

HUMAN RESOURCE-BASED ENTREPRENEURSHIP IN ERA OF INDUSTRIAL REVOLUTION 4.0 : A STUDY ON DIGITAL STARTUPS IN MEDAN

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Received : 01 August 2025

Published : 20 September 2025

Revised : 15 August 2025

DOI : <https://doi.org/10.54443/morfai.v5i3.4059>

Accepted : 11 September 2025

Link Publish : <https://radjapublika.com/index.php/MORFAI/article/view/4059>

Abstract

The development of the Industrial Revolution 4.0 has brought significant changes in the business world, especially in the digital startup sector. In this context, human resources (HR) are the key elements that determine the success of entrepreneurship. This study aims to analyze the role of human resources in encouraging the success of entrepreneurship in digital startups in Medan City. The approach used is quantitative descriptive with data collection through questionnaires distributed to digital startup actors. Data analysis was carried out using linear regression techniques to test the influence of human resource competencies on business success. The results show that human resource competencies that include innovation skills, mastery of digital technology, adaptive flexibility, and team collaboration have a significant influence on the success of startups. These findings confirm that in the era of the Industrial Revolution 4.0, strengthening the quality and capacity of human resources is a crucial strategy for the growth and sustainability of digital startups. This research provides practical contributions for business actors and local governments in building a digital entrepreneurship ecosystem based on the development of superior human resources.

Keywords: *Entrepreneurship, human resources, digital startups, Industrial Revolution 4.0, Medan.*

INTRODUCTION

The rapid development of technology in the era of the Industrial Revolution 4.0 has brought significant changes in various aspects of life, including in the world of entrepreneurship (Paijan et al., 2024). This revolution is characterized by the integration of digital technology, the Internet of Things (IoT), artificial intelligence (AI), and big data that directly change the way industries and businesses, including digital startups, work (Wahdi et al., 2025). In this context, technology-based entrepreneurship no longer only relies on innovative business ideas, but also requires human resources (HR) who are adaptive, creative, and have high digital competence (Wirausaha et al., 2025). The city of Medan as one of the centers of economic growth in the Sumatra region shows the rapid development of the startup ecosystem. The emergence of various digital startups in Medan reflects a strong entrepreneurial spirit among the younger generation (Alkatiri et al., 2024). However, the main challenge that is often faced is the lack of readiness of human resources to face the demands of the digital industry, both in terms of technical skills and soft skills such as collaboration, leadership, and innovation (Yulianti et al., n.d.). Entrepreneurship in the 4.0 era not only requires financial capital, but also quality human capital. The role of HR is a crucial factor in designing business strategies, creating innovative products, and building market networks competitive (Mikro, n.d.). Therefore, It is important to examine the extent to which the capacity and quality of human resources support the growth of digital startups in Medan, as well as how their development strategies can strengthen business competitiveness in the digital era (Salsabila & Achmad, 2025). In the last decade, the study of entrepreneurship has shifted from focusing on financial capital and business ideas alone, to a deeper understanding of the importance of human resource capacity as a key pillar of business success (Fakhira & Arief, 2024). Along with the emergence of the Industrial Revolution 4.0, the need for human resources who have digital competence, innovative thinking, and adaptive skills is becoming increasingly urgent, especially in the context of digital startups. Several previous studies have shown that human capital has a significant role in influencing business innovation and entrepreneurial competitiveness. According to Becker (1993), trained and educated human resources make a great contribution to business efficiency and

productivity(Gandung, 2024). In the context of digital startups, the ability to manage technology, think critically, and understand the digital market is an absolute requirement that must be possessed by business actors. In the 4.0 era, HR-based entrepreneurship approaches have been widely studied globally. For example, research by Drucker (2015) emphasizes the importance of knowledge workers in innovative organizations. Meanwhile, a study by the World Economic Forum (2020) noted that skills such as analytical thinking, problem-solving, and digital literacy are key to building a modern entrepreneurial ecosystem. Research in Indonesia is also starting to lead to the importance of human resources in driving the growth of the digital economy. A study by Pratama & Sari (2022) shows that many local startups face obstacles in terms of the availability of human resources relevant to technology needs. Similarly, Arifin (2023) highlights the importance of continuous training in improving the digital competence of start-ups in big cities such as Medan, Bandung, and Surabaya(Kholifah et al., 2024).

LITERATURE REVIEW

1. Personal Innovation

Definition of Personal Innovation Personal innovation refers to the ability of individuals to generate new ideas, creative approaches, and original solutions to problems faced, both in personal and professional life (Scott & Bruce, 1994). According to Hurt et al. (1977), personal innovation also reflects the readiness of individuals to accept and adopt change as well as the willingness to take risks in implementing new ideas. **Dimensions of Personal Innovation** Some researchers state that personal innovation includes the following dimensions (Liu et al., 2016; Wang & Cheng, 2010): (1) Creativity: The ability to create unique and useful ideas. (2) Risk taking: Willingness to try new things despite uncertainty. (3) Proactivity: The tendency to act first rather than waiting for the situation, (4) Independence of thinking: The ability to develop and defend one's own opinions or solutions(Purwanto & Meilani, 2024). Personal innovation is influenced by internal and external factors. Internal factors include personality, motivation, and self-efficacy (Bandura, 1997). Meanwhile, external factors include the work environment, organizational culture, leadership support, and incentive system (Amabile et al., 1996). **Personal Innovation in the Context of Organization and Entrepreneurship.** In organizations, personal innovation is closely related to productivity, team innovation, and competitive advantage (De Jong & Den Hartog, 2010). In the context of entrepreneurship, personal innovation is an important foundation for entrepreneurs in creating new value, responding to market dynamics, and building sustainable businesses (Schumpeter, 1934). **Relevance to the Digital Era and Industrial Revolution 4.0** In the era of the Industrial Revolution 4.0, personal innovation is increasingly important because technology is developing rapidly and changes are constant. Innovative individuals are better able to adapt, utilize technology, and create digital solutions (Li et al., 2018). Therefore, the development of personal innovation is an important part of the 21st century human resource development and education strategy(Al Faruq & Suwaji, 2024).

2. Work Motivation

Work motivation is an internal and external drive that affects an individual's attitude, behavior, and performance in carrying out his or her duties in the work environment (Robbins & Judge, 2023). Motivation can come from within the individual (intrinsic), such as personal satisfaction, or from outside (extrinsic), such as incentives and recognition. **Theories of Work Motivation** Work motivation has been explained through various classical and contemporary theories, including:Maslow's Hierarchy of Needs TheoryAccording to Maslow (1943, cited in Robbins & Judge, 2023), human needs are arranged hierarchically, ranging from physiological needs to self-actualization(Hermawati et al., 2024). Workers will be motivated to work better if these needs are met gradually. Herzberg's Two-Factor Theory Herzberg distinguishes between motivating factors (such as achievement and recognition) and hygienic factors (such as salary and working conditions). Motivators provide job satisfaction, while hygienic factors prevent dissatisfaction (Herzberg, 1959; revised Robbins & Judge, 2023). VroomVroom's Theory of Hope (1964) states that a person's motivation depends on the expectation that his or her efforts will result in good performance, which then results in the desired outcome. Deci & Ryan's Self-Determination Theory (SDT) (2000; revised by Gagné et al., 2022) emphasizes the importance of autonomy, competence, and interconnectedness in forming strong intrinsic motivations. SDT is increasingly popular in contemporary studies of millennial and Gen Z employees. Rahman & Susanti, 2023), factors that affect work motivation include: Leadership, Leadership communication style, Work environment, Career development, Organizational culture, Reward and compensation system. **Work Motivation and Employee Performance** Work motivation has a significant relationship to performance. A study by Setiawan and Lestari (2023) shows that high work motivation positively affects employee productivity and loyalty(Layek & Koodamara, 2024). Motivated employees will show a positive work attitude, be more initiative,

and contribute more to the achievement of organizational goals. Work Motivation in the Hybrid and Digitalization Work Era changes in the work system due to digitalization and the COVID-19 pandemic also affect work motivation. Hybrid work models require new approaches to maintaining motivation, such as time flexibility, work-life balance, and efficient use of technology (Purwanti et al., 2023). Organizations need to adapt motivation management strategies to meet the expectations of the digital generation.

3. Creativeness

Creativity is defined as the ability of individuals to generate new, original, and useful ideas in a particular context (Amabile, 1996; Runco & Jaeger, 2012). According to Robbins and Judge (2023), creativity is an important element in decision-making, problem-solving, and innovation in the work and educational environment (Anggraini, 2024). Several theoretical approaches explain how creativity is formed and developed: Componential Theory of Creativity (Amabile, 1996; updated 2022): Creativity consists of three main components, namely: Domain-relevant skills Creative-thinking skills Intrinsic motivation The organizational and managerial environment can strengthen or inhibit interactions between these components. 4P Framework (Rhodes, 1961): Creativity is studied from four dimensions: Person (creative individual) Process (creative thinking process) Press (environment) Product (result of creativity) Systemic Theory Csikszentmihalyi (2014): Creativity is the result of interaction between individuals, domains (knowledge), and fields (society or institutions that assess the idea). Factors Affecting Creativity Recent research shows that creativity is influenced by a combination of personal and situational factors: Personal Factors: Personality openness to experience, Curiosity Creative self-efficacy, Intrinsic motivation. Environmental Factors: Supportive work climate, Transformational leadership, Innovative culture Freedom of thought and expression (Zhang & Zhou, 2023; Widyaningrum et al., 2023). Creativity in the Context of Organization and Education In organizations, creativity is the basis for innovation, adaptation, and competitive advantage (Anderson et al., 2022). Meanwhile, in the world of education, creativity is seen as a 21st-century skill that is important to be developed through project-based learning, digital technology, and collaborative learning (OECD, 2023). Creativity and Digital Technology Digital transformation is also changing the way creativity is developed and channeled. Technologies such as AI, big data, and digital platforms provide new tools and spaces for the exploration of ideas. However, the challenge is how to maintain originality in the era of automation (Kurniawati & Sari, 2023).

4. Organizational Culture

Organizational culture is a system of values, beliefs, norms, and habits embraced by members of an organization that shape the way they think, behave, and interact (Robbins & Judge, 2023). According to Schein (2010), organizational culture is a pattern of basic assumptions that are discovered, developed, and taught to new members as the correct way to perceive and respond to the internal and external environment. Recent research shows that organizational culture has a positive influence on employee performance, job satisfaction, and productivity. A strong culture that is aligned with the organization's vision increases motivation, commitment, and synergy between teams (Handayani et al., 2023; Suwandi & Rahmawati, 2023). Organizational culture in the digital age emphasizes agility, virtual collaboration, information openness, and value transformation. Organizations that are able to adapt their culture to technological changes and the preferences of the new generation (millennials & Gen Z) will be more adaptive and sustainable (Putri et al., 2023).

5. Success of Start Ups

Startup success is defined as the ability of startups to survive, grow, and achieve business goals in a sustainable manner, both in terms of customer growth, profitability, and business scalability (Blank & Dorf, 2023; Ries, 2011). In the digital context, the success of startups is not only seen from the financial aspect, but also from the speed of innovation, user acquisition, and technological competitiveness (Pranata & Yuliana, 2023). According to recent research (Utami & Fadli, 2023; Nasution et al., 2023), the success of a startup can be measured through the following indicators: User or customer growth. Revenue growth Ability pendanaan (funding & investor interest), Inovasi produk dan teknologi, Kepuasan dan retensi pelanggan, Skalabilitas dan ekspansi pasar, Tim Solid and adaptive management Factors Influencing Startup Success Various studies have identified key factors that influence startup success.

Research Conceptual Framework

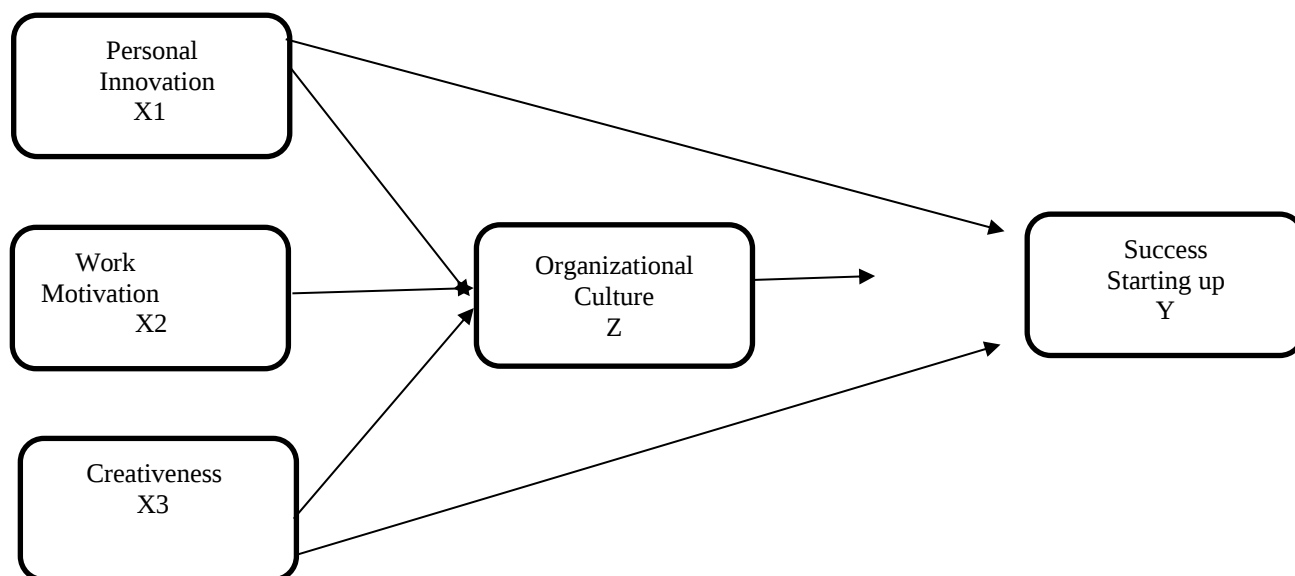


Figure 1. Research Conceptual Framework

Research Hypothesis

- H1 : Personal innovation has a positive and significant effect on organizational culture
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- H2 : Work motivation has a positive and significant effect on organizational culture
In the Era of the Industrial Revolution 4.0: A Study on Digital Startups in Medan
- H3 : Creativity has a positive and significant effect on organizational culture
In the Era of the Industrial Revolution 4.0: A Study on Digital Startups in Medan
- H4 : Organizational culture has a positive and significant effect on the success of start-ups in
the era of the industrial revolution 4.0: a study on digital startups in Medan
- H5 : Personal Innovation has a positive and significant effect on the era of the industrial
revolution 4.0: a study on digital startups in the field
- H6 : Work motivation has a positive and significant effect on the success of start-ups
In the Era of the Industrial Revolution 4.0: A Study on Digital Startups in Medan
- H7 : Creativity has a positive and significant effect on the success of start-ups
In the Era of the Industrial Revolution 4.0: A Study on Digital Startups in Medan
- H8 : Personal Innovation has a positive and significant effect on the success of start-ups in
the era of the industrial revolution 4.0: a study on digital startups in Medan through
organizational culture
- H9 ; Work motivation has a positive and significant effect on the success of start-ups
In the Era of the Industrial Revolution 4.0: A Study on Digital Startups in Medan through
Organizational Culture
- H10: Creativity has a positive and significant effect on the success of start-ups
In the Era of the Industrial Revolution 4.0: A Study on Digital Startups in Medan through
Organizational Culture

METHOD

This analysis was carried out using a quantitative method approach. The population consists of Human Resources (Employees) who work at Star Up Companies in Medan City. The variables in this study consist of Personal Innovation, Work Motivation, Creativity, Organizational Culture, Success of Start Ups. Sampling is individuals from a larger population who are specifically selected to represent the population as a whole (Abdillah & Hartono, 2015). This study uses a non-probability purposive sampling technique because the identity of the

respondents for the preparation of the sample framework could not be obtained in detail. Purposive sampling is sampling with certain criteria, such as experts (Milman et al., 2020). Since the population size cannot be ascertained (Chen & Rahman, 2018), the sample count needs to be at least 5-10 times the indicator variable. This results in a sample obtained by multiplying the indicator by 5 ($20 \times 5 = 100$). Thus, the sample of this study is 100 start-up companies in the city of Medan. This study uses structural equation modeling (SEM) with partial least squares (PLS) to analyze the data because the statistical model is quite complex and aims to explore knowledge. The benefit of using PLS is that it minimizes the demand on data distribution and works on nominal, ordinal, and interval variables. In addition, PLS can detect differences between different groups and is best suited for predicting a set of dependent variables and a large set of independent variables (Hair et al., 2019).

CONCLUSION

This study aims to explore the influence of personal innovation, work motivation and employee creativity on organizational culture and explore the influence of personal innovation, work motivation and employee creativity on the success of start-ups and use organizational culture as a mediating variable. These findings prove that all hypotheses are accepted. Personal innovation has a significant impact on the success of start-ups. Personal innovation has a significant effect on organizational culture, and personal innovation has a significant effect on the success of start-ups. The findings also found that personal innovation, employee motivation and employee creativity influence the success of start-ups through organizational culture. To earn start-up success, companies can leverage various channels to strengthen their organizational culture and improve and focus their development on innovation and better quality. The success of start-ups is also expected to carry out promotions that are oriented to the desires of employees and create personal innovations and creativity that appeal emotionally to employees.

This study also contributes by showing that personal innovation is the most crucial phase in the process of determining the success of start-ups. Startups that grow and succeed can provide strategic benefits for local governments, including: Local Job Creation Growing startups will recruit workers, especially from the surrounding areas. Reducing unemployment and increasing people's income. In addition, the improvement of the regional economy for local economic turnover increased (supporting MSMEs, local vendors, services, etc.) and encouraged the growth of the creative and digital economy sectors. In addition, Public Service Innovation Some startups offer technology-based solutions to support public services (e.g., payment systems, transportation, education). The government can collaborate with startups for smart cities, digital governance, etc. Successful Startup Original Revenue (PAD) Increase will contribute to regional taxes. Potential sources of PAD from levies, business licenses, and private-government sector cooperation (PPP)).

SUGGESTION

This study makes an important contribution to the study of start-up companies, but it still has some limitations. First, many environmental and non-environmental factors have not been included in this study. Therefore, future studies need to identify additional variables, such as environmental orientation and employees' personal relationship with the organization's culture that can improve the development of start-ups. Environmental factors also need to be included, considering the development of start-up companies up will require personal innovation, motivation, and creativity mediated by organizational culture

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