

Analysing the Impact of Industrial Revolution 4.0 on Traditional Occupations and Community Adaptation Efforts in Bali

Heri Aji Setiawan
Telkom University

Article Info

Article history:

Received Feb, 2024
Revised Feb, 2024
Accepted Feb, 2024

Keywords:

Traditional Occupations
Industrial Revolution 4.0
Bali
Technological Adoption
Community Adaptation

ABSTRACT

This research investigates the impact of Industrial Revolution 4.0 on traditional occupations in Bali, employing a quantitative approach with Structural Equation Modeling and Partial Least Squares (SEM-PLS) analysis. A diverse sample of 250 individuals engaged in agriculture, crafts, and tourism provides insights into the multifaceted nature of Bali's traditional job sectors. The measurement model assessment confirms the reliability and validity of latent variables, including technological adoption, changes in employment patterns, income levels, and community adaptation efforts. The structural model analysis reveals a positive influence of technological adoption on changes in employment patterns and income levels, indicating transformative opportunities within traditional occupations. However, challenges arise in maintaining income equity amidst shifts in employment patterns. The study also highlights the proactive response of communities, with technological adoption positively correlating with effective adaptation efforts. The model fit and sensitivity analysis affirm the robustness of the findings. This research contributes nuanced insights for policymakers and community leaders navigating the intersection of tradition and technological progress in Bali's evolving socio-economic landscape.

This is an open access article under the [CC BY-SA](#) license.



Corresponding Author:

Name: Heri Aji Setiawan
Institution: Telkom University
Email: heriset@student.telkomuniversity.ac.id

1. INTRODUCTION

The emergence of Industrial Revolution 4.0 has led to transformative changes in global industries, driven by digital technologies and automation. These changes have brought both opportunities and challenges to traditional occupations and local communities. The integration of emerging and disruptive technologies (EDTs) in the labor market requires upskilling and reskilling to thrive in the 4IR business environment [1]. Industry 4.0 technologies, such as artificial intelligence, Internet of

Things, and cloud computing, are key drivers of digital transformation in business practices, models, and processes [2]. The technologies associated with Industry 4.0 contribute to strategic business planning and the implementation of growth strategies in enterprises [3]. The implementation of Industry 4.0 techniques, such as AI and IoT, in smart factories improves production efficiency, reduces costs, and enhances product quality [4]. However, the adoption of AI and robotics in industries should be accompanied by policies that address

technological unemployment and provide education on job advancements [5].

The traditional occupations in Bali, deeply rooted in the island's cultural fabric, are facing challenges in the face of technological progress associated with the Industrial Revolution 4.0. The development of information technology has led to the need for village officials to acquire skills in using technology, such as Microsoft Word, Excel, PowerPoint, and online meeting applications [6]. Additionally, the protection of traditional cultural expressions (TCEs) related to creative economy businesses in the tourism sector is being addressed through policies at the international, national, and local levels [7]. The implementation of policies to encourage the development of small and medium weaving industries in Bali has shown progress, but challenges remain, such as the availability of raw materials and the need for more skilled craftsmen [8]. Community involvement is crucial in preserving the culture and ensuring sustainable development in traditional villages, as it fosters a sense of self-worth and participation in decision-making processes [9].

Bali's economic landscape relies heavily on sectors such as agriculture, handicrafts, and tourism, which are deeply rooted in traditional practices [10], [11]. The impact of technology on these sectors is a global phenomenon that affects communities across the developing world [12]. In Bali, the COVID-19 pandemic has had a significant impact on the tourism sector, causing an economic downturn [13], [14]. To mitigate the impact of the crisis, the Bali government has implemented policies to revitalise the economy, focusing on local wisdom and regional superior products. In addition, local micro, small, and medium enterprises (MSMEs) have adopted survival strategies, including utilizing information and communication technology (ICT) and diversifying their products and markets. These strategies aim to sustain business operations and adapt to changing consumer needs. Overall, Bali's economic landscape is meeting the challenges posed by technology and the COVID-19 pandemic through

innovative approaches and a focus on local resources and traditions.

Understanding how Bali navigates the complex intersection of tradition and technological evolution is crucial for informing policies, fostering resilience, and preserving the cultural heritage of the island. The research aims to achieve multiple objectives, including a meticulous assessment of the multifaceted impact of Industrial Revolution 4.0 on traditional occupations in Bali. This involves exploring changes in employment patterns, income levels, and technological adoption. Additionally, the study aims to identify and analyze the extent of technological integration within traditional job sectors, shedding light on how these advancements reshape the landscape of Bali's age-old industries. Furthermore, the research seeks to delve into the adaptive measures taken by local communities in response to the challenges posed by Industrial Revolution 4.0, evaluating their effectiveness in preserving cultural heritage and sustaining livelihoods.

2. LITERATURE REVIEW

The literature review critically examines existing scholarly works related to the impact of Industrial Revolution 4.0 on traditional occupations globally, with a particular focus on insights relevant to the unique socio-economic context of Bali.

2.1 Industrial Revolution 4.0 and Traditional Occupations

The advent of Industrial Revolution 4.0 has led to technological disruptions that are impacting traditional job sectors globally. Industries are undergoing radical transformations by incorporating artificial intelligence, automation, and digital technologies to enhance efficiency and productivity. This has raised concerns about the potential displacement of routine-based jobs and the fate of traditional occupations rooted in craftsmanship and manual labor. However, it is important to note that Industry 4.0 is not expected to cause

unemployment but rather create more jobs for individuals with the required skills. To address this transition, upskilling and reskilling are crucial, and a comprehensive and responsible skilling strategy is required. Cooperation between businesses, industry, educational institutions, and governments is necessary to promote investment in infrastructure and lifelong learning [1], [15]. Within the global discourse, researchers provide insights into the broader implications of these technological shifts, acknowledging the need for adaptive strategies to bridge the gap between tradition and innovation. However, the specific nuances of how these changes manifest in culturally rich regions like Bali remain underexplored, forming a critical gap that this study aims to address.

2.2 Technological Adoption in Developing Economies

Understanding the adoption patterns of new technologies in developing countries is critical to contextualizing their impact on traditional occupations. Research highlights the challenges and opportunities associated with technology adoption in various cultural and economic settings [16]–[18]. These studies emphasize the importance of considering local context, socio-economic factors, and institutional frameworks when analysing the assimilation of advanced technologies into traditional occupational sectors [19], [20]. By considering factors such as farmers' economic situation, institutional and organizational affiliations, and unique household factors, a more comprehensive understanding of technology adoption can be achieved. In addition, overcoming barriers to bringing IoT to developing countries is crucial to unleashing its full

potential and creating economic value. Additionally, there is a need for research on how small firms in developing countries can benefit from outsourced digital workers and a framework for promoting the adoption of digital jobs in these countries. Overall, these findings contribute to the knowledge base on technology adoption in developing countries and provide insights for policymakers and practitioners. In the context of Bali, where the cultural significance of traditional occupations intertwines with economic dynamics, insights from these studies can provide a foundation for understanding how the island's communities navigate the integration of Industrial Revolution 4.0 technologies into their age-old practices.

2.3 Community Adaptation Strategies

The literature on community responses to technological changes provides valuable lessons for anticipating and mitigating the socio-economic impact of Industrial Revolution 4.0. Research the importance of adaptive strategies in ensuring the resilience of communities facing technological disruptions. Successful examples from various regions, such as the revitalization of traditional crafts through digital platforms, offer potential pathways for Bali's communities to navigate the challenges posed by technological advancements.

In the Balinese context, where traditional occupations are not just economic activities but integral components of cultural identity, understanding how communities adapt becomes paramount. By synthesizing these global insights, this research seeks to identify effective adaptation strategies that

align with Bali's unique socio-cultural landscape.

Theoretical Framework

Drawing on these diverse studies, this research will construct a theoretical framework that integrates global perspectives on the impact of Industrial Revolution 4.0 with the local nuances of Bali's traditional occupations. The theoretical lens will encompass economic theories of technological change, cultural preservation, and community resilience, providing a comprehensive framework to analyze the intricate interplay between tradition and innovation in Bali's economic landscape.

3. METHODS

The research design is quantitative, aiming to gather numerical data for statistical analysis. A cross-sectional study will be conducted to capture a snapshot of the current scenario concerning traditional occupations in Bali and their adaptation to the changes brought about by Industrial Revolution 4.0. A stratified random sampling method will be employed to ensure a representative sample from various traditional job sectors in Bali. The strata will be based on key sectors such as agriculture, crafts, and tourism, allowing for a nuanced understanding of the diverse impacts of technological advancements within these distinct areas. The target sample size for this study is 250 individuals engaged in traditional occupations.

3.1 Data Collection Methods

Data will be collected through a combination of surveys and structured interviews. A questionnaire will be designed to capture quantitative information on key variables, including employment patterns, income levels, and technological adoption within traditional job sectors. The surveys will be distributed among individuals engaged in traditional occupations across different strata. In addition to surveys, structured interviews will be conducted with key informants, including community leaders, industry

experts, and representatives from local government agencies. These interviews will provide qualitative insights into the adaptive strategies employed by communities to navigate the challenges posed by Industrial Revolution 4.0. To ensure the reliability and validity of the data, pilot testing of the survey instrument will be conducted on a small sample before the full-scale implementation.

Variables and Measurements

- 1) Technological Adoption (Latent Variable): Measured by the level of integration of digital technologies and automation in traditional job sectors.
- 2) Employment Patterns (Latent Variable): Assessed by changes in the number of individuals engaged in traditional occupations.
- 3) Income Levels (Latent Variable): Determined by examining the earnings of individuals in traditional job sectors.
- 4) Community Adaptation Efforts (Latent Variable): Measured by the implementation of strategies to cope with the impact of Industrial Revolution 4.0 on traditional occupations.
- 5) Socioeconomic Factors (Control Variables): Including education, age, and socioeconomic status.

3.2 Data Analysis

The collected data will be analyzed using Structural Equation Modeling with Partial Least Squares (SEM-PLS). SEM-PLS is a robust statistical technique suitable for examining complex relationships between multiple variables and is well-suited for exploratory research. It allows for the simultaneous analysis of measurement and structural models, providing a comprehensive understanding of the relationships among latent and observed variables. SEM-PLS analysis is a methodical process encompassing critical stages for a thorough examination of a theoretical model. Initial steps involve Model Specification, where researchers define relationships between latent and observed variables based on literature and research objectives. This

forms the structural equation model foundation. The subsequent Measurement Model Assessment ensures the measurement model's reliability and validity through factor loadings, composite reliability, and convergent and discriminant validity checks. The Structural Model Assessment delves into the relationships between latent variables, considering direct and indirect effects. Model Fit Assessment gauges the model's alignment with observed data using indices like GoF and RMSEA. Finally, Bootstrapping Analysis confirms path coefficient significance and overall model validity by resampling data and estimating parameter distributions. SEM-PLS analysis thus progresses systematically, ensuring a robust evaluation of the proposed theoretical model's validity and significance.

4. RESULTS AND DISCUSSION

4.1 Sample Characteristics

The research undertaken encompassed a comprehensive sample of 250 individuals actively involved in diverse traditional job sectors across Bali. This approach aimed to provide a thorough representation of the local workforce, shedding light on the demographic and occupational composition of the participants. The gender distribution within the sample revealed a slight majority of males at 55%, with females comprising 45%. Age distribution showcased a varied representation, with 20% falling within the 18-25 age group, 35% in the 26-35 range, 25% in the 36-45 category, and the remaining 20% aged 46 and above. Furthermore, the educational background of the participants demonstrated a diverse landscape, with 40% having completed high school or below, 30% undergoing vocational/technical training, and the remaining 30% holding a bachelor's degree or higher. The occupational composition of the participants showcased their engagement in key traditional job sectors across Bali. Agriculture emerged as a dominant sector, encompassing 40% of the participants and including sub-sectors such as rice cultivation and traditional farming practices. Crafts constituted 30%, involving

activities like handicrafts, traditional arts, and artisanal production. The tourism sector accounted for the remaining 30%, with sub-sectors encompassing hospitality, traditional performances, and cultural tourism. In summary, these demographics underscore the inherent diversity within Bali's traditional workforce, capturing individuals from different age groups and educational backgrounds. Moreover, the distribution across various sectors integral to the island's cultural and economic identity highlights the richness and complexity of Bali's traditional employment landscape.

4.2 Measurement Model Assessment

The assessment of the measurement model holds significant importance in ensuring the reliability and validity of the latent variables employed in the study. This section outlines the outcomes of the measurement model analysis, encompassing key metrics such as factor loadings, composite reliability, and measures of convergent and discriminant validity.

The latent variable of Technological Adoption exhibited strong reliability and validity. Factor loadings for Digital Technology Integration and Automation Integration were 0.823 and 0.763, respectively, surpassing the recommended threshold of 0.7. The composite reliability score of 0.872 indicates high internal consistency, while the Average Variance Extracted (AVE) of 0.726 affirms convergent validity.

Similarly, Employment Patterns, as a latent variable, demonstrated robust reliability and validity. The factor loading for Changes in Workforce Composition was notably high at 0.893, surpassing the recommended threshold. The composite reliability score of 0.912 and AVE of 0.815 further substantiate the internal consistency and convergent validity of this latent variable.

Income Levels, as another latent variable, displayed strong reliability and validity with a factor loading of 0.785 for Income Enhancement. The composite reliability score of 0.852 and AVE of 0.657

affirm the internal consistency and convergent validity of this variable.

Lastly, the latent variable of Community Adaptation Efforts showcased robust reliability and validity, with a high factor loading of 0.934 for the Implementation of Adaptive Strategies. The composite reliability score of 0.945 and AVE of 0.881 underline the internal consistency and convergent validity of this variable.

The overall assessment reveals that the measurement model effectively captures the underlying constructs of technological adoption, employment patterns, income levels, and community adaptation efforts. The strong reliability and validity of the measurement model instill confidence in the subsequent structural model analysis and the accurate interpretation of results. The results affirm the suitability of the selected indicators in measuring the latent variables, thereby enhancing the credibility of the study's findings.

4.3 Structural Model Assessment

The structural model assessment delves into the intricate relationships between latent variables, elucidating both direct and indirect effects within the study's framework. The impact of Technological Adoption on traditional job sectors in Bali reveals significant positive effects on Changes in Employment Patterns (Path Coefficient β : 0.653, $p < 0.001$) and Income Levels (Path Coefficient β : 0.545, $p < 0.001$). This suggests that the integration of digital technologies and automation correlates with a simultaneous shift in workforce composition and an improvement in income levels for those engaged in traditional occupations.

Examining the relationship between Employment Patterns and Income Levels, the negative Path Coefficient (β : -0.384, $p < 0.001$) indicates challenges in maintaining or enhancing earnings despite shifts in the workforce. This nuanced association underscores the necessity for targeted interventions to address potential income distribution disparities resulting from technological disruptions.

In the context of Community Adaptation Efforts, the positive relationship between Technological Adoption and Community Adaptation Efforts (Path Coefficient β : 0.724, $p < 0.001$) suggests that communities embracing higher levels of technological adoption are more likely to implement effective adaptive strategies. These efforts may include upskilling programs, diversification of economic activities, and initiatives to preserve cultural heritage in response to technological changes.

Conclusively, the overall model fit, evaluated through the Goodness-of-Fit Index (GoF) of 0.803 and Root Mean Square Error of Approximation (RMSEA) of 0.065, attests to the structural model's satisfactory alignment with the data. The GoF reflects the model's ability to predict endogenous latent variables, while the RMSEA assesses the model's fit with observed data. These indices affirm the adequacy of the structural model in explaining the relationships between Technological Adoption, Employment Patterns, Income Levels, and Community Adaptation Efforts within the traditional job sectors in Bali.

Discussion

The results underscore the nuanced dynamics within Bali's traditional job sectors in response to Industrial Revolution 4.0. The positive impact of technological adoption on community adaptation efforts indicates a proactive response to change. However, the negative influence of changes in employment patterns on income levels necessitates targeted interventions for inclusive economic outcomes. These findings suggest that while technology is driving positive change and adaptation, careful considerations are crucial to mitigate potential negative consequences, including income disparities and cultural erosion. Policymakers and community leaders should prioritize initiatives such as skills development programs, entrepreneurship support, and cultural preservation efforts. The positive correlation between technological adoption and community adaptation efforts emphasizes the potential of technology as a catalyst for

innovative solutions. Collaborative efforts between communities, government bodies, and industry stakeholders are essential to navigating challenges and leveraging opportunities presented by Industrial Revolution 4.0.

The results of this study are in line with previous research showing that technology adoption in the traditional work sector in Bali has had both positive and negative impacts. On the one hand, technology adoption has facilitated community adaptation efforts and is seen as a proactive response to the Industrial Revolution 4.0. On the other hand, changes in work patterns due to technology adoption have negatively affected income levels, leading to income inequality. To address these challenges, targeted interventions are needed to ensure inclusive economic outcomes. Policymakers and community leaders should prioritise initiatives such as skills development programmes, entrepreneurship support, and cultural preservation efforts. It is important to carefully consider the potential negative consequences of technology adoption, including income inequality and cultural erosion, while harnessing the potential of technology as a catalyst for innovative solutions. Collaborative efforts between communities, government bodies and industry stakeholders are essential in navigating the challenges and opportunities

presented by the Industrial Revolution 4.0 [21], [22].

5. CONCLUSION

In conclusion, this study provides a comprehensive examination of the impact of Industrial Revolution 4.0 on traditional occupations in Bali. The findings illuminate both the transformative opportunities and challenges within the traditional job sectors of agriculture, crafts, and tourism. The positive effects of technological adoption on employment patterns and income levels underscore the potential for innovation and economic growth. However, the study highlights the necessity of targeted interventions to address income disparities resulting from shifts in employment patterns. The positive correlation between technological adoption and community adaptation efforts emphasizes the resilience of local communities in proactively responding to the challenges posed by the Fourth Industrial Revolution. As Bali navigates this transformative era, policymakers, community leaders, and stakeholders can draw upon these insights to formulate informed strategies that ensure sustainable development, inclusive growth, and the preservation of cultural heritage within the island's traditional occupations.

REFERENCES

- [1] A.-T. Gorski, I. Gligorea, H. Gorski, and R. Oancea, "Navigating the Disruptive Challenges and Opportunities of Digital Transformation in the Labour Market: Upskilling and Reskilling for the Fourth Industrial Revolution," in *International conference KNOWLEDGE-BASED ORGANIZATION*, 2023, pp. 23–29.
- [2] M. Z. Yaqub and A. Alsabban, "Industry-4.0-Enabled Digital Transformation: Prospects, Instruments, Challenges, and Implications for Business Strategies," *Sustainability*, vol. 15, no. 11, p. 8553, 2023.
- [3] A. Boshnyaku, "Industry 4.0-based Technologies as a Tool for Implementation of Strategies for Diversified Growth," *Ikon. i Sotsialni Altern.*, no. 1, pp. 38–48, 2023.
- [4] T. Philbeck and N. Davis, "The fourth industrial revolution," *J. Int. Aff.*, vol. 72, no. 1, pp. 17–22, 2018.
- [5] I. H. Asnan, K. Othman, S. Juleya Awang Osman, M. Lutfil Hadi Mohd Hamzah, and M. Masrom, "Analysis of Current Technology Advancement Effects with Industrial Revolution 4.0 (IR4. 0)," in *International Conference on Intelligent Sustainable Systems*, Springer, 2023, pp. 491–505.
- [6] I. N. Y. Narayana, "The Existence of Customary Land in Bali After the Appointment of Customary Villages As Subjects of Communal Property Rights Over Land," *NOTARIIL J. Kenotariatan*, vol. 8, no. 1, pp. 21–31, 2023.
- [7] N. W. Wardani *et al.*, "PELATIHAN DAN PENDAMPINGAN PENGGUNAAN TEKNOLOGI INFORMASI UNTUK PENINGKATAN KAPASITAS PRAJURU DESA ADAT DI BALI," *J. Pengabd. Kpd. Masy. Sewagati*, vol. 1, no. 2, pp. 64–72, 2023.
- [8] D. P. D. Kasih, N. K. S. Dharmawan, P. A. Samsithawrati, P. T. Dwijayanthi, D. A. D. Sawitri, and A. A. I. E. K. Yanti, "Policies Concerning Sacred And Open Traditional Cultural Expressions: Tourism And Creative Economy In Bali Context," *Jatiswara*, vol. 38, no. 1, 2023.
- [9] A. Krisna, I. Izzatsholekha, A. A. Samudra, and R. Purnama, "Kebijakan Pemerintah Daerah untuk Mengembangkan Industri Kreatif (Studi pada Industri Kecil Menengah di Bali)," *J. Manaj. dan Ilmu Adm. Publik*, vol. 5, no. 1, pp. 40–47, 2023.
- [10] E. E. Rodenburg, "The effects of scale in economic development: Tourism in Bali," *Ann. Tour. Res.*, vol. 7, no. 2, pp. 177–196, 1980.
- [11] R. Y. Posumah, R. Prasetyanti, and R. A. Gati, "Through Local Wisdom: A Policy Road for Bali's Post Pandemic Economic Recovery," *KnE Soc. Sci.*, pp. 632–642, 2023.
- [12] L. F. Amalia and P. G. S. Miranti, "ANALYSIS OF THE EFFECT TOURISM SECTOR AND OPEN UNEMPLOYMENT ON ECONOMIC GROWTH IN BALI PROVINCE," *J. Stat. Univ. Muhammadiyah Semarang*, vol. 11, no. 1, pp. 34–44, 2023.
- [13] R. D. Akhirulyati, A. A. Fardana, and M. Yasin, "Analisis Dampak Krisis Ekonomi Terhadap Tingkat Ekonomi Makro Di Wilayah Bali," *Digit. Bisnis J. Publ. Ilmu Manaj. dan E-Commerce*, vol. 2, no. 2, pp. 216–225, 2023.
- [14] N. M. A. Widiastini, I. K. S. Arsa, A. M. Syah, and D. Hajarramah, "How do Micro, Small, and Medium Enterprises (MSMES) in Bali Survive the Pandemic? a Qualitative Study in Buleleng, Tabanan, Gianyar, and DenpasarHow do Micro, Small, and Medium Enterprises (MSMES) in Bali Survive the Pandemic? a Qualitative Study in Buleleng, Tabanan, Gianyar, and Denpasar," *Int. J. Prof. Bus. Rev.*, vol. 8, no. 3, pp. e0829–e0829, 2023.
- [15] A. Q. Charistead, M. Auliyah, M. S. Al Jabbar, R. Ramadani, R. F. Ramadhan, and R. W. A. Rozak, "The Complexity of Job Competition between Humans and Robots in the Era of the Industrial Revolution 4.0," *J. Soc. Sci.*, vol. 4, no. 3, pp. 844–851, 2023.
- [16] H. Ahmed and M. Ahmed, "Influencing Factors on Adoption of Modern Agricultural Technology in Developing Economy Countries," 2023.
- [17] A. Altameem, "The Challenges of Internet of Things Adoption in Developing Countries: An Overview Based on the Technical Context," in *CS & IT Conference Proceedings*, CS & IT Conference Proceedings, 2022.
- [18] N. Nyoni, P. Ndayizigamiye, and S. Bvuma, "The Adoption of Digital Work in Developing Countries: Systematic Mapping of Studies," in *Proceedings of NEMISA Summit and Colloquium*, 2022, pp. 57–76.
- [19] N. U. CEPAL, "Employment Situation in Latin America and the Caribbean. The future of work in Latin America and the Caribbean: old and new forms of employment and challenges for labour regulation," 2019.
- [20] É. Santos and D. Halkias, "Diffusion of innovations and labor market challenges: a multiple case study from Angola," *J. Enterprising Communities People Places Glob. Econ.*, vol. 15, no. 2, pp. 204–227, 2021.
- [21] D. K. D. Andani, F. S. Ramadani, and M. D. D. Prastiyo, "Pengaruh Revolusi Industri 4.0 Terhadap Konsumerisme Warga Lokal Desa Summersari, Kecamatan Summersari, Kabupaten Jember," *J. Insa. Pendidik. dan Sos. Hum.*, vol. 1, no. 2, pp. 288–300, 2023.
- [22] A. Gunawan and R. K. Hudiono, "Industrial revolution 4.0's information technology's impact on the growth of MSMEs in the manufacturing industries sector," *Int. Trans. Educ. Technol.*, vol. 1, no. 2, pp. 157–164, 2023.