, the influence of statistics and big data, the expanding role of universities, increased expenditure on research and development in governments or businesses, open innovation, and the spread of IT innovation are some manifestations of the knowledge economy [15–17,21,22,31,32,47]. To achieve competitive advantage, companies, regions, and countries seek to organize the processes of knowledge generation and implement new production technologies, either through internal processes or through open or external means [10,11,16,32,48–50]. Baumard [51] further argued that the main function of an organization is to generate knowledge, and firms primarily need to invest in the generation and use of knowledge.

Although there has been less consensus on the metrics or indicators for assessing knowledge-based innovation, recent studies such as [52–54] have converged around analyzing utility models, intellectual properties, patent registrations or inventions, production optimization, and the development of advanced technologies, among other factors. For example, a recent study in Canada utilized the potential number of patents for inventions, utility models, and advanced production technologies as indicators of knowledge generation in natural resource industries [52], while a separate study argued that the number of inventions and utility models reflect the overall research productivity and innovation activity of enterprises [53]. Furthermore, Amry et al. [54] studied the commercialization of intellectual property in universities and showed that the main results of knowledge generation are the number of inventions and production technologies. Lee et al. [55], examining efficiency and research and development in South Korea's electric car industry, settled on the number of new advanced technologies as a reflection of the level of innovation in the industry.

Therefore, we selected the following indicators to analyze innovation development in the knowledge economy:

1. The number of patents issued for inventions.
2. The number of obtained utility models.
3. The number of advanced technologies developed.

2.2. Socio-Cultural Factors

The concept of a socio-cultural system is often attributed to cultural materialism. According to this model, human societies are broadly comprised of an 'infrastructure', a 'structure', and a 'superstructure' [56]. Marvin Harris, a leading pioneer of socio-cultural studies, explained 'infrastructure' as consisting of the systems of production and reproduction [57]. While production explains the conversion of energy and raw materials for consumption, reproduction deals with issues like demographics, population growth or decline, birth control, and sexual or mating behavior, among other aspects. Other socio-cultural factors include approaches to politics and the economy, values, beliefs, recreation, art, rituals, and science [56,57]. As a result, studies have examined socio-cultural factors from a myriad of perspectives. For example, Troshin et al. [58] examined the impact

of socio-cultural factors on the manufacturing and innovation activities of enterprises. Barreto et al. [59] investigated the relationship between socio-cultural temporal orientation and levels of innovation. Tekic and Tekic [60] analyzed how Hofstede's dimensions interact to influence national innovation performance. The socio-cultural factors in their analysis include traditional economic practices, family size, marriage rates, and number of children [60]. The study by Barreto et al. [59] highlighted the importance of modelling the impact of socio-cultural factors on innovation, and described how these factors define the competitiveness of national economies.

In an examination of informal entrepreneurship in rural Zimbabwe, Bango et al. [61] analyzed the impact of the region's unique structural and socio-cultural context in which business value refers to financial income and also to the dissemination of culture and heritage. Moreover, in the relevant socio-economic literature, studies on the influence of socio-cultural factors on Indigenous peoples have been prominent. Many studies have highlighted the impact of factors such as land, sea, kinship ties, number of children, interpersonal relationships, heritage, and language, just to name a few [40–44,62].

In recent years, evidence connecting socio-cultural factors to knowledge-based innovation has increased. Auzan et al. [63] argued that any analysis of processes in a knowledge economy should include socio-cultural factors. In an examination of the knowledge economy in societies dominated by religion and other cultural influences, Alfalih and Alfalih [64] showed the strength and influence of cultural factors within the knowledge economy. Other relevant studies include those by Sarbaini et al. [65] which analyzed individualism/collectivism—one of the key dimensions of national culture in Hofstede's interpretation—in relation to the development of e-learning technologies, and showed the effects of national cultural factors on the staff of organizations in the public sector. However, in spite of its importance, there are few contemporary studies on the topic [66]. As such, to evaluate the impact of socio-cultural factors on the development of the knowledge economy, a robust system of indicators are necessary [67].

Thus, we settled on certain socio-cultural factors and indicators for consideration in this study:

i. Traditional economic practices (indicators: percentages of rural and urban population).
ii. Family stability (indicator: number of divorces per 1000 marriages).
iii. Number of children (indicators: natural population growth per 1000 people; number of births per 1000 people; and number of abortions per 100 live births).

2.3. The Influence of Digital Technologies on the Knowledge Economy

The exponential growth in the number of journal articles on digitalization and its impact on economic processes captures the unrelenting interest of the scholarly community on this topic [68]. This trend has become particularly pronounced since 2010, after the journal Long Range Planning published a special issue devoted to this topic [69]. A search of the Scopus citation database revealed that in 2010 there were 315 peer-reviewed publications on the digital economy, while in 2019 this figure surged to 2388 publications. According to the Web of Science citation database, numbers of publications on the digital economy were 149 in 2010 and 1795 in 2019. Scopus and the Web of Science are two of the most reputable bibliographic sources in academia [70–72]. These data signify a surge in scholarly interest in the phenomenon of the digital economy, and in particular the influence of the digital economy on economic development.

Digitalization has become crucial for the development of knowledge and education, for the circular economy and green initiatives, for human resources management, for the competitive advantage of companies, for city planning, and for the delivery of government services, among other issues [73–79]. Digital technologies are important for knowledge generation, and influence economic innovation [80,81]. They are the most efficient method of knowledge management in organizations, and accelerate the processes of knowledge sharing within an organization and between different economic agents [82,83]. Therefore, there is sufficient evidence linking digital technologies with knowledge-based innovation.

However, the actual mechanisms underlying this relationship, particularly the efficiency of knowledge generation, remain largely underexplored.

As a result, based on the indicators for innovation development and socio-cultural factors, we hypothesized the following:

H_1. *Socio-cultural factors have a significant influence on knowledge-based innovation.*

H_2. *Digital technologies can compensate for the negative influence of certain socio-cultural factors and serve as a major driver for the development of the knowledge economy.*

3. Materials and Methods

Our study used official data from the 2020 statistical yearbook on Russian regions by the Russian Federal State Statistics Service—Rosstat [45]. The report includes detailed data on the economic and socio-demographic changes in Russian regions between 2015 and 2019. Rosstat obtains this information through a holistic system including official census data, data from businesses, organizations, and government agencies, and from survey agencies, statistical observation of the population, and official surveys, among other sources. To analyze these data, we followed the analytical process as presented in Figure 1. We used correlation regression analysis to test our first hypothesis. We performed a graphical test for linearity to determine the specific type of regression model to use. After this, we conducted correlation analysis on the selected factors to determine the cause of multicollinearity. At the third stage, we built a regression model, and subsequently checked the quality and robustness of the model. Finally, we concluded our analysis with residual tests for autocorrelation, and test for heteroscedasticity. All data were normalized for the regression analysis. Our analyses include the F-test, Durbin–Watson test, and the Gauss–Markov assumptions for ordinary least squares.

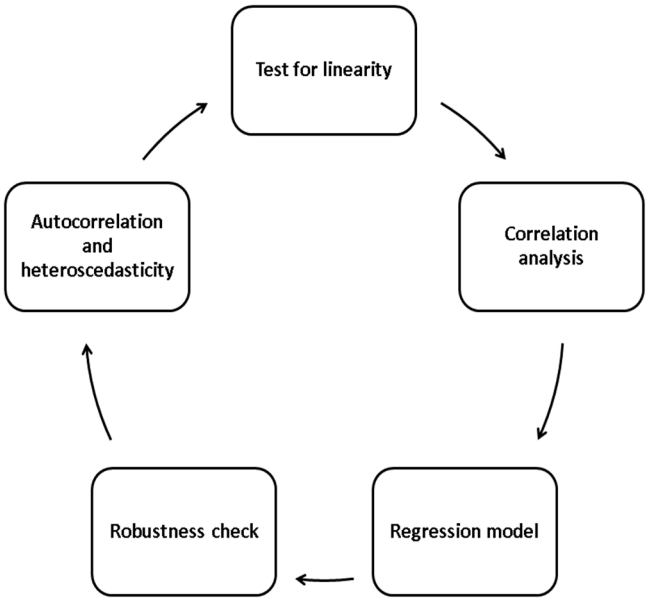

Figure 1. Analytical approach. Source: authors' elaboration.

To examine the impact of socio-cultural factors on the knowledge economy, we analyzed the three selected indicators. For the first indicator, our analysis of the impact of socio-cultural factors on the normalized number of issued patents for inventions can be described as:

$$\Delta NPact = \Delta NPpl \times (1 + ((-0.11 \times \Delta PRP) + 0.41 \times \Delta PUP + (-0.84 \times \Delta NB) + 0.01 \times \Delta ND + 0.01 \times \Delta NA) \quad (1)$$

where $\Delta NPact$ is the actual change in the number of issued patents for inventions in the given period, $\Delta NPpl$ is the planned change in the number of issued patents for inventions

in the given period, ΔPRP is the change in the percentage of the total population in rural areas in the given period, ΔPUP is the change in the percentage of the total population in urban areas in the given period, ΔNB is the change in the number of births per 1000 total people in the given period, ΔND is the change in the number of divorces per 1000 marriages in the given period, ΔNA is the change in the number of abortions per 100 live births in the given period.

For the second indicator, our analysis of the impact of socio-cultural factors on the normalized number of obtained utility models can be described as:

$$\Delta NUMact = \Delta NUMpl \times (1 + ((-0.02 \times \Delta PRP) + 0.12 \times \Delta PUP + (-0.12 \times \Delta NB) + 0.005 \times \Delta ND + 0.05 \times \Delta NA) \quad (2)$$

where $\Delta NUMact$ is the actual change in the number of obtained utility models in the given period, $\Delta NUMpl$ is the planned change in the number of obtained utility models in the given period, ΔPRP is the change in the percentage of the total population in rural areas in the given period, ΔPUP is the change in the percentage of the total population in urban areas in the given period, ΔNB is the change in the number of births per 1000 total population in the given period, ΔND is the change in the number of divorces per 1000 marriages in the given period, ΔNA is the change in the number of abortions per 100 live births in the given period.

For the third indicator, our analysis of the impact of socio-cultural factors on the normalized number of advanced technologies developed can be described as:

$$\Delta NATact = \Delta NATpl \times (1 + ((-0.21 \times \Delta PRP) + 0.17 \times \Delta PUP + (-0.37 \times \Delta NB) + 0.06 \times \Delta ND + 0.12 \times \Delta NA) \quad (3)$$

where $\Delta NATact$ is the actual change in the number of advanced technologies developed in the given period, $\Delta NATpl$ is the planned change in the number of advanced technologies developed in the given period, ΔPRP is the change in the percentage of the total population in rural areas in the given period, ΔPUP is the change in the factor percentage of the total population in urban areas' in the given period, ΔNB is the change in the number of births per 1000 total population in the given period, ΔND is the change in the number of divorces per 1000 marriages in the given period, ΔNA is the change in the number of abortions per 100 live births in the given period.

Following these, we proceeded to analyze whether digitalization can be used to overcome the negative impact of socio-cultural factors on the knowledge economy. To achieve this, we assessed expenditure on digitalization alongside the three aforementioned indicators of the knowledge economy.

4. Results

The first stage of our analysis was to estimate the influence of socio-cultural factors on knowledge-based innovation. The results of the correlation analysis are presented in Tables 1–3.

Table 1. Socio-cultural factors and the number of issued patents.

Socio-Cultural Factors	Correlation Coefficient
Percentage of the total population in rural areas	−0.871
Percentage of the total population in urban areas	0.834
Number of births per 1000 total population	−0.764
Number of divorces per 1000 marriages	0.774
Number of abortions per 100 live births	0.761

Source: authors' calculations.

Table 1 shows the correlation coefficients of socio-cultural factors on the first indicator of the knowledge economy: the 'number of patents issued for inventions'. Our results show that the coefficient of determination in the regression model equals 0.68 (R^2 = 0.68). This means that the model was highly reliable and showed the representativeness of the sample. The results of the F-test (*F-statistic* = 1.98×10^{-13}) and *p*-value show that the model was significant with a significance level of $\alpha = 0.05$. Therefore, the testing of the null hypothesis

on the insignificance of the regression coefficients shows that the selected factors influenced knowledge-based innovation, and that their regression coefficients were statistically reliable and significant. Finally, we verified that the data met the Gauss–Markov assumptions for ordinary least squares. The mathematical expectation of the random deviation of residuals for all observations tended towards zero. The Durbin–Watson statistic to test for autocorrelation in the residuals (DW = 1734) detected no autocorrelation, which means that the residuals were randomly distributed.

Table 2. Socio-cultural factors and the number of utility models.

Socio-Cultural Factors	Correlation Coefficient
Percentage of the total population in rural areas	−0.753
Percentage of the total population in urban areas	0.814
Number of births per 1000 total population	−0.821
Number of divorces per 1000 marriages	0.834
Number of abortions per 100 live births	0.791

Source: authors' calculations.

Table 3. Socio-cultural factors and the number of advanced technologies.

Socio-Cultural Factors	Correlation Coefficient
Percentage of the total population in rural areas	−0.893
Percentage of the total population in urban areas	0.819
Number of births per 1000 total population	−0.887
Number of divorces per 1000 marriages	0.852
Number of abortions per 100 live births	0.841

Source: authors' calculations.

Table 2 shows the correlation coefficients between socio-cultural factors and the second indicator of the knowledge economy, i.e., the number of obtained utility models. The results show that the coefficient of determination in the regression model was 0.74 ($R^2 = 0.74$). This means that the model was highly reliable and shows the representativeness of the sample. The F-test (*F-statistic* = 1.34×10^{-13}) and *p*-value indicate that the model was significant with a significance level of $\alpha = 0.05$. Therefore, the testing of the null hypothesis on the insignificance of the regression coefficients revealed that the selected factors did influence the knowledge economy. It also showed that their regression coefficients were statistically reliable and significant. Finally, we verified that the data met the Gauss–Markov assumptions for ordinary least squares. The mathematical expectation of the random deviation of residuals for all observations tended towards zero. Moreover, the Durbin–Watson statistic to test for autocorrelation in the residuals (DW = 1576) detected no autocorrelation, which means that the residuals were randomly distributed. The results from Table 2 support the conclusion that for Indigenous communities, the socio-cultural context has a significant influence on knowledge-based innovation and innovation in the activities of economic agents.

Table 3 shows the correlation coefficients between socio-cultural factors and the third indicator of the knowledge economy, i.e., the number of advanced technologies developed. The coefficient of determination in the regression model was 0.76 ($R^2 = 0.76$). This means that the model was highly reliable and shows the representativeness of the sample. The F-test (*F-statistic* = 1.22×10^{-13}) and *p*-value demonstrate that the model was significant with a significance level of $\alpha = 0.05$. Therefore, the testing of the null hypothesis on the insignificance of the regression coefficients revealed that the selected factors did influence knowledge-based innovation, and their regression coefficients were statistically reliable and significant. Finally, we verified that the data met the Gauss–Markov assumptions for ordinary least squares. The mathematical expectation of the random deviation of residuals for all observations tended towards zero. Furthermore, the Durbin–Watson statistic to test for autocorrelation in the residuals (DW = 1381) detected no autocorrelation, which means that the residuals were randomly distributed.

The results of our overall analyses showed that socio-cultural factors had an ambivalent impact on knowledge-based innovation. Certain factors such as the percentage of rural population were negatively correlated with knowledge-based innovation, while others such as the percentage of urban population may, in contrast, contribute to it. Therefore, our subsequent goal was to reveal whether knowledge-based innovation can be increased when socio-cultural factors negatively impact the knowledge economy. We chose to follow existing research evidence, outlined in the theoretical part of this paper, showing that digitalization can enhance innovation within the knowledge economy. As a result, the second stage of our analysis was to assess the impact of digitalization on knowledge-based innovation. A key indicator to measure digitalization is expenditure on its implementation and use.

Table 4 shows the correlation coefficients between knowledge-based innovation and expenditure on the implementation and use of digital technologies. The results of the correlation analysis revealed a steady and strong influence of digitalization on knowledge-based innovation. In other words, an increase in the expenditure on digital technology contributed to an increase in knowledge-based innovation. Importantly, this correlation was characteristic of all regions, regardless of their socio-cultural contexts. Thus, the second hypothesis was fully confirmed.

Table 4. Digital expenditure and knowledge-based innovation.

Knowledge-Based Innovation	Correlation Coefficient
Number of patents issued for inventions	0.939
Number of utility models obtained	0.958
Number of advanced technologies developed	0.963

Source: authors' calculations.

5. Discussion

Our results confirmed our two hypotheses. The first part of our analysis showed that socio-cultural factors had a significant impact on knowledge-based innovation (Tables 1–3). This confirms the results of prior similar studies. For example, a study of research innovation in universities in Thailand found that social and demographic factors were impactful, and consistent with a global study of productivity in biomedical research [84,85]. Results shown in Table 1, assessing the number of patents issued for inventions, revealed that certain socio-cultural factors had a significant influence on knowledge-based innovation. In particular, the socio-cultural factor of 'traditional economic practices' measured by the percentages of the total population in rural and urban areas had the greatest influence on knowledge-based innovation. Nevertheless, research on the impact of population density on innovation has led to mixed results. Previous studies including those by Knudsen et al. [86], Galliano et al. [87], and Gossling and Rutten [88] found that population percentage or density impacts to some degree on the innovation levels of rural and urban regions. However, other studies, such as those by Fearne et al. [89] and Hindman [90] have reached opposite conclusions. Our results regarding traditional economic practices can be explained by the fact that most Indigenous communities are rural and rely predominantly on traditional practices, maintaining strong family values, and are less inclined to pursue profit-making activities or innovation. This supports the findings of previous studies on the practices of Indigenous groups and other minorities [40–44,62]. In contrast, urban dwellers are more oriented towards profit-making and seek to maximize the efficiency of their economic activities through inventions and new technologies, thus contributing to innovation-driven development.

Furthermore, assessing the correlation between socio-cultural factors and the number of obtained utility models, results shown in Table 2 indicate that for rural communities, the socio-cultural context had a significant influence on knowledge-based innovation and innovation in the activities of economic agents. This supports the findings of previous studies stating that social and cultural factors can influence the research productivity and

innovation levels of communities [84,85,88]. Results given in Table 3 show the influence of socio-cultural factors on the number of advanced technologies, revealing that rural communities adhering to traditional economic practices were less susceptible to innovation due to their cultural characteristics, while urban dwellers were more oriented towards profit-making and efficient economic practices. Urban dwellers take greater interest in innovation and advanced production technologies, in order to gain a competitive edge and accelerate the development of their production processes [37,38]. Although some studies have reached opposite conclusions [89], our result is similar to the findings of most previous studies which found that location in rural or urban areas significantly impacts innovation levels [91,92].

The second part of our analysis (Table 4) examined the influence of digitalization on the knowledge economy, measured through expenditure on the implementation and usage of digital technologies. The results confirmed that digitalization improves the knowledge economy. There is an overwhelming consensus in academic research that digitalization, including the use of internet technologies, open innovation, big data, and artificial intelligence, significantly contributes to the economic success of businesses, regions, governments, and nations [47,73–81,81–83].

6. Conclusions

6.1. Implication

We analyzed the impact of socio-cultural factors on the knowledge economy and examined the impact of digitalization in this context. We began with a theoretical background justifying our research approach and identified the research gaps. Next, we presented our methodology, stating the multiple econometric models adopted to guarantee the accuracy and reproducibility of our results. The main part of our analysis was a correlation regression model which showed a strong and stable influence of socio-cultural factors on knowledge-based innovation. However, this influence was also ambivalent. For example, while factors such as the percentage of rural population may have a negative impact on knowledge-based innovation, others such as the percentage of urban population may contribute to it. Finally, we showed the impact of digitalization on knowledge-based innovation, revealing that even with challenges from socio-cultural factors, digitalization remains a powerful influencer.

In theoretical terms, our research significantly extends the range of academic debate on the knowledge economy by examining the impact of socio-cultural factors on its development. In practical terms, our research shows that digitalization can be a powerful tool for developing rural areas, even where socio-cultural factors limit levels of innovation. Consequently, we recommend that policy makers and business leaders pay close attention to these findings.

6.2. Lmimitation and Future Research

This study should be considered a baseline for future research. Our study is based on data obtained referring to socio-cultural and economic characteristics of Russia. Our results might not be immediately generalizable to other parts of the world. Therefore, we encourage further studies on the topic. Future studies should consider additional socio-cultural variables and indicators and examine a longer timespan. We also recommend that future studies consider advanced statistical approaches such as causal analysis, among others.

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