

## The Role of Technology and Industry 4.0 in Enhancing Digital Connectivity, Local Economic Development, and Human Resource Quality in the Digital Era in Gorontalo City

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### Abstract

*The digital economic transformation and the implementation of Industry 4.0 have become a primary urgency in accelerating regional development, particularly in enhancing digital connectivity, local economic development, and the quality of human resources (HR) in the digital era. This study aims to analyze the role of technology and Industry 4.0 in driving digital-based economic progress in Gorontalo City and to evaluate its effectiveness in three main aspects: digital connectivity, local economy, and HR strengthening. Using a mixed-method approach with an explanatory design, data were collected through questionnaires, observations, documentation, and focus group discussions (FGD) from 20 respondents consisting of local government agencies (OPD), the public, and relevant stakeholders. The analysis was conducted using the Importance-Performance Analysis (IPA) method and the qualitative technique of the Miles & Huberman model. The results show that the impact of technology on the local economy and digital connectivity was deemed quite effective, although improvements are still needed, particularly in infrastructure and access equity. Meanwhile, the strengthening of HR and digital skills-based employment is still categorized as less effective and remains a top priority for improvement. Therefore, it is recommended that the government expand digital training, strengthen cross-sector partnerships, and promote inclusive policies to ensure that digital transformation progresses equitably and sustainably.*

**Keywords:** Economic Transformation; Industry 4.0; Local Economy; Digital Connectivity; Human Resources



## **INTRODUCTION**

The transformation of technology in the current digital era has become a key factor driving significant changes in the economic and industrial structure worldwide, including in Indonesia. Industry 4.0, which focuses on automation, the Internet of Things (IoT), and information technology, offers new opportunities to improve the efficiency and competitiveness of the local economy, particularly in cities like Gorontalo. Wibowo et al. emphasize that digital transformation can accelerate economic growth if well integrated, but it can also become a barrier if not managed properly (Wibowo et al., 2024). Therefore, understanding and implementing this technology is crucial to optimizing local economic growth in Gorontalo.

Better connectivity through digital infrastructure is a key element in facilitating this change. Initiatives to develop more comprehensive digital infrastructure, as explained in Strilchuk et al.'s research, can provide greater access for communities and business sectors to utilize digital technology (Strilchuk et al., 2024). Without adequate infrastructure, investments in information and communication technology (ICT) will be hindered, and the positive impact on the local economy cannot be maximized (Mirolyubova & Radionova, 2020). Therefore, this study focuses on analyzing how digital connectivity plays a role in enhancing local economic development and quality of life.

Rapid digital transformation also significantly impacts human resources (HR) in the region. In this context, it is essential not only to improve access to technology but also to enhance digital skills among the community to contribute effectively in a market that increasingly prioritizes technology. Marku notes that to face the challenges posed by Industry 4.0, investment in HR development and digital skills enhancement is essential (Marku, 2024). This aligns with the challenges faced by many countries, including Indonesia, in preparing the workforce for the digital era.

The COVID-19 pandemic has also accelerated the adoption of digital technology across various sectors, including in Gorontalo. Research by Ha and Chuah shows that Southeast Asian countries experienced a surge in the use of digital platforms to facilitate interactions and transactions (Ha & Chuah, 2023). This transformation has created opportunities for MSMEs, which are a vital sector of the local economy, to grow by utilizing digital technology and online platforms to expand their markets. Therefore, analyzing this shift is essential in the context of the influence of digital technology and local economic development in Gorontalo.

The growing role of digitalization also has implications for the development of entrepreneurship in the creative economy. Cahyani et al. emphasize the importance of innovation in creating products and services that meet the needs of society in the digital context (Cahyani et al., 2023). The digital economy has provided greater access for entrepreneurs in Gorontalo, who can leverage technology to develop local products and



enhance their competitiveness. This calls for further research on how digital technology can be optimally utilized by small and medium-sized enterprises (SMEs).

The interconnection between digital infrastructure development and government policies cannot be overlooked. In the study by Priambodo et al., it was found that government support in terms of regulation and policy initiatives plays a crucial role in driving regional economic growth through digitalization (Priambodo et al., 2025). Proactive policies can create better opportunities for the population to access the necessary technology and training, improving adaptability in the ever-changing labor market. This research aims to understand how such policies are applied in Gorontalo and their impact on the population.

HR quality is a determining factor in the successful implementation of digital technology in the Industry 4.0 era. Zhang et al. identify that small and medium-sized enterprises (SMEs) that undergo digital transformation will have a better competitive advantage in an increasingly competitive market (Zhang et al., 2022). Therefore, improving skills and basic education among the people of Gorontalo becomes essential to help them compete in the advanced digital economy. This is a focus of the study to understand the supporting and hindering factors in the development of HR that can adapt to technological advancements.

In addition to the economic aspect, digitalization also contributes to addressing the social challenges faced by society. As explained by Kustanto, in the context of Indonesia, unequal access to technology can worsen economic inequality (Kustanto, 2024). Focus on the development of technological infrastructure, as well as digital skills training, becomes an integral part of ensuring that all layers of society in Gorontalo, including the underprivileged, can benefit from this change. This study is crucial to address how to bridge this digital gap.

This research aims to explore the impact of improving HR quality, digital connectivity, and local economic development in technology and Industry 4.0. In this case, the opportunities provided by digitalization must be balanced with adequate training for HR, so that innovations and new business models can emerge that are more adaptive and responsive to market needs. This study seeks to provide an in-depth analysis of (1) the impact of technology, digital transformation, and Industry 4.0 on local economic development as well as the improvement of digital connectivity and infrastructure; (2) the enhancement of human resources (HR) and employment through strengthening digital skills and access to technology-based economic opportunities.



## LITERATURE REVIEW

### Concept and Implications of Industry 4.0

Industry 4.0 is a new paradigm that integrates digital technology with production processes, changing the way industries operate. This concept includes the use of artificial intelligence, the Internet of Things (IoT), and big data, all of which aim to create more efficient and responsive production systems (Barykin et al., 2020). In this context, there are significant implications for human resources, where the demand for new skills to operate advanced technologies has increased dramatically (Snopenko et al., 2021). Additionally, Industry 4.0 can accelerate product and service innovation, creating added value for companies and enhancing customer satisfaction (Varshney et al., 2022). Thus, the transition to Industry 4.0 requires collaboration among various disciplines, government policies, and support from the education sector to create a competent workforce ready to face future challenges (Chernyaev et al., 2022).

### Digitalization and Connectivity as a New Economic Infrastructure

Digitalization and connectivity have become the new foundation for the global economy. Digital infrastructure such as broadband and 5G networks not only supports business growth but also expands market access and improves operational efficiency (Lynn et al., 2022). In this context, providing equitable digital services across various segments of society is crucial to reducing economic disparities and increasing participation in the digital economy (Salminen & Hossain, 2018). As digital technology evolves, companies can access data and analytics in real-time, enabling faster and more informed decision-making (Grinin et al., 2016). Furthermore, digitalization drives innovation in business models, such as e-commerce and application-based services, which not only create new jobs but also provide opportunities for sustainable local economic growth (Roos et al., 2021).

### Local Economy in the Digital Era

The digital era has significantly changed the dynamics of the local economy. Digitalization has opened opportunities for small entrepreneurs to market their products to a broader audience through online platforms, thus enhancing their competitiveness (Yohanitas, 2025). The application of digital technology in local contexts can create new jobs and stimulate regional economic growth (Folorunsho et al., 2024). However, the main challenge faced is the varying readiness of digital infrastructure in each region, which can affect access to technology and learning services (Vokony et al., 2024). Moreover, digital inequality may arise if digital education and training are not expanded equitably, threatening the inclusivity of the local economy (Vokony et al., 2024). Therefore, synergy between the government, private sector, and local communities is necessary to optimize



the potential of the digital economy and ensure the participation of all parties in this transition (Chernyaev et al., 2022).

### **Human Resource (HR) Development in the Technology Era**

In the rapidly developing technology era, human resource (HR) development is a key factor in achieving competitive advantage. Human resources must be effectively managed to meet the demands of a constantly changing market, especially in the field of information and communication technology (Korder et al., 2024). Training and educational programs focusing on digital skill enhancement are essential to prepare a workforce capable of competing in the global market (Varshney et al., 2022). Additionally, with the adoption of automation and digital technology across various sectors, companies are expected to create flexible and innovative work environments where HR are involved in decision-making and product development (Barykin et al., 2020). Investment in skill development will not only increase productivity but also empower HR to adapt to technological changes and leverage opportunities offered by the digital era (Snopenko et al., 2021).

### **METHODOLOGY**

The research location is in Gorontalo City, with the target subjects being local government agencies (OPD) in Gorontalo City, the community, and other relevant stakeholders, totaling 20 individuals. The research will be conducted in 2025. This study uses a Mixed Method research approach. Mixed Method is a research approach that combines qualitative and quantitative approaches with a specific design to answer research objectives. In this study, the Mixed Method is aligned with the explanatory design method, where the main quantitative results are then supported by qualitative results.

Data collection in this study will involve questionnaires, observations, documentation, and Focus Group Discussions (FGD). The data analysis used will be Importance Performance Analysis (IPA), which is an approach on a graph that shows the importance of various attributes with the performance of a company or product through the use of a matrix. Importance scores and performance scores will be plotted on a matrix consisting of four different quadrants: main priority, low priority, maintain performance, and excessive.

The analysis will then continue with qualitative analysis using the Miles and Huberman model, which includes data reduction, data display, and conclusion drawing/verification activities. The processes of data collection, data reduction, and verification/conclusion are cyclical processes that occur simultaneously and interact with each other.

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**RESULTS AND DISCUSSION**

The digital era has brought about a major transformation in various aspects of life, including urban development and the improvement of human resource quality. Gorontalo City, as one of the developing cities in Indonesia, has great potential to leverage technology and the principles of Industry 4.0 to accelerate digital connectivity, drive local economic growth, and enhance the competence of its community. Through the utilization of technologies such as the Internet of Things (IoT), artificial intelligence (AI), and data-based systems, Gorontalo City has the opportunity to develop an inclusive and adaptive digital ecosystem that responds to global changes. Therefore, the involvement of various parties, ranging from the local government, society, to business actors, is crucial in ensuring that digital transformation can proceed in a directed and sustainable manner for the common good.

**Impact of Technology, Digital Transformation, and Industry 4.0 on Local Economic Development and Improvement of Digital Connectivity and Infrastructure**

The Importance Performance Analysis (IPA) method is a data analysis technique used to evaluate the performance of products, services, or various policies based on two main dimensions: importance and performance. The performance results for the impact of technology, digital transformation, and Industry 4.0 on local economic development and the improvement of digital connectivity and infrastructure in Gorontalo City are presented in the table below:

**Table 1: Results of the Effectiveness Analysis of the Impact of Technology, Digital Transformation, and Industry 4.0 on Local Economic Development and the Improvement of Digital Connectivity and Infrastructure**

| No. | Statement             |                   |           |                        | Indicator |                                        |
|-----|-----------------------|-------------------|-----------|------------------------|-----------|----------------------------------------|
|     | Performance (Reality) | Importance (Hope) | Reach (%) | Effectiveness Criteria | Reach (%) | Effectiveness Criteria                 |
| 1   | 49.00                 | 57.00             | 85.96     | Quite Effective        | 80.85     | Quite Effective (Maintain Achievement) |
| 2   | 47.00                 | 59.00             | 79.66     | Less Effective         |           |                                        |
| 3   | 47.00                 | 58.00             | 81.03     | Quite Effective        |           |                                        |
| 4   | 48.00                 | 60.00             | 80.00     | Quite Effective        |           |                                        |
| 5   | 45.00                 | 58.00             | 77.59     | Less Effective         |           |                                        |
| 6   | 48.00                 | 60.00             | 80.00     | Quite Effective        | 80.11     | Quite Effective (Low Priority)         |
| 7   | 43.00                 | 58.00             | 74.14     | Less Effective         |           |                                        |
| 8   | 44.00                 | 55.00             | 80.00     | Quite Effective        |           |                                        |
| 9   | 48.00                 | 56.00             | 85.71     | Quite Effective        |           |                                        |
| 10  | 46.00                 | 57.00             | 80.70     | Quite Effective        |           |                                        |



|       |        |        |       |                 |
|-------|--------|--------|-------|-----------------|
| Total | 465.00 | 578.00 | 80.45 | Quite Effective |
|-------|--------|--------|-------|-----------------|

Source: Processed Data, 2025

Meanwhile, the follow-up steps based on the IPA analysis are presented in the figure below:

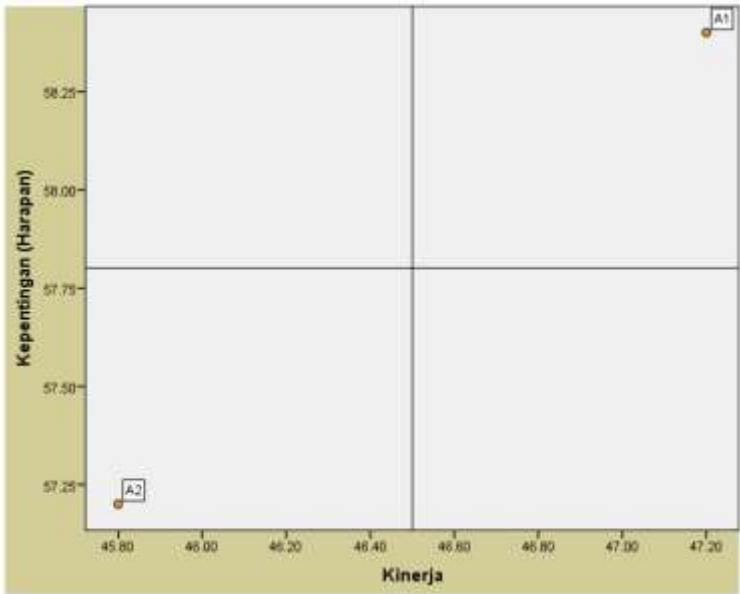


**Figure 1: Results of Importance Performance Analysis (IPA) on the Impact of Technology, Digital Transformation, and Industry 4.0 on Local Economic Development and the Improvement of Digital Connectivity and Infrastructure**

Based on the IPA analysis figure above, the results indicate that:

**1. Impact of Technology and Digital Transformation on Local Economy**

The analysis results show that the impact of technology, digital transformation, and Industry 4.0 on local economic development in Gorontalo City falls into the category of quite effective. This indicates that the implementation of modern technology and digitalization has contributed positively to driving local economic growth, although there is still room for improvement and optimization. Digital technology has helped accelerate business processes, improve operational efficiency, and open up wider market access for local entrepreneurs. With digitalization, MSMEs in Gorontalo City can leverage e-commerce platforms to expand their marketing reach, while the creative economy sector benefits from technology-based innovations. However, the "adequate" level of effectiveness indicates that there are still challenges, such as limited human resource capacity, uneven digital infrastructure, and the need to improve digital literacy. Therefore, to achieve a higher level of effectiveness, a



comprehensive strategy is needed that includes digital HR development, improved technology access, and collaboration between the government, private sector, and local communities.

The adequate effectiveness of digital transformation in Gorontalo City also reflects the success of some digitalization programs that have been implemented, such as the adoption of technology in public services and the development of an innovation ecosystem. Several local economic sectors have begun to show productivity improvements through the use of automation technologies and data-based information systems. However, challenges in the widespread dissemination of technology and resistance to digital change among certain segments of society remain key obstacles. To address this, proactive steps are needed, such as expanding digital literacy training for MSMEs and local communities and accelerating the implementation of policies that support technology investments in the local economy sector. With strong commitment from various stakeholders, Gorontalo City has great potential to enhance the effectiveness of digital transformation and maximize its impact on local economic development.

Based on the Importance Performance Analysis (IPA), the impact of technology, digital transformation, and Industry 4.0 on local economic development in Gorontalo City falls under the "Maintain Achievement" category. This indicates that digital technology and industrial innovation have been considered highly important in driving economic growth, and the current performance level is satisfactory. This success reflects the local government's efforts to promote digitalization in the economic sector, such as facilitating access to technology for entrepreneurs, supporting startup incubation programs, and utilizing technology to improve public service efficiency. With high performance already achieved, it is important to ensure the continuity and sustainability of the various ongoing digital initiatives. The next step is to maintain the successful programs, expand the scope of digital transformation to sectors not yet covered, and continuously monitor technological developments to adopt new innovations relevant to the needs of the local economy.

In addition to maintaining achievements, it is also important to identify areas requiring strengthening to sustain the momentum of technology-based economic growth. One strategic step is to strengthen collaboration between the government, private sector, and communities to develop an inclusive and sustainable innovation ecosystem. Digital training programs and technical assistance for MSMEs need to be expanded to ensure all local economic actors have access to and the ability to utilize technology. Furthermore, periodic monitoring of the performance and impact of digital transformation should be carried out to identify opportunities for improvement and future innovation. By maintaining commitment to the development of technology and



digital transformation, Gorontalo City can maintain its competitive edge and become a hub for innovation-based economic growth.

## 2. Improvement of Connectivity and Digital Infrastructure

The analysis results show that the effectiveness of the improvement of connectivity and digital infrastructure in Gorontalo City falls under the category of quite effective. This indicates that although efforts to build digital infrastructure have had a positive impact on the economy and public services, several barriers remain that reduce its overall effectiveness. The improvement of internet access and communication infrastructure has opened opportunities for local entrepreneurs to utilize digital technology in developing their businesses. Additionally, the digitalization of public services has begun, allowing for faster and more efficient access for the community. However, connectivity limitations in certain areas and the uneven distribution of digital infrastructure pose challenges that need to be addressed. To further improve effectiveness, there needs to be continued investment in technological infrastructure, particularly in areas that have not yet optimally received digital services.

Although there has been progress in digital infrastructure, the effectiveness still being at the "adequate" level indicates that there is a need to expand coverage and improve the quality of digital services. Major challenges include limited access in peripheral areas, inconsistent internet speeds, and a lack of supporting advanced technology facilities in education and business sectors. To improve effectiveness, strategies can include accelerating the development of digital infrastructure, collaborating with internet service providers, and providing public Wi-Fi access in strategic areas. Additionally, digital literacy programs for the community need to be promoted so that all groups can optimally utilize the available infrastructure. By strengthening connectivity and digital infrastructure, Gorontalo City can create an environment conducive to innovation, digital economic growth, and technological inclusion in various sectors.

Based on the Importance Performance Analysis (IPA), the improvement of connectivity and digital infrastructure in Gorontalo City falls into the "low priority" category, indicating that although this aspect is important to support digital transformation, its performance is still suboptimal and requires further attention. This condition indicates that limitations in digital infrastructure, particularly in rural or peripheral areas, are the main obstacles to extending the benefits of technology to the entire population. To improve performance in this area, long-term planning needs to focus on building evenly distributed communication networks, enhancing technological capacity, and providing community-based digital services. These efforts



may involve public-private partnerships to accelerate investments in the technology sector and ensure fair access for all societal layers.

The "low priority" category also highlights the need for policy improvements to support digital infrastructure in Gorontalo City. The government needs to adopt a more proactive approach in building modern and sustainable digital infrastructure, including expanding internet network coverage in remote areas and improving speed and connection stability. Furthermore, collaboration with the private sector becomes essential to accelerate development and drive technological innovation. By increasing focus on this area, Gorontalo City can not only improve digital connectivity performance but also strengthen the foundation for technology-based economic transformation in the future, ensuring that every citizen has access to digital opportunities fairly and sustainably.

Technology, digital transformation, and Industry 4.0 have a significant impact on local economic development in Gorontalo City. The implementation of modern technology and digitalization plays a role in improving operational efficiency and creating new opportunities for entrepreneurs, especially MSMEs. Digitalization allows MSMEs to expand their market reach through e-commerce, while the creative economy sector gains wider access to innovation. However, the effectiveness being at the "adequate" level indicates that challenges such as limited human resource capacity and uneven digital infrastructure need to be addressed. Previous studies have highlighted the importance of digital literacy and training to ensure that human resources can adapt to changes and effectively integrate technology into businesses (Pambudi et al., 2024; Hamsal et al., 2024; KUSDARDJANTO et al., 2025; HULU & WARUWU, 2025). Other studies also emphasize the need for collaboration between the government and the private sector to develop technology-based training programs to better prepare MSME actors for the challenges of digitalization (Rosyadi et al., 2025; Usman et al., 2025). By utilizing the results of this Importance Performance Analysis (IPA), it is expected that Gorontalo City can optimize strategies and actions, as well as strengthen an inclusive digital ecosystem to further drive economic growth.

The research results on the improvement of connectivity and digital infrastructure in Gorontalo City show "adequate" effectiveness, reflecting progress but still facing challenges. The improvement of digital infrastructure has had a positive effect on entrepreneurs and public services, but limitations in distribution and internet access speed, especially in remote areas, remain. As stated in the literature, addressing technology infrastructure evenly and sustaining investments will significantly affect achieving optimal digital connectivity (Susilawati et al., 2023; Della & Frinaldi, 2024). Collaboration between the government and the private sector in infrastructure



development is crucial to ensuring better access for the community (Alam et al., 2023). Additionally, challenges such as resistance to change and low digital literacy in society need to be addressed with effective training programs, in line with research recommendations that highlight the enhancement of digital skills as a means of empowering the community to maximize the benefits of existing infrastructure (Ferdiansyah & Setiawan, 2024; Pujiati et al., 2023). Thus, Gorontalo City needs to focus on policy improvements and infrastructure updates with a more inclusive approach to ensure that everyone can benefit from this digital transformation.

**Improvement of Human Resources (HR) and Employment through Strengthening Digital Skills and Access to Technology-Based Economic Opportunities**

The Importance Performance Analysis (IPA) is a method used to evaluate the level of importance and performance of an attribute or service. This technique helps identify priority areas for improvement by mapping the results in four quadrants on a diagram. The performance results for the effectiveness of the improvement of human resources (HR) and employment through strengthening digital skills and access to technology-based economic opportunities in Gorontalo City are presented in the table below:

**Table 2: Results of the Effectiveness Analysis of the Improvement of Human Resources (HR) and Employment through Strengthening Digital Skills and Access to Technology-Based Economic Opportunities**

| No.   | Statement             |                   |           |                        | Indicator |                                 |
|-------|-----------------------|-------------------|-----------|------------------------|-----------|---------------------------------|
|       | Performance (Reality) | Importance (Hope) | Reach (%) | Effectiveness Criteria | Reach (%) | Effectiveness Criteria          |
| 1     | 38.00                 | 53.00             | 71.70     | Less Effective         | 70.46     | Less Effective (Top Priority)   |
| 2     | 38.00                 | 54.00             | 70.37     | Less Effective         |           |                                 |
| 3     | 37.00                 | 54.00             | 68.52     | Less Effective         |           |                                 |
| 4     | 38.00                 | 52.00             | 73.08     | Less Effective         |           |                                 |
| 5     | 35.00                 | 51.00             | 68.63     | Less Effective         |           |                                 |
| 6     | 34.00                 | 53.00             | 64.15     | Less Effective         | 74.42     | Less Effective (Not A Priority) |
| 7     | 39.00                 | 54.00             | 72.22     | Less Effective         |           |                                 |
| 8     | 43.00                 | 54.00             | 79.63     | Less Effective         |           |                                 |
| 9     | 38.00                 | 48.00             | 79.17     | Less Effective         |           |                                 |
| 10    | 40.00                 | 52.00             | 76.92     | Less Effective         |           |                                 |
| Total | 380.00                | 525.00            | 72.38     | Less Effective         |           |                                 |

Source: Processed Data, 2025

Meanwhile, the follow-up actions based on the IPA analysis are presented in the figure below:



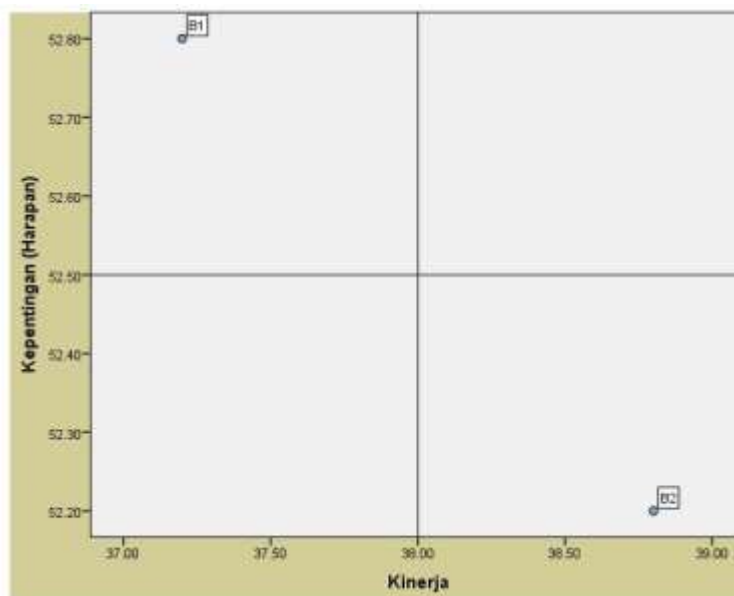


**Figure 2: Results of Importance Performance Analysis (IPA) on the Effectiveness of Improving Human Resources (HR) and Employment through Strengthening Digital Skills and Access to Technology-Based Economic Opportunities**

Based on the IPA analysis figure above, the results indicate that:

#### 1. Improvement of Human Resources (HR) in the Digital Era

The analysis results show that the effectiveness of improving human resources (HR) in the digital era in Gorontalo City falls into the "less effective" category. This reflects that, although there are various initiatives and training programs, the results have not been able to create HR with sufficient digital skills to face the challenges of a technology-based economy. One of the main reasons for the lack of effectiveness is the limited access to digital training across all layers of society. Many people, especially in peripheral areas, do not have adequate opportunities to participate in technology-based training or develop digital skills relevant to the current labor market demands. Additionally, training curricula are often not fully aligned with the latest technological developments and industry needs, leading to a gap between the skills possessed by the workforce and the skills required in a digital-based workplace.

The lack of effectiveness may also be attributed to the limited collaboration between educational institutions, the government, and the private sector in building an integrated training ecosystem. Many training programs operate separately without strong coordination, making it difficult to achieve long-term effectiveness. Furthermore, the low awareness of the community about the importance of digital literacy also becomes an obstacle in creating HR capable of competing in the digital

era. To improve effectiveness, a comprehensive strategy is needed, such as expanding training programs based on the needs of the digital labor market, fostering partnerships with the technology industry, and ensuring equitable access for all community groups. By strengthening training infrastructure and building a collaborative ecosystem, Gorontalo City can improve effectiveness in enhancing HR quality to meet the challenges of the digital era.

Although the effectiveness of improving HR quality in the digital era is at the "less effective" level, the IPA analysis shows that this aspect falls into the "maintain achievement" category. This indicates that, although there are weaknesses in the final results, this program is still considered highly important and has performed satisfactorily in some specific sectors. Some initiatives, such as technology-based training carried out by the local government and collaboration with the education sector, have had a positive impact on certain segments of the community. Therefore, the next strategic step is to strengthen the programs that have been successful and expand their scope to include more layers of society. The focus should be on competency-based digital training aligned with industry needs to minimize the skills gap.

Another step that needs to be taken is to strengthen the monitoring and evaluation systems on a regular basis to ensure the effectiveness of training programs. Existing training programs must be adapted to the latest technological developments to ensure that HR in Gorontalo City have relevant skills and are competitive in the digital labor market. Additionally, building stronger partnerships with the private sector can enhance the quality of training and open up new job opportunities for participants. By maintaining effective programs and improving areas that need more attention, Gorontalo City can strengthen the HR ecosystem that supports better digital transformation.

The improvement of human resources (HR) in the digital era in Gorontalo City is a key driver for sustainable economic transformation. This improvement is carried out through the Multiple Intelligence approach, which includes three main aspects: intellectual (knowledge and skills), emotional, and spiritual. These three aspects play an important role not only in improving technical skills and managerial abilities but also in building intellectual capital and social capital. By combining these three aspects, HR in Gorontalo City can adapt quickly to technological developments, innovate, and strengthen social relationships that support the digital economy ecosystem. This holistic approach aligns with the goal of economic transformation, which is to create economic opportunities that leverage information and communication technology (ICT) to enhance efficiency, productivity, and regional competitiveness.



The intellectual aspect in the digital era refers to the improvement of knowledge and skills needed to face technology-based economic challenges. In Gorontalo City, strengthening HR capacity in digital skills is crucial to building an innovative and adaptive industry ecosystem. With adequate knowledge of information technology, automation, and data analytics, the local workforce can support more efficient production processes in various industrial sectors. Digital skills such as coding, data analysis, and technology-based system management enable industry actors to leverage the Internet of Things (IoT) and Artificial Intelligence (AI) to improve productivity. Furthermore, the improvement of these skills fosters the creation of new jobs in the technology and creative economy sectors, strengthening the region's competitiveness at the national and global levels. By building competent HR in technology, Gorontalo City can create an industrial ecosystem that supports innovation, production efficiency, and accelerated economic transformation.

The emotional aspect relates to an individual's ability to manage emotions, build social relationships, and understand community needs. In the context of economic transformation in Gorontalo City, this ability becomes important to ensure that technological progress benefits all layers of society. By building HR with high emotional intelligence, the government and private sector can design inclusive technology-based economic policies and programs. Community empowerment programs, digital training for vulnerable groups, and technology-based social support can help reduce social and economic disparities. Moreover, emotional intelligence supports empathetic and collaborative leadership in managing digitalization projects, ensuring that technological innovations not only improve efficiency but also contribute to the overall well-being of society. By combining digital skills and emotional intelligence, Gorontalo City can reduce poverty levels and create a more prosperous society amidst economic transformation.

The spiritual aspect of HR development includes ethical values, integrity, and social responsibility in conducting technology-based economic activities. In the digital financial transaction ecosystem in Gorontalo City, integrity and transparency are key factors in building public trust in technology-based services. Spiritual intelligence encourages the ethical and responsible management of financial transactions, minimizing the risk of technology abuse, and supporting fair financial inclusion. HR quality improvement in this field can be carried out through training on cybersecurity, personal data protection, and ethical business practices in the digital era. Furthermore, strengthening spiritual values promotes digital financial policies that favor underserved community groups, enabling them to access formal financial services such as digital payments, technology-based credit, and digital investment. By strengthening the spiritual aspect in managing the financial ecosystem, Gorontalo



City can build a secure, trustworthy digital transaction system that supports sustainable technology-based economic growth.

Improvement of HR quality through the Multiple Intelligence approach also directly impacts the development of intellectual capital in Gorontalo City. Intellectual capital includes collective knowledge, technical skills, and innovations that become the main strength in building a technology-based economy. By improving digital skills and critical thinking abilities, the local workforce can become a strategic asset for the growth of the technology-based economy sector. Strong intellectual capital allows Gorontalo City to adapt quickly to Industry 4.0 developments, integrate the latest technologies into economic processes, and create innovative solutions to local challenges. Additionally, strengthening intellectual capital plays a crucial role in building an innovation community where business actors, academics, and government can work together to create a dynamic and competitive economic ecosystem at both national and global levels.

In addition to intellectual capital, the development of HR based on Multiple Intelligence also strengthens social capital in Gorontalo City. Social capital includes networks, trust, and cooperation that support collaboration in the development of the digital economy. In the context of economic transformation, strong social capital allows cross-sector collaboration between government, the private sector, communities, and educational institutions. Collaborative training programs and digital communities can strengthen social networks that support innovation and knowledge sharing across the economic ecosystem. By building strong social relationships, Gorontalo City can accelerate technology adoption, encourage community participation in the digital economy, and ensure that the benefits of economic transformation are felt by all social groups. Strengthening social capital also facilitates effective public-private partnerships in expanding access to technology and strengthening digital connectivity in the city.

## 2. Effectiveness of Access to Technology-Based Economic Opportunities

The analysis results show that the effectiveness of access to technology-based economic opportunities in Gorontalo City falls into the "quite effective" category. This indicates that although there has been significant progress in opening access to the digital economy, several challenges remain that limit full inclusion across all social layers. The government's efforts to provide digital infrastructure, encourage technology-based innovation, and support the development of digital MSMEs have yielded positive results, especially in urban areas. However, in some areas, particularly in peripheral regions, access to technology-based economic opportunities remains limited due to inadequate infrastructure and low digital literacy. Small



business actors also face barriers in accessing digital platforms and funding sources to develop technology-based businesses.

The "quite effective" criterion also indicates that there is great untapped potential in promoting access to technology-based economic opportunities. Many local entrepreneurs still lack sufficient skills to optimally use technology to develop their businesses. Additionally, the lack of public education programs on the benefits of the digital economy also presents a challenge in encouraging active community participation. To improve effectiveness, the government needs to expand access to technology, provide financial support for local startups, and increase digital literacy among the community. By addressing these barriers, Gorontalo City has significant opportunities to create an environment conducive to inclusive and sustainable technology-based economic growth.

Based on the Importance Performance Analysis (IPA), access to technology-based economic opportunities in Gorontalo City falls under the "low priority" category, indicating that although this aspect has strategic potential, the level of importance and performance is still relatively low. This condition suggests that initiatives related to technology-based economy have not yet been fully integrated as a primary priority in regional development policies. Some of the main challenges contributing to low performance include a lack of policy support to comprehensively foster the digital economic ecosystem and minimal effective collaboration between the government, private sector, and local communities. To address this, strategic steps are needed to accelerate investments in technology infrastructure and expand access for small businesses to participate in the digital ecosystem.

Moreover, the government needs to develop policies that promote technology-based economic inclusion across all sectors of society. Education and mentoring programs to help MSMEs transition to digital platforms should be expanded and focused on the groups most in need. Providing targeted financing access for technology-based innovations can also increase participation from business actors in the digital economy. While it is currently a low priority, improving access to technology-based economic opportunities becomes crucial for building a sustainable economy in the future. By adopting a comprehensive and locally tailored approach, Gorontalo City can create an environment that facilitates the growth of an inclusive technology-based economy that benefits all social layers.

Achieving the "less effective" criterion clearly shows that many existing initiatives have not yet met community expectations in enhancing the digital skills needed in the current digital era (Rahman, 2024). Such findings align with the theory that to maximize the potential of Industry 4.0, integration between education, training, and private sector participation is needed (Petko, 2023). Therefore, it is important to create synergy between



educational institutions and industries to ensure that training curricula align with industry developments. Strong digital skills among HR can potentially strengthen intellectual and social capital in Gorontalo City, which in turn can drive more sustainable and inclusive local economic growth (Lestari & Nisa, 2024).

In the analysis of access to technology-based economic opportunities, Gorontalo City falls into the "quite effective" category. Despite progress in digital infrastructure delivery, significant challenges remain that hinder full access for the community, especially underserved groups (Irawan et al., 2025). This reflects the urgent need for better policy integration and financing to develop a comprehensive digital economic ecosystem (Putri & Putri, 2022). Efforts to strengthen HR through enhanced digital literacy are also vital. Other studies have documented how technology-based empowerment can significantly improve quality of life in underserved communities by providing access to information and opportunities (Wartoyo & Haida, 2020). Therefore, improving access to technology is a fundamental strategic step to building an ecosystem that supports the growth of a technology-based economy, which will create new jobs and encourage cross-sector collaboration within the community. From a broader perspective, the synergy between technology, HR quality, and the local economy will build a stronger economic resilience in Gorontalo City, preparing the community to adapt to the dynamics of global economic changes that are increasingly digital (Rahman, 2024; Hawa et al., 2022).

## **CONCLUSION AND RECOMMENDATIONS**

The role of technology, digital transformation, and the implementation of Industry 4.0 in Gorontalo City has had a significant impact on the development of the local economy, the enhancement of digital connectivity, and the quality of human resources (HR), although its effectiveness has yet to reach the optimal category. The results of the analysis using the Importance Performance Analysis (IPA) method show that most indicators fall into the category of fairly effective, particularly in the aspects of local economic development and digital connectivity. This reflects progress in the application of technologies such as the digitalization of MSMEs and the improvement of technology-based public services. However, challenges remain, such as digital infrastructure inequality, limited digital literacy, and skills gaps in the labor sector. On the other hand, the enhancement of HR quality and access to technology-based economic opportunities shows low effectiveness and is situated in the main priority and low priority quadrants, indicating the need for more structured, comprehensive, and collaborative efforts to address the challenges of sustainable digital transformation across all layers of society in Gorontalo City.

Based on the findings and data analysis, it is recommended that the Gorontalo City Government, together with other stakeholders, strengthen their commitment to

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developing equitable and high-quality digital infrastructure, particularly in the peripheral areas still facing access limitations. The government needs to formulate integrated strategic policies focusing on three main pillars: improving HR digital capacity through relevant and industry-based training; strengthening support for MSMEs and the creative economy sector to optimize the use of digital technology; and building a collaborative ecosystem involving the private sector, education, and communities to drive technology-based innovation. Furthermore, periodic monitoring and evaluation of the effectiveness of digitalization programs are necessary, along with expanding access to financing and digital economic literacy for local business actors. With a holistic and inclusive strategy, Gorontalo City can accelerate sustainable digital transformation and significantly enhance the region's economic competitiveness.

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