International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 12 Issue: 2
Article Received: *25 November2023* ***Revised:*** *12 December 2023* ***Accepted:*** *30 January 2024*

Redefining Citizenship in the Digital Age: Understanding Smart Digital Census for Citizen's Population Data Collection and Analysis.

Muhammad Younus[1,2], Zuly Qodir[1], Achmad Nurmandi[1], Dyah Mutiarin[1], Andi Luhur Prianto[3], Imelda Zamjanah Rahmawati[4], Iswadi Amiruddin[5], Nur Isda Khaerunnisaa[5], Ahmad Harakan[3], Nurbiah Tahir[5] and Andi Muhammad Zachary Vhilbar[5]

[1]Department of Government Affairs and Administration,
Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia.
[2]Department of Product Research and Software Development,
TPL Logistics Pvt Ltd, Karachi, Pakistan.
[3]Department of Government Science
Universitas Muhammadiyah Makassar, Makassar, Indonesia.
[4]Department of Government Studies
Universitas Muhammadiyah Cirebon, Cirebon, Indonesia.
[5]Department of Public Administration,
Universitas Muhammadiyah Makassar, Makassar, Indonesia.

Email: mohammedyounusghazni@gmail.com , m.younus.psc22@mail.umy.ac.id

Abstract--- A novel idea in population data gathering is the Smart Digital Census, which makes use of cutting-edge tools like mobile computing, cloud computing, and data analytics to improve the precision and effectiveness of conventional census methods. The traditional census method can be expensive, time-consuming, and inaccurate, and on the other end, the Smart digital censuses provide a practical, affordable, and precise alternative. This paper study tries to fully comprehend the smart digital census and how it differs from conventional census techniques. We'll start by outlining what a smart digital census is and why nations ought to implement it. The significant characteristics of the smart digital census are then highlighted, including real-time data collecting, increased accuracy, and lower costs. This article also examines how the Smart Digital Census might affect other fields like corporate intelligence, policymaking, and urban planning. Finally, the comparative advantage of the smart digital census over conventional census methodologies is highlighted in the paper's results, as how it will affect future data collection and analysis. Future research directions in this area are also covered in the paper.

Keywords- Digital Census, Smart Census, Blockchain, Metaverse

1 INTRODUCTION

Governments and organizations utilize a census to gather information on the population and homes to help with policy and decision-making. The old paper-based census has been replaced by digitized equivalents known as the "smart digital census" (Alverti et al., 2020) as a result of technological advancements. This essay seeks to give readers a conceptual knowledge of the advantages of the smart digital census over conventional techniques. The way we live, work and communicate has been entirely transformed by the digital era. The traditional methods of conducting censuses (Al-Lawati & Barbosa, 2020) have been enhanced by technological improvements to provide more accurate and efficient data collection. The time-consuming and error-prone traditional census approach entails going door to door, collecting data using paper forms, and manually processing the data. This article explores the idea of the smart digital census (Ostermann, 2021) and compares its benefits to the old-fashioned approaches. A computerized method of gathering, storing, and analyzing census data is known as a "smart digital census." This innovative approach uses contemporary technologies like the internet, cloud computing, and mobile devices to gather, store, and analyze data. Respondents complete electronic forms on their mobile devices using this technique, which transmits the completed forms to a central database for processing. This strategy decreases the need for door-to-door visits, speeds up data processing, and minimizes data entry errors. For governments and politicians to comprehend and address societal issues, censuses—the process of gathering, compiling, evaluating, and releasing demographic, sociological, and economic data about a nation's population—are crucial tools. The idea of the smart digital census has been suggested as a replacement for conventional census methods with the development of digital technologies. A smart digital census (Black et al., 2022) is one that makes use of digital tools, technology, and information to increase the process' accuracy, effectiveness, and inclusivity. Digital tools like mobile phones, web-based surveys, social media, and geospatial technologies make it possible to get more accurate and recent data on the population. The ability to swiftly assess and share this information enables quicker decision-making and better policy planning. The precision of the smart digital census is one of its key benefits. Traditional census (Jain et al., 2014)

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 12 Issue: 2
Article Received: *25 November2023* ***Revised:*** *12 December 2023* ***Accepted:*** *30 January 2024*

procedures frequently result in inaccurate data collection since information is either submitted incorrectly or not at all. Using digital tools, however, ensures that data is captured consistently and reliably with the smart digital census. Also, mapping population data using geospatial technologies makes it simpler to spot trends and patterns. The effectiveness of smart digital census is another benefit. Conventional census procedures require census employees to visit every home in order to gather data, which can be time-consuming and expensive. With the use of a clever digital census (Páez et al., 2020), information may be gathered without the need for door-to-door visits, saving time and resources. The speedy examination and publication of data made possible by the use of digital tools also allow for quicker decision-making. Also, the intelligent digital census has the benefit of being more inclusive. Certain populations, are frequently underrepresented in censuses conducted using traditional methodologies, including marginalized groups and refugees. With a smart digital census, data from these populations may be collected using digital means, ensuring that their wants and concerns are taken into consideration when formulating policy. The study will offer insightful information on the most recent developments in digital technology and how they are used in the census process. It will also look at the difficulties and restrictions of conventional census techniques and how Smart digital census can get over these restrictions.

2 LITERATURE REVIEW

In this Section, we will be explaining the key terms which are used in this article for readers, so they can be able to understand the concept of this paper better.

2.1 Definition and Overview of a Census

2.1.1 What is Census

Human capital is the most important capital for the well-being and prosperity of modern society. It is critical for evidence-based governance, civil societies, academics, researchers, and all members to have an accurate and credible assessment of this capital at the local, regional, and national levels (Farley, R., & Haaga, J. (2005)). The population and housing census's primary goal is to offer that assessment. Aside from answering the question "How many of us?" there is also a need to answer "Who are we?" in terms of age, gender, education, occupation, economic activity, and other critical characteristics, as well as "Where do we live?" in terms of housing, access to water, availability of essential facilities, and Internet access. The answers to these questions provide a numerical profile of a country, which is required for evidence-based decision-making at all levels (Šanda, R. (2022)). In brief, the Census serves as the foundation for evaluating the nation's accomplishments over the past ten years, monitoring the government's current initiatives, and developing long-term plans.

2.1.2 Types of Census

2.1.2.1 Population Census

A population census is an entire process of organizing, gathering, compiling, evaluating, disseminating, and analyzing demographic, economic, and social data at the most localized geographic level that pertains, at a given time, to all people in a country or a clearly delineated region of a country (Collins, W. G., & El-Beik, A. H. A. (1971)). The creation and distribution of tangible wealth are fundamentally dependent on population. The population's size, distribution, and composition must be known with certainty to plan and carry out scientific research, administrative activity, and economic and social growth. The population census, which includes the settled population, homeless people, and nomadic tribes, is the primary source of these fundamental benchmark figures (Farley, R., & Haaga, J. (2005)). Statistics on people and families should be able to be presented and analyzed using information from population censuses for a wide range of geographical units, from the entire nation to specific small communities or city blocks.

2.1.2.2 Housing Census

A housing census is the entire process of planning, gathering, compiling, evaluating, disseminating, and analyzing statistical data relating to the number and condition of housing units and facilities as available to households at a specified time pertaining, at that time, to all abodes and their occupants in a country or a well-defined area of a country (Farzanegan, M. R., Gholipour, H. F., & Javadian, M. (2023)). The census must contain information on the availability of housing units, structural features and facilities that affect privacy and health, and the expansion of average family living conditions.

2.1.3 Main Components of Census

2.1.3.1 Individual Enumeration or Counting

The word "census" suggests that every person and every living quarter are counted separately, and each set's attributes are recorded separately. The data on the various qualities can only be cross-classified using this process (Bahrami, B., Frith, C., Didino, D., Butterworth, B., & Rees, G. (2013)). The need for individual enumeration can be satisfied by gathering data on the ground, using data from the proper administrative registration or group of registers, or combining these methods.

2.1.3.2 Universality Within a Specific Area

A delineated area should be included in the census (for example, the entire country or a well-delimited part). Depending on the sort of population count required, the population census should include every person present and resident within its boundaries. No. Of type, every living quarter should be counted in the housing census (Si Youcef, K., Boukerch, I., Hocine, I., & Benabdelkader, A. (2021)). This does not rule out the use of sampling techniques to gather data on specific features, as long as the sample design is appropriate for the size of the areas for which the data are to be tabulated and the level of detail required for the cross-tabulations.

2.1.3.3 Simultaneity

Each person and each set of living quarters should be counted as belonging to the same well-defined point in time, and the data gathered should pertain to a well-defined reference period. However, the time-reference period does not have to be the same for all data collected (Kim, S. S., Kim, Y. J., Park, J. S., Ho, S. H., Kweon, H., & Bae, Y.-H. (2022)). The day

of the census will be used for most of the data; in other cases, it may be a period before the census.

2.1.3.4 Defined Periodicity

Regular censuses should be conducted to provide comparable data in a predetermined order. It is feasible to evaluate the past, accurately characterize the present, and predict the future through a series of censuses. A national census should be conducted at least every ten years (Marks, E. S., & Mauldin, W. P. (1950)). Some nations may discover that they must conduct censuses more frequently due to the quickness of significant changes in their population and housing conditions.

2.2 History of Census

The present population census took shape in the 17th century. Certainly, inventories of individuals, taxpayers, or valuables were created before that period, but the methodologies and inventories utilized differed from those employed today. The most notable difference was that early inventories were used to regulate specific people, such as determining who should pay taxes, be recruited into the military, or be forced to work (Wang, Y., Li, H., Yu, Z., & Luo, B. (2012)). Because it was frequently not in a person's best interest to be counted or to supply accurate information for these purposes, premodern enumerations often needed to be more precise. Another distinction was that early inventories only attempted to count members of specific categories, such as household heads or males of military age, rather than the entire population or even a representative sample. It is known that similar surveys were conducted in ancient Babylonia, Palestine, Persia, China, and Egypt. The Romans counted their citizens and possessions every five years to assess their responsibilities. In 5 BCE, this custom was expanded to cover the entire Roman Empire. The tradition was abandoned in the West once Rome fell until the present era. In the 17th and 18th centuries, the concept of a population census slowly evolved into what it is today: a thorough listing of every person and all of their significant characteristics to understand the fundamental trends and structure of the society rather than to identify and govern specific individuals (Burgstahler, K., Isidro, J., Van Vuren, D. H., Collins, A. C., Aliperti, J. R., & Wells, C. P. (2023)). There was never "the first census" because, while early attempts included certain modern elements, none of them did so with full force. Between 1665 and 1754, 16 enumerations were conducted in New France (Quebec) and Acadia (Nova Scotia), which may have been the first attempt to count everyone in a region more significant than a city. The early census takers only gradually learned basic information and how to acquire it. For instance, the first United States census did not collect data on occupation, birthplace, marital status, or exact age.

2.3 Definition and Overview of a Smart Digital Census

A Smart Digital Census is a modern, innovative, and technologically advanced method of conducting a census. It involves using digital technologies, such as smartphones, tablets, and online platforms, to gather data on population demographics and characteristics (Wakhariya, J., Gangrade, P., & Manekar, A. (2019)). The main objective of a Smart Digital Census is to provide a more accurate, efficient, and cost-effective way of collecting and analyzing data. It allows for real-time data collection, reducing the need for manual data entry and reducing the risk of errors. Additionally, it allows for a more comprehensive view of population characteristics and trends. It can gather data on a broader range of topics, including but not limited to age, gender, education level, occupation, and household structure (Zachary, Schwartz. (2020)). Smart Digital Census also provides improved privacy and security measures, as the data is collected and stored electronically, reducing the risk of data breaches. Furthermore, it enables the dissemination of data and results to the public in real-time, allowing for better transparency and public engagement. Overall, the Smart Digital Census is a significant step forward in modernizing the traditional census-taking process and ensuring more accurate, comprehensive, and secure data collection (Stokes, Rose. (2020)).

2.4 Current Practices of Census

Traditional Census studies refer to research conducted before the digital age and the widespread use of technology in conducting population surveys (Demirci Meryem (2020)). These studies focused on traditional data collection methods, such as door-to-door surveys, telephone interviews, and paper-based questionnaires.

Some previous examples of traditional Census are:

The 1990 U.S. Census: This study was conducted using traditional methods and resulted in a high response rate of nearly 94%. The results of the 1990 census provided valuable information on the demographic and social characteristics of the U.S. population (Semina, A. E., & Maximova, S. V. (2019)).

The UK Census of 2001: This study used both traditional and modern data collection methods, with the majority of the data being collected through paper questionnaires. The results of the 2001 census provided important information about the population, including their age, gender, ethnicity, and occupation (Liu, T., Zhuo, Y., Peng, R., & Cao, G. (2022)).

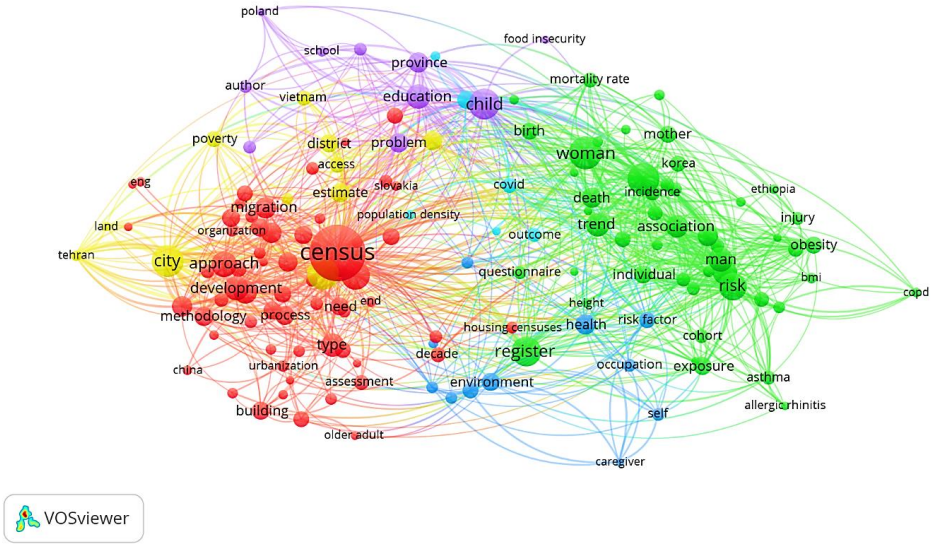
The Canadian Census of 2006: This study used a combination of traditional and modern methods, including paper questionnaires and telephone interviews. The 2006 census provided valuable information about the Canadian population, including their age, gender, language, and immigration status (Counting people: Census sensitivity. (2007)).

3 RESEARCH METHOD

The in-direct citation was used for the literature review, while the research study employed "Qualitative Research." To accomplish the research goal, a systematic review of pertinent literature was carried out using the VOSviewer program. The VOSviewer is a piece of software that uses visual representations to show how concepts and phrases relate to one another throughout a collection of texts. The program was used to map and analyze the connections between various concepts and words linked to both smart digital censuses and conventional censuses. Peer-reviewed publications, scholarly journals, and governmental reports found in academic databases, including Scopus, Google Scholar, and JSTOR,

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 12 Issue: 2
Article Received: *25 November2023* ***Revised:*** *12 December 2023* ***Accepted:*** *30 January 2024*

were the sources of the data for this study. Keywords like "smart digital census," "digital census," "comparative advantage," "conventional census," and "census methodologies" were used in the search. The VOSviewer program was used to analyze the data that was gathered. The program was used to produce a graphic representation of the connections between various terms and concepts connected to both the smart digital census and the conventional census. The important ideas, their linkages, and the degree of those connections were all determined using the software. The study revealed that smart digital census approaches are more efficient, accurate, and cost-effective than traditional census methods in a number of ways. The VOSviewer software's visual representation further demonstrated that the smart digital census has better data processing abilities and a higher level of technological integration. The visual representation offered by the VOSviewer program made it easier to understand the connections between various phrases and concepts linked to the smart digital census and the conventional census. The study emphasizes the value of technology in updating census procedures and the necessity of ongoing research in this area.



(Fig. 1: Shows Key Terms on the Current Research done on the Census topic)

4 RESULTS AND DISCUSSION

The purpose of this study was to conceptualize a smart digital census and highlight its advantages over a conventional census. A thorough examination and analysis of the literature revealed that a smart digital census is a novel method for gathering population data that makes use of contemporary tools like mobile phones, cloud computing, and geographic information systems. Compared to the conventional census, this method has a number of benefits, including lower costs, increased accuracy, increased efficiency, and improved data quality. The smart digital census has several benefits, including the removal of the need for paper-based forms and human data entry, which lowers costs and improves efficiency. Real-time data gathering and analysis are made possible by the usage of mobile devices and cloud computing, allowing for a more dynamic understanding of population demographics and trends. The smart digital census also reduces errors brought on by manual data entry and enables real-time data validation, both of which can increase data accuracy. The inclusion of geospatial data and its integration with other data sources, such as social media and administrative records, can improve the quality of the data, which is another benefit of the smart digital census. This makes it possible to assess population demographics more fully and accurately, taking into account elements like migration trends and socioeconomic status. Notwithstanding these benefits, the smart digital census also has significant drawbacks, such as privacy concerns, technical issues, and the requirement for qualified staff to develop and administer the system. Adequate privacy and security measures can be implemented, and capacity for data administration and analysis can be built to meet these issues.

4.1 Process Flow of Smart Digital Census:

Using digital technologies like mobile phones, cloud computing, and geographic mapping, a smart digital census is a contemporary method of gathering information on the population and households. Real-time data collecting, increased accuracy and thoroughness, and far more effective data processing and distribution are all made possible by this technology. The following is a summary of the smart census's process flow;

4.1.1 Preparation

The government creates a digital platform for the census, forms a census team, and trains the team to use the platform and collect data.

4.1.2 Data Collection

The census team goes door-to-door and collects data from citizens through their digital platform. They also encourage citizens to participate in the census by completing the form online.

4.1.3 Data Verification

The collected data is checked for accuracy and completeness by the census team. The team corrects any missing or incorrect data.

4.1.4 Data Processing

The verified data is processed through the digital platform and converted into usable information. The data is then analyzed to identify trends, patterns, and other insights.

4.1.5 Data Management

The government securely stores and manages the processed data. The data is used to create demographic and geographic profiles of the population.

4.1.6 Data Sharing

The government shares the census data with other government agencies and stakeholders, such as policymakers and researchers. The data is used to make informed decisions about resource allocation, urban planning, and other public policies.

4.1.7 Data Analysis

The government analyzes census data to determine population growth, age structure, educational attainment, and other social and economic indicators.

4.1.8 Report Generation

The government generates reports based on census data, which are used to inform policy decisions and inform the public about the state of the population.

4.1.9 Review and Refinement

The digital census process is reviewed and refined after each census to ensure that it is effective, efficient, and accurate. The government continues to improve the process based on feedback from the census team, citizens, and other stakeholders.

4.2 Advantages of Smart Digital Census over Traditional Census

4.2.1 Cost-Effective

A cost-effective alternative is the smart digital census, which eliminates the need for paper forms and saves on printing and data entry expenses. Due to the manual processing and collection of data using paper forms, the traditional census method is time-consuming and prone to inaccuracies. The recruiting and training of census workers, the printing and distribution of paper forms, and the manual data processing involved in traditional census procedures are all expensive and time-consuming. By using mobile devices to collect data instead of paper forms, smart digital census lowers the expenses associated with these tasks. Cloud computing reduces the need for manual data processing by performing data processing.

4.2.2 Improved Data Quality

The accuracy and thoroughness of the information gathered are improved through the use of digital technologies like geospatial mapping and real-time data entry. Using digital tools like GPS and mapping programs, the Smart Digital Census can provide more precise information on the population's position and distribution. The population's demographics can be better understood with the use of these increased data quality insights, allowing for better planning and management.

4.2.3 Increased Efficiency

A smart digital census makes data gathering and processing more efficient, shortening the time it takes to conduct the survey and distribute the results. Due to the manual processing and collection of data using paper forms, the traditional census method is time-consuming and prone to inaccuracies. Yet, a clever digital census does away with the need for human data entry. Real-time data collecting and processing are made possible, which expedites the census process and lowers data entry errors.

4.2.4 Increased Accessibility

Hard-to-reach communities can participate more readily in smart digital censuses, boosting data representation and lowering the risk of undercounting. The response rate for traditional census procedures is low because some people might not be able or willing to participate in the census. While respondents may complete the forms on their mobile devices at their convenience, the smart digital census offers them a more practical and accessible option to participate in the census. A higher response rate is most likely to follow from this improved accessibility. The Smart Digital Census makes the process of gathering data more accessible to the general people. There is no need for in-person participation in the census because citizens can take part online or through mobile applications.

4.2.5 Increased Data Usage

Census data are more relevant for decision-making since digital data is simple to analyze, visualize, and share. Real-time data analysis provided by the smart digital census enables quicker decision-making and adaptation to change demographics. Traditional census procedures take several months to process the data, and by the time the data is analyzed, it cannot be useful anymore.

4.3 Future of Smart Digital Census

The application of cutting-edge technology like artificial intelligence, blockchain, and the Internet of Things will define the future of smart digital censuses (IoT). With less possibility for fraud and error, this will result in data collecting that is more accurate and efficient. People will be able to participate from the comfort of their own homes, making the procedure quicker, safer, and less intrusive. Personal data will be protected by using digital identity verification and encryption. A sophisticated digital census will also enable real-time data analysis, giving decision-makers and resource managers useful information. A more effective planning and governance process will be facilitated by integrating smart digital census with other government systems. Overall, the future of smart digital census will bring about a more informed and empowered society.

4.3.1 AI-Powered Data Collection

The digital census is a cutting-edge method of data collection and processing that makes use of artificial intelligence (AI) technologies. The data collection procedure will be automated by using AI algorithms, improving its accuracy

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 12 Issue: 2
***Article Received:** 25 November2023 **Revised:** 12 December 2023 **Accepted:** 30 January 2024*

and efficiency. As the data is analyzed and processed by AI algorithms, the likelihood of human error is decreased. When conducting a census using traditional methods, data is gathered from respondents by human operators. This procedure takes a lot of time and is prone to human mistakes. Because AI algorithms will examine and process the data in real time and decrease the likelihood of data entry errors, using them in the digital census will dramatically reduce the likelihood of human error. Furthermore, real-time data analysis will be possible thanks to AI algorithms, which will make it simpler for the authorities to see any trends or patterns in the data. As a result, the accuracy of the census data will be increased, and it will be easier to make judgments based on acquired data. Due to AI algorithms' ability to quickly handle vast amounts of data, the digital census will also speed up the data collection process. As a result, it will take less time to collect and analyze data, giving authorities quicker access to the information they need to make judgments. In summary, the use of AI algorithms in the digital census will greatly increase the precision, efficiency, and speed of data collection. Reducing human error and the ability to analyze the data in real time will make the digital census a more reliable and effective tool for collecting and processing data.

4.3.2 Census Through Metaverse Technology

As a result of technological breakthroughs, people will be able to participate in the census in the future from the comfort of their own homes by employing Metaverse technology. The term "metaverse technology" describes a virtual world or environment that resembles the actual world but runs on a platform created by computers. This makes it possible for citizens to take part in the census in a way that is more effective and practical. Using Metaverse technology, the census will be carried out online without the use of paper forms or census takers. The census can be completed by citizens using computers, laptops, or mobile devices, and the information will be electronically gathered and saved. Not only will this save time and money, but it will also improve accessibility for people with mobility, accessibility, or language problems. The use of metaverse technology will improve the census process' accessibility and convenience while also offering a more private and secure platform for data collection. In order to protect the privacy and confidentiality of the citizens, the acquired data will be encrypted and stored securely. In summary, the employment of Metaverse technology in the census offers citizens a more effective, practical, and secure way to take part in the survey. It does away with the requirement for paper forms and census takers, making the procedure more readily available and practical for everyone.

4.3.3 Data Security Through Blockchain Technology

A contemporary method for gathering and storing population data is a digital census. The traditional census procedure will experience a new degree of security, transparency, and immutability thanks to the usage of blockchain technology.

Security: Data storage is made secure and decentralized via blockchain technology. As each block in the chain is encrypted, it is challenging for outsiders to access or alter the data. Sensitive data from the digital census will be kept secure and safeguarded from cyberattacks by being stored on the blockchain along with personal information and identification.

Transparency: The blockchain enables a system that is transparent and auditable. As a result, there can be a high degree of confidence in the accuracy of the data since it is simple to verify and audit the information gathered during the digital census. By doing this, the census process can be made more secure against fraud and other kinds of manipulation.

Immutability: Since the information on the blockchain is immutable, it cannot be changed or removed after it has been recorded. For the data to remain accurate over time, this is crucial. For many years to come, it will be possible to access and evaluate the digital census data, which will give important insights into population patterns and demographics.

Overall, employing blockchain technology in the digital census will assist in guaranteeing the security, openness, and immutability of the information gathered. As a result, there will be an improved supply of demographic data that can be utilized for a variety of tasks, such as planning and decision-making, formulating policies, and conducting research.

4.3.4 Digital Census Through Mobile Application

A cutting-edge and creative method of gathering demographic data is the digital census. Using mobile technology is crucial for successful and economical data collection due to the rising popularity and accessibility of mobile devices. A mobile-based application will be used to access the digital census, making it considerably simpler for people to participate and giving them a convenient way to submit information about themselves and their families. One of the main advantages of a digital census is that it saves money by eliminating the need for paper-based forms. When conducting a census on paper, there are significant costs associated with printing, distributing, and collecting forms. Particularly for nations with huge populations, this can be a substantial financial burden. A digital census, on the other hand, may be completed on a vast scale for very little money, making it more effective. No of their level of technical expertise, everyone will be able to utilize and access the digital census. The application will be easy to use and come with detailed directions for completing the forms. This will guarantee that everyone, even those who are not tech-savvy, can take part in the census. The program will also be accessible to users from a variety of linguistic backgrounds thanks to its availability in several languages. A computerized census will also give a more precise and thorough picture of the population. This is so that a variety of data, such as demographic data, economic situation, educational background, and health status, can be collected using the program. Following that, choices concerning the demands of the people and the efficient use of resources can be made using this knowledge.

4.3.4 Real-Time Census Data Analysis

A contemporary and cutting-edge way of gathering and processing population data is the digital census. The digital census allows for real-time data analysis, so the results may be utilized to make informed decisions almost instantly. This

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 12 Issue: 2
***Article Received:** 25 November2023 **Revised:** 12 December 2023 **Accepted:** 30 January 2024*

is in contrast to traditional census methods, which are frequently time-consuming, expensive, and out of date by the time they are finished. The digital census uses digital tools and technology to collect and process data from a variety of sources, including online surveys, mobile applications, and geographic information systems. As a result, the population can be represented in a more thorough and precise manner, and the data collection process is made more effective. Policymakers and planners may immediately spot trends and patterns in the population and react to changing situations as they happen, thanks to the real-time data analysis provided by the digital census. In emergency situations, where prompt decision-making is essential, this can be very helpful. For instance, the digital census can be used to swiftly pinpoint the regions most affected by a natural disaster and distribute resources there.

4.3.5 Machine Learning-Powered Data Interpretation

The digital census is a cutting-edge method for gathering and analyzing data that makes use of the capabilities of machine learning algorithms to compile and analyze data on demographics and behavior. The information gathered from the digital census can be utilized to shed light on patterns, trends, and projections that are essential for making well-informed decisions. Data will be gathered for the digital census from a variety of platforms, including social media, online polls, and other digital ones. Then, using machine learning algorithms, this data will be analyzed to find patterns, trends, and correlations. This data will be used by the algorithms to forecast future trends and give an understanding of the characteristics and behavior of the population under study.

4.3.6 Voice Activated Interface in Digital Census

The digital census is a cutting-edge method of gathering data about a population. Everyone, including people with disabilities or low computer proficiency, can use it because of its universal design. The census can now be taken via voice-activated interfaces like Amazon Alexa or Google Home, making it simpler for everyone to participate. Those with impairments who might have trouble using a computer or keyboard can easily complete the census by using voice-activated interfaces. They only need to utilize their voice to respond to inquiries and impart knowledge. As a result, they won't have to fight to type or navigate a challenging website. Likewise, even those with little computer experience might benefit from the digital census. They can avoid worrying about completing paperwork or navigating a challenging website by using voice-activated interfaces. Because of how easily they can submit the necessary information thanks to the streamlined process. Also, even those who do not speak English well can access the digital census. People can participate in the census in their native tongue thanks to voice-activated interfaces that can be trained to recognize a variety of languages. This guarantees that everyone has equal access to the census and is free to participate. In short, there are numerous benefits to the digital census, particularly for people with disabilities or little computer skills. With the advent of voice-activated interfaces like Amazon Alexa or Google Home, anyone, regardless of ability, may now take the census. This is a critical step in ensuring that everyone can access crucial information and take part in the census.

4.3.7 Geolocation-based Technology in Digital Census

GPS, Wi-Fi triangulation, and cell tower triangulation are all used in geolocation-based technology to pinpoint the location of a person or object. The accuracy and thoroughness of census data collection can be considerably increased by incorporating this technology into the digital census. Using geolocation technology has many advantages, one of which is the ability to gather real-time data. Conventional census procedures, which can be labor-intensive and prone to inaccuracy, rely on paper-based questionnaires or door-to-door visits to gather data. Census takers can rapidly and precisely determine a person's position by employing geolocation technology, ensuring that the information gathered is current and pertinent. Geolocation technology can also aid in locating regions with low response rates and precisely focusing follow-up visits there. Especially in areas that are normally underrepresented in census data, such as rural areas or areas with low levels of education, this can result in a more thorough and accurate count of the population. Geolocation technology also enables more precise population and demographic statistics. The census can collect information on population density, age, gender, and other demographics by pinpointing a person's exact location. Governments and organizations must have access to this data in order to plan effectively and allocate resources.

5 CONCLUSION

In conclusion, the smart digital census is a cutting-edge, effective, and economical method of gathering information on people and households. It is a better alternative to traditional census methods because of its use of digital technology, which also improves the data quality and accessibility. The use of smart digital census is anticipated to rise in popularity over the next several years as technology continues to progress. Compared to conventional census methodologies, the smart digital census has a number of benefits. These benefits include improved responsiveness, cost-effectiveness, speed, and accuracy, as well as real-time data processing. The smart digital census is expected to overtake other methods of gathering and processing census data in the future as a result of ongoing technological improvements. Compared to conventional census methodologies, the smart digital census has a number of benefits. Because it makes use of digital tools, technology, and data, the census process is more precise, effective, and inclusive, which facilitates better policy planning and decision-making. Future population data collection and analysis will probably favor the smart digital census due to the ongoing development of digital technology. The idea of a "Smart Digital Census" has the potential to alter how population data is gathered and handled completely. Its benefits, such as improved data quality, cost-effectiveness, higher efficiency, and expanded accessibility, make it a useful tool for population control and planning. Future population management will become more and more dependent on smart digital censuses as technology and digital

devices continue to advance. The concept of a Smart Digital Census holds immense potential for modern-day population management, providing valuable insights and enabling better decision-making. It represents a significant step forward in the evolution of the census process and is set to play a vital role in shaping the future of population management.

6 ACKNOWLEDGEMENT

The research work of this article was supported by Zuly Qodir from the University of Muhammadiyah Yogyakarta. The researcher would like to express his immense gratitude to his supporters who have provided all necessary insight and expertise for assistance in this research.

7 FINDING

The authors of the paper reported that there is no funding associated with the work featured in the article.

8 CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Bahrami, B., Frith, C., Didino, D., Butterworth, B., & Rees, G. (2013). Collective enumeration. *Journal of Experimental Psychology: Human Perception and Performance*, *39*(2), 338–347. https://doi.org/10.1037/a0029717
2. Burgstahler, K., Isidro, J., Van Vuren, D. H., Collins, A. C., Aliperti, J. R., & Wells, C. P. (2023). Daily roadkill monitoring and long-term population census reveal female-biased mortality for small mammals along a wildland-urban interface. *Biological Conservation*, *277*. https://doi.org/10.1016/j.biocon.2022.109863
3. Collins, W. G., & El-Beik, A. H. A. (1971). POPULATION CENSUS WITH THE AID OF AERIAL PHOTOGRAPHS: AN EXPERIMENT IN THE CITY OF LEEDS. *The Photogrammetric Record*, *7*(37), 16–26. https://doi.org/10.1111/j.1477-9730.1971.tb01124.x
4. Counting people: Census sensitivity. (2007). *Economist*, *385*(8560). https://www.scopus.com/inward/record.uri?eid=2-s2.0-74949120970&partnerID=40&md5=5e8b602645ed21e3e2c92425b444cfbc
5. Demirci Meryem (2020), United Nations Statistics Division Programme in Support of the 2020 Round of Population and Housing Censuses and Civil Registration and Vital Statistics, United Nations Statistics Division, retrieved from: https://www.unescap.org/sites/default/files/Session 2 Programme support 2020 Rou nd Population Housing Censuses UNSD-Workshop SDG PHC CRVS.pdf.
6. Farley, R., & Haaga, J. (2005). The American people: Census 2000. In *The American People: Census 2000*. Russell Sage Foundation. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84885606354&partnerID=40&md5=3412b55ed0f1c86868767777b56c7cf9
7. Farzanegan, M. R., Gholipour, H. F., & Javadian, M. (2023). Air pollution and internal migration: evidence from an Iranian household survey. *Empirical Economics*, *64*(1), 223–247. https://doi.org/10.1007/s00181-022-02253-1
8. Guidelines on the use of electronic data collection technologies in population and housing censuses (2019), Department of Economic and Social Affairs, retrieved from: https://unstats.un.org/unsd/demographic/standmeth/handbooks/data-collection-census201901.pdf
9. Kim, S. S., Kim, Y. J., Park, J. S., Ho, S. H., Kweon, H., & Bae, Y.-H. (2022). A comparative analysis of the work environments for registered nurses, nurse aides, and caregivers using the 5th Korean Working Conditions Survey. *BMC Nursing*, *21*(1). https://doi.org/10.1186/s12912-022-01120-9
10. Lacy, L. W., & Byrd, R. (2009). Supporting multiple equipment enumeration approaches in the military simulation description language (MSDL). *Spring Simulation Interoperability Workshop 2009*, 33–40. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84865511395&partnerID=40&md5=81a833d3b78ce0cc4a70ad76369740bf
11. Liu, T., Zhuo, Y., Peng, R., & Cao, G. (2022). Urban-rural population change and the regional types evolution of China's urbanization. *Dili Xuebao/Acta Geographica Sinica*, *77*(12), 3006–3022. https://doi.org/10.11821/dlxb202212005
12. Marks, E. S., & Mauldin, W. P. (1950). Response Errors in Census Research. *Journal of the American Statistical Association*, *45*(251), 424–438. https://doi.org/10.1080/01621459.1950.10501134
13. Šanda, R. (2022). THE USE OF ADMINISTRATIVE DATA SOURCES IN POPULATION CENSUSES WITH A FOCUS ON THE CZECH 2011 CENSUS. *Demografie*, *64*(2), 106–123. https://doi.org/10.54694/DEM.0298
14. Semina, A. E., & Maximova, S. V. (2019). Digital census of Upper Kama towns architectural and urban environment. *International Conference on Construction, Architecture and Technosphere Safety 2019, ICCATS 2019*, *687*(5). https://doi.org/10.1088/1757-899X/687/5/055051
15. Si Youcef, K., Boukerch, I., Hocine, I., & Benabdelkader, A. (2021). The setting up of a gis for the general population and housing census. In P. N., M. C., L. F., Y. M.Y., Z. S., D. S., S. G., A. G., A. J.J., B. P., B. M., B. M.A., C. S., C. A., D. M.R., A. D. M., G. E., F. C.C., H. J., … Z. X.G. (Eds.), *24th*

ISPRS Congress on Imaging Today, Foreseeing Tomorrow, Commission IV (Vol. 43, Issues B4-2021, pp. 313–319). International Society for Photogrammetry and Remote Sensing. https://doi.org/10.5194/isprs-archives-XLIII-B4-2021-313-2021

16. Stokes, Rose. (2020), The implications of the first digital census, Raconteur, December 2, retrieved from: https://www.raconteur.net/public-sector/implications-digital-census/
17. Thieme Michael (2019), Considering a Digital 2020 Census, U.S. Census Bureau, retrieved from: https://nces.ed.gov/FCSM/pdf/Thieme_2012FCSM_IV-B.pdf
18. United Nations Statistics Division (2020), Report on the results of the UNSD survey on 2020 round population and housing censuses, March 6, retrieved from: https://unstats.un.org/unsd/statcom/51st-session/documents/BG-Item3j-Survey-E.pdf
19. Wakhariya, J., Gangrade, P., & Manekar, A. (2019). Mahaganana: An Approach to a Smart Census in India. In P. S.B. & N. D.D. (Eds.), *1st International Conference on Innovative Trends and Advances in Engineering and Technology, ICITAET 2019* (pp. 166–169). Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/ICITAET47105.2019.9170251
20. Wang, Y., Li, H., Yu, Z., & Luo, B. (2012). Approaches to census mapping: Chinese solution in 2010 rounded census. *Chinese Geographical Science*, *22*(3), 356–366. https://doi.org/10.1007/s11769-012-0540-2
21. Zachary, Schwartz. (2020), U.S. Census Bureau: Digital transformation of the 2020 Census, September 23, retrieved from: https://www.pega.com/customers/us-census-bureau-digital-platform
22. Zhou Youyou (2019), Ghana is betting on a digital census in 2020 to transform its informal economy, Quartz Africa, retrieved from: https://qz.com/africa/1630207/howghana-conducts-its-2020-digital-census/