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Society 5.0: The Use Of Technology As A Tool For Inclusion, Sustainability, Energy Safety And Quality Of Life

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Abstract: Around the world, people are seeking to adapt technology to meet their needs, positioning digital transformations in favor of human beings. Thus, this article contemplates the environment of Society 5.0, in Japan, bringing relevant information and concepts about the subject, in addition to ratifying its close relationship with inclusion, sustainability, energy security and quality of life. The objective of the research is to place the human being at the center of innovation, seeking to understand how technology is inserted in the daily lives of students from a Brazilian public university, in the State of Pernambuco, in the city of Recife/PE. For this purpose, the methodology used was the Survey type, in which research of opinion is used as a technique for obtaining information about a certain group of people. From the applied, the results and discussions demonstrated that despite of a certain lack of knowledge about what society 5.0 actually is, respondents revealed that they are walking towards this new and more digital social structure. Finally, the present study has made it possible to understand that technological innovations, when directed to human beings, can help not only in people's quality of life, but also enable social inclusion, a more focused look to sustainability and the rise of renewable, focused on the solution of the current environmental imbalance.

Key words: Sustainability; Inclusion; Quality of life; Technology; Renewable energy.

SOCIETY 5.0: THE USE OF TECHNOLOGY AS A TOOL FOR INCLUSION, SUSTAINABILITY, ENERGY SAFETY AND QUALITY OF LIFE

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Introduction

In recent decades, new technologies have become the focus of debate around the world. Media coverage of the technological development of countries has boosted a greater social interest on the subject of innovation, seeking to increasingly place digital transformations in favor of human beings (MONTE, 2021).

Currently, society is in constant transformation and while the world is still adapting to the new tools and advances provided by Industry 4.0, with the improvement of efficiency, productivity and automation of industrial processes, the concept of Society 5.0 appears in Japan (ROJAS *et al.*, 2021).

On this perspective, in January 2015, the Japanese government launched the 5th Basic Science and Technology Plan, which is a base document that defines innovation policies to be instituted by the country between the years 2016 to 2021. This model was only shown to the world in 2017 (ROJAS *et al*., 2021).

Members of the cabinet of Shinzo - Abe, Prime Minister then, presented this innovative proposal at the CeBIT fair, the world's largest trade exhibition on digital telecommunications services and Information Technology (IT), which took place in Hannover, Germany (ROJAS *et al*., 2021).

Thus, a new social model emerged that provides the transition from an ordinary society to a super-intelligent one *(Super smart Society 5.0*) emerged, which places the human being at the center of innovation and technological transformation (SALIMOVA; VUKOVIC; GUSKOVA, 2020).

This means that all the technological and digital advances previously focused on companies, the industry 4.0, in contemporary times will be redirected to the well-being of men, their quality of life and the resolution of social and environmental problems (SALIMOVA; VUKOVIC; GUSKOVA, 2020).

In this sense, it is understood that the three main values of Society 5.0 consist of people's quality of life, with safer cities and technologies focused on health, social inclusion and technology with eyes on all individuals, with the rise of renewable energy sources that can contribute to greater energy security in the country, since they reduce dependence from a single source of energy, and innovations aiming to solve the current environmental imbalance (GUIMARÃES *et al*., 2021).

In this way, the present article is justified as a necessary and essential source of knowledge for society, business organizations and, mainly, the academic community, given the relevance of the theme today, with the possibility of implementing this new social model in numerous countries, including Brazil.

Thus, the main studies carried out on the subject are by the authors Rojas, Penãfiel, Buitrago and Romero (2021), when analyzing the 5.0 society, the Japanese concept for a super-intelligent society, as well as the authors Salimova, Vukovic and Guskova (2020), when analyzing the path to sustainability through industry 4.0 and society 5.0.

Therefore, we seek to answer how this 5.0 society is evolving in Brazil. Based on this assumption, the objective of the research is to place the human being at the center of innovation, aiming to understand how technology is inserted in the daily lives of students from a Brazilian public university, in the state of Pernambuco, in the city of Recife/PE.

It is believed that this research will contribute to the dissemination of scientific knowledge, on this recent theme, to society and the academic community, boosting future research and encouraging, in practice, the use of technology to facilitate everyday tasks.

For this matter, the article is structured in five sections. In this first section, introductory notions about the theme were presented. In the second section, the guiding concepts of society 5.0, developed by several scholars and researchers, are discussed. In the third section, the methodological procedures of the research are presented, followed by the fourth section, with the results and discussions of the research. At last, the fifth section brings the final considerations.

Theoretical Foundation

Society 5.0: conceptuality

Society 5.0 goes beyond seeking greater productivity and efficiency in processes with the help of new technologies. It aims to convert new technologies, focusing on making life easier for individuals, which means the development of technological solutions for human wellness, quality of life and the resolution of social problems (DAVIES, 2018).

Society 4.0 or Industry 4.0 was originally a term used in 2011 by the German government in its high-tech development strategy for the future. The strategy prioritizes the digitalization of the economy and society, a more sustainable energy production and a merge of sectors to limit energy waste (GRANRATH, 2019).

In addition to covering smart mobility and the creation of smart cities, which serve as an incentive for the circular economy, as well as automation, with the increasing advances in technology. Internet of Things, *machine learning* and providing real-time data are some of the new tools employed for this purpose (GRANRATH, 2019).

Society 5.0 is similar to Industry 4.0, but it steps in further direction, portraying both economy and society data based – a Super Smart Society, with focus on individual needs and capabilities. The concept envisages a fusion between the real, physical world with cyberspace in order to efficiently collect more accurate and personalized data for better problem solving and value creation (FUKUYAMA, 2018).

The vast amount of information that until now required a large amount of time and human resources must be analyzed by Artificial Intelligence much faster and transformed into easy-to-understand data that humans can use in industry and social services (ROJAS *et al*., 2021)

Recently Keidanren, which is the Federation of Industries of Japan, defined Society 5.0 as the society of imagination, where digital transformation will be combined with creativity and values to develop a sustainable society (ANDRADE, 2020).

The alignment of the actions and goals of society 5.0 with the Sustainable Development Goals (SDGs) of the United Nations Development Program is a universal call to end poverty, protect the planet and guarantee peace and prosperity for all people by 2030 (ROJAS *et al.*, 2021).

Considering this, it is possible to understand that these SDGs were planned in order to achieve collective progress between governments and citizens, avoiding the consequences of social inequality (AQUILANI *et al*., 2020).

Since then, many countries have oriented their investment and research strategies towards a similar model, in which sustainable development is conceived from its initial planning, considering advances in infrastructure and technology, consequently achieving an improvement in industrialization and also on the environment (AQUILANI *et al.*, 2020).

Guimarães *et al*., (2019) applied the exploratory research methodology, with a quantitative approach, and literature review. In this study, the objective was to search for an analysis of the evolution of the theme society 5.0, analyzing the characteristics of publications on the keyword "Society 5.0" on the field "Article title" indexed in the *scopus* base along its trajectory.

The results show that the studies are very recent in relation to the topic addressed, starting in 2017, therefore presenting a growth in research in 2018, led by the Japanese with greater participation in the publications.

Society 5.0 and its relationship with inclusion, sustainability, energy safety and quality of life

Digital and socioeconomic transformation maintains a relationship of joint efforts between the government structure, the business community, social institutions and the population as a whole, so that they can face the challenges of sustainable development (ANDRADE, 2020).

For Monte (2019), when talking about Society 5.0 it is important to regress and watch Germany, since it is necessary to relate the topic to Industry 4.0, also called the Fourth Industrial Revolution.

This is a new production mode based on automation technology, integrating concepts from the internet of things and on cloud computing, for example, on which precisely because of this integration or value chain presupposes the sustainability of the business, through the quick decision - making by managers (MONTE, 2019).

Industry 4.0 has been developing different business models, such as companies that search for customer solutions online; organizations that offer indirect services using service platforms, models that use collective and voluntary knowledge, obtained especially on the internet, to solve day-to-day problems, develop new technologies, create content and provide services, among others (SALIMOVA; VUKOVIC; GUSKOVA, 2020).

These changes make it possible to increase production, improve product quality and reduce production costs in China, factors that increase business competitiveness. However, the robotization of industrial production leads to negative social consequences, such as the reduction of jobs, in which the solution to this problem is not included in the concept of smart factories (SALIMOVA; VUKOVIC; GUSKOVA, 2020).

However, it is necessary to understand that to be inserted in Society 5.0 it is necessary to guarantee socioeconomic sustainability to the population, as sustainability is one of the pillars of this new model of society (AQUILANI *et al*., 2020).

It is necessary to mention that sustainability can also have a broad meaning, encompassing rights such as the right to work, for example. The three dimensions of sustainability, namely economic, social and environmental, are embraced by this new work model (FILHO; ASHLEY; MARELLA, 2019).

According to Shen and Benson (2016, p. 1725), conceptualizations of Corporate Social Responsibility as "a company's sense of responsibility to the community and environment in

which it operates" and the "obligation of the organization to serve its own interests and those of society", show great agreement in the content and in the methodological consideration of the organizations' responsibility.

Such conceptualizations of Corporate Social Responsibility aim to improve organizational care - and also from its stakeholders - with the preservation of nature and ensuring social prosperity (WANG *et al*., 2016).

Sustainability in a broad sense brings a strong relationship with social inclusion, as it provides means of economic provision for the population and protects environmental resources for the current and future generation (KISH *et al*., 2019).

The topic of renewable energy, especially the use of solar energy, is on the agenda of discussions in several countries, as energy security is fundamental for economic growth, especially on long terms, of any nation. Therefore the United States, Japan, Germany, China, Brazil and other countries have been working to balance energy demand and supply. Still, they have invested in solutions to these problems, through research on efficient ways to generate energy, for example (FURKAN, 2011).

There is a joint effort of people, companies and countries, in search of energy alternatives with lower carbon content, which has stimulated investment in research and new technologies. This international awareness comes mainly from concerns surrounding the environment and climate change. All of these focusing on the establishment of policies that promote economic and social development, as well as the energy security of nations (LODI, 2011).

In Brazil, for example, these actions in search of renewable energies can contribute to greater energy security in the country, since they reduce dependence from a single source - which in the Brazilian case is concentrated in the hydraulic source, whose share on electricity supply was 68.1% in 2016 (BRASIL, 2017).

Furthermore, it is important to note that in 2016 Japan presented the concept of the Superintelligent Society (Super smart Society 5.0), which uses all this technological evolution to benefit society and solve its problems by incorporating the fourth industrial revolution into an advanced and disciplined culture (MERLUZZI, 2018).

Poto-can, Mulej and Nedelko (2020) applied the Corporate Social Responsibility methodology aligned with the goals of a forward-looking and socially responsible society. The purpose of this article is to report research on how Society 5.0 balances Industry 4.0, the responsible economic development and the resolution of social problems by advancing social responsibility in organizations. As a result, the study suggests the incorporation of technology in Corporate Social Responsibility models and the change of environmental, social and economic dimensions, according to the circumstances of Society 5.0.

Considering this, in a near future, society will strengthen values and develop services that improve people's quality of life, making it more sustainable and also inclusive (SALIMOVA; VUKOVIC; GUSKOVA, 2020).

Methodology

According to Gil (2008), the present research is applied, on which the main objective revolves around the generation of practical knowledge in order to solve a problem.

The method to be used is hypothetical-deductive, adopting a qualitative approach, characterized by the researcher's concern to understand the phenomenon according to the

perspective of the participants and not just their own. Bibliographic research was also carried out with the analysis of scientific journals from the last five years, obtained through the *Web of Science* database platform.

The methodology used is the Survey type, an opinion survey, in which information is requested from a significant group of people about the problem studied and then, through quantitative analysis, to obtain the conclusions of the collected data (GIL, 2008).

Therefore, a structured questionnaire was applied to students from a public university in the State of Pernambuco, in the city of Recife/PE, seeking to analyze how technology is inserted in the daily lives of these students.

This research can be classified as exploratory for practical purposes, since it aims to collect information to make an initial diagnosis, in addition to contributing to the improvement of the services offered (LAKATOS; MARKONI, 2017).

The sample size, although small, included 60 questionnaires collected among students from a public university in the state of Pernambuco, Brazil. The following steps were performed to obtain the data.

A questionnaire was prepared based on the literature review, which contained the population's knowledge about the topic addressed (questions 1 and 2), there were also questions related to the use of technology to ensure a better quality of life for the respondents (questions 3 to 7), as well as the relationship between the topic and social inclusion (questions 8 to 11), and after there were questions about sustainability (questions 12 to 16).

On the groups of questions applied, more specifically from 1 to 17, a Likert scale was used. Questions 18, 19 and 20 addressed the socioeconomic profile of the respondents. This way, a study was set up for the application of the questionnaire stage.

Regarding the structure of the questionnaire, a pre-test was first prepared and answered by three university students. After applying for the pre-test, there were no changes in the structure of the questionnaire and, therefore, it was applied.

The researchers virtually applied the questionnaires, through the *Google Forms tool*, for a period of three days, to verify the current scenario of the Society 5.0 theme. The sample was chosen among students from a public university. In this stage, 60 questionnaires were collected, with no incomplete responses by respondents.

The questions were formulated based on the research problem, which analyzes the evolution of the sample population regarding the Society 5.0 theme, based on fundamental values such as sustainability, inclusion and quality of life.

Then, after the sample planning phase, there was the writing and application of the questionnaires, on Survey type research. Soon after, after obtaining the data, a statistical analysis was performed through Excel and, finally, the analysis of the results was carried out.

Results and discussion

The applied research was of the Survey type , through the application of a structured questionnaire, which had the collaborative participation of 60 (sixty) students from a public university in Recife/PE.

The research execution time was of two days for the pre-test questionnaire application adding three days for the application of the definitive questionnaire – a total of 5 (five) days. The questionnaire was applied virtually, through *Google Forms* and the data obtained was processed and tabulated through *Excel.*

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From the results of the questionnaire filled in by the respondents, percentage data on the main profiles and characteristics of the sample were obtained. The analysis of the collected data is presented below, which are displayed in graphical form.

Initially, analyzing the data referring to gender, the total percentage of women participating in this research was significantly higher than the total of men. The female gender presented 68.3% of the responses to the survey, while the male gender corresponded to only 31.7%.

The most participatory age group in the research was between 18 and 24 years old, with a percentage of 56.7%. Furthermore, the family income of the interviewees was also analyzed, showing that most of them, which is 41.7%, have a family income greater than 9 (nine) minimum wages, as shown in Table 1.

Table 1. Gender, Age Group and Age of the participants.

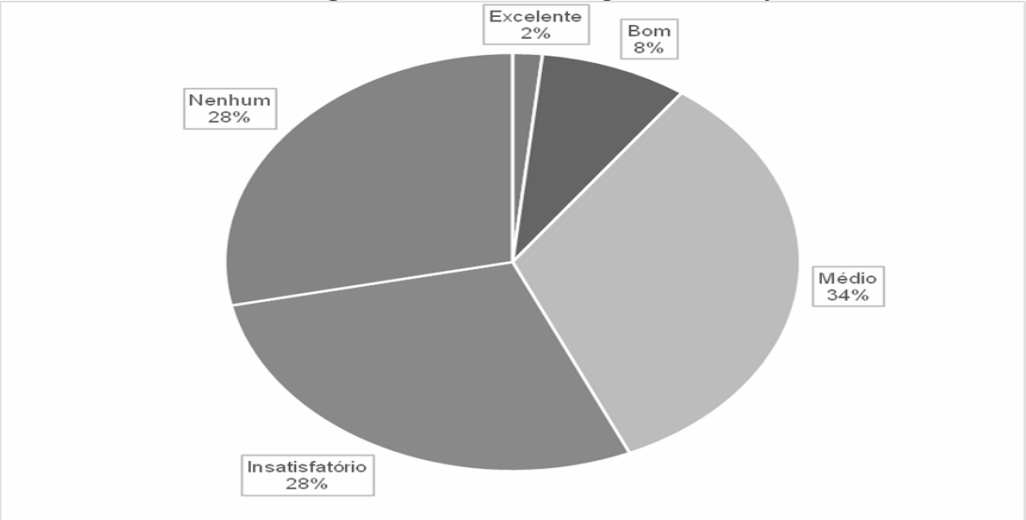
	Dados	Porcentagens
Gênero	Masculino	31,67%
	Feminino	68,33%
Faixa Etária	18-24	56,67%
	25-30	8,33%
	31-40	15,00%
	41-50	13,33%
	51-60	3,33%
	61+	3,33%
Renda Familiar	Menos de um salário mínimo	3,33%
	Entre 1 e 2 salários mínimos	11,67%
	Entre 3 e 4 salários mínimos	11,67%
	Entre 5 e 6 salários mínimos	21,67%
	Entre 7 e 8 salários mínimos	10,00%
	Mais de 9 salários mínimos	41,67%

Source: the authors.

To test the knowledge about Society 5.0, it was first asked if the respondents had already heard about the topic, in which only 51.67% had already heard about the theme.

As for the level of knowledge on the subject, the following responses were shown graphically in Figure 1:

Figure 1. Level of knowledge about Society 5.0



Source: the authors.

It can be noted that the majority, 90% of respondents, do not have a good knowledge of the topic. During the bibliographic research, carried out on the *Web of Science* and *Scopus platforms*, it was noted that Brazil did not present a considerable number of publications on the topic Society 5.0, which means the topic is not yet being explored in the country.

Considering this, the study on this topic is very important, as the country needs more incentives to disseminate knowledge about this new society in order to prepare its population for a new social reality.

However, when asked about the use of technology to facilitate daily tasks, 45% of respondents chose the maximum intensity scale, "5". In second place was the intensity scale "4" with 36.67%, which means that 81.67% use technology a lot to facilitate their daily tasks.

This way the respondents, despite of not having a good knowledge of Society 5.0, mostly use technologies to facilitate their daily activities, demonstrating that in practice they are using the precepts of this new society.

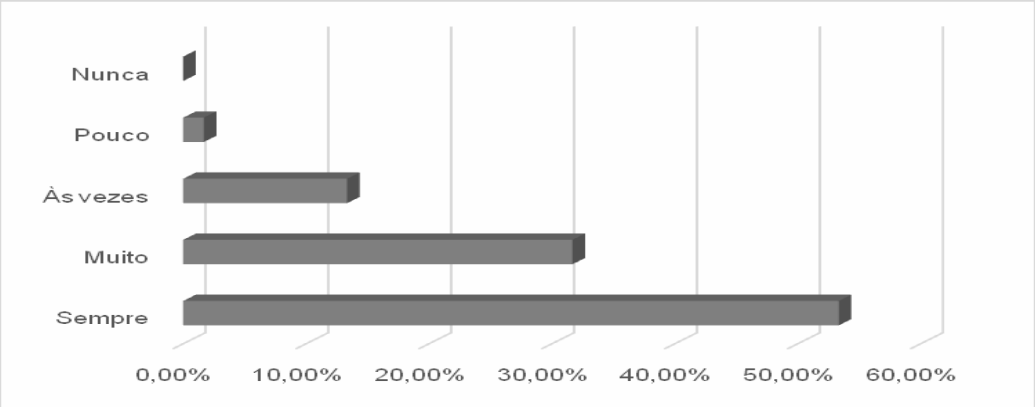
Therefore, only 51.67% of the public in this sample stated that they had already heard about the theme Society 5.0, however most respondents (81.67%) use technology to facilitate their daily tasks. In addition, the total of respondents - 100% - stated that they had access to a smartphone, notebook or computer.

The intention of selecting and configuring these parameters was to identify whether people are following the new era of advanced technologies, the so-called "5.0 Society". The progress of the theme was subdivided into three parts in the survey.

The first part concerns the use of technology to improve the individual's quality of life. The second part deals with the social inclusion that this technology can provide. The third part relates the theme to sustainability. The results were obtained through the application of a questionnaire with a field survey, through Survey type research.

Regarding the use of technology as an instrument to improve the quality of life of individuals, it can be noted that most respondents use technology to obtain it. As for example the artificial intelligence - the majority (98.3%) answered that they used such technology with certain frequency, as seen below, on Figure 2.

Figure 2. Use of Artificial Intelligence in everyday life.



Source: the authors.

Based on figure 2, more than 50% of respondents stated that they always use artificial intelligence tools in their routine. In second place, over 30% stated that they use artificial intelligence a lot. The sum of respondents who never used or use little of this service did not exceed 10%.

The same happened with the use of the Internet of Things. Most of the respondents make use of this type of service, either frequently or sometimes, as indicated by the obtained percentage of 80%.

The purpose of these questions was to verify if the selected population sample is using the technologies available on the market to assist in the execution of their daily activities. Considering that this new concept of society aims to focus on the human being, balancing the implementation of technologies such as Big Data, Internet of Things and Artificial Intelligence, with the resolution of society's main problems such as: competitiveness, productivity, connection and well-being (ROJAS *et al.*, 2021).

Therefore, the central objective is for people to have a more comfortable life, regardless of their age, with the automation that technology provides. This way, manual work will be reduced or even finalized so the population can enjoy more health, more security, more education and, consequently, reduce the level of stress (ROJAS *et al.*, 2021).

Taking this under consideration, when the topic of social inclusion was approached, 86.67% of the respondents said they believed that technology provides social inclusion. However, 88.33% agreed that the advent of the 5.0 society, which means the technological society, can also increase inequality among people and end up concentrating greater wealth among the most economically favored population.

Still from the inclusion point of view, 88.33% of the respondents consider that technology has contributed to the execution of academic activities on the researched educational institution.

The same percentage of 88.33% of respondents considered that the elderly and/or people with disabilities who use technology have greater social interaction, in comparison with the same group that does not use it.

Social inclusion aims to reduce social inequalities, providing equal access for all citizens, however, for that, it is necessary intervention and encouragement by the state. Social inclusion reduces inequalities, because all human beings have the same rights.

Concerning sustainability, 93.33% of respondents agreed that in order to experience society 5.0, sustainability must be a basic premise for this process of evolution.

Further on, still under the aegis of sustainability, 96.67% of the participants stated that they were interested in using the solar energy service, however only 8.33% already did.

Society 5.0, as a sustainable society, argues that environmental resources can cease with the excessive consumption of humanity - 93.33% of respondents agreed that they should consume only what is necessary on a daily basis.

However, when asked if there was any thought about the real need when buying a product or contracting a service – to analyze if at the point they thought sustainably - only 11.67% said that they always thought that way, other 35% stated that they thought that way a lot and 40% said that they sometimes thought that way.

Finally, 71.67% of the participants stated that they consider they are acquiring the necessary knowledge and mechanisms to be part of the 5.0 society.

Considering what was presented, the theme is fundamental, given that the growth of the world population causes the increasing exploitation of the planet's natural resources, causing greater environmental degradation, which both affects the ecosystem, through endangered species, and affects the climate change (GARCIA, *et al.*, 2020).

This way, sustainability becomes a mandatory discussion for the evolution of humanity, being a challenge and a goal to be achieved by Industry and Society 5.0 (GARCIA *et al*., 2020).

Conclusion

For all the information brought in this study, it can be seen that society is in constant transformation, which arouses a growing interest in topics related to new technologies and innovations.

Considering this, analyzing a topic that has been much debated in the academy - such as industry 4.0 - and relating it to Society 5.0, a recent topic that has small quantity of academic material, is an important task, which allowed us to conclude that Brazil is giving the first steps towards the future of super-intelligent and interconnected societies, which, in itself, already demonstrates the relevance and originality of the research.

As already mentioned, all the technological and digital advances previously focused on companies, today, are being redirected to the wellness of human beings, to their quality of life, with social inclusion and resolution of environmental problems (SALIMOVA; VUKOVIC; GUSKOVA, 2020).

It is noteworthy that the theoretical implications pointed out in the present study are important, however, practical implications are also necessary for technological evolution to be present in various social sectors, such as the daily lives of individuals. Therefore, a joint effort between government, companies, universities and society as a whole is necessary to focus, direct and invest in this new social model.

In this way, the results presented contributed to the understanding that the 5.0 society, a not yet known topic, has taken its first steps in Brazil - even in the daily lives of university students who participated on this research.

These students already use numerous technological tools daily, inside and outside the university environment, since the use of a simple *smartphone* to the use of artificial intelligence, with *smart watches, apple watch, Alexa* virtual assistant and vacuum robots, for example -

which help the simplest everyday tasks and ratify the presence of technology in favor of human beings.

Regarding study limitations, even though *Google Scholar platform* shows Brazilian material over the theme, as it is a state-of-the-art topic, the main bibliographies are in the native language, Japanese, and in the second language, English. For this matter, no Brazilian work published on the *Web of Science and Scopus* platforms was found, which further highlights the originality of the study.

It is concluded, with the present research, that technological innovations, when directed to the human being, can materialize the 5.0 Society in Brazil, improving not only people's quality of life, but enabling inclusion and a more sustainable view. It is necessary to invest resources to identify reliable sources of energy that have minimal environmental impact.

Finally, it is confirmed that complementary studies are necessary, with the elaboration of future material, to supply the information not fully contemplated in this work and to give more interdisciplinary connotations on the subject – and also pointing out how Brazil will behave in the scenario of Society 5.0 and whether this technological society can increase inequality between the most economically favored people and those with few resources.

Notes

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