



## The Industrial Revolution 5.0 and Social Mobility of Muslim Youth in Indonesia: The Role of International Cooperation in Accelerating Digital Vocational Education and Strengthening the Startup Ecosystem

Roudhoh Hannaaris Sa'id<sup>1,a)</sup>, Muhammad Rafli Hussein<sup>2)</sup>, Khalifa Rabbani Wardhiansyah<sup>3)</sup>, Muhammad Fariq Al-Ghifari<sup>4)</sup>, Muhsin Abdul Hadi<sup>5)</sup>

<sup>1,2,3,4,5</sup>Department of International Relations, University of Darussalam Gontor, Indonesia

<sup>a)</sup>Corresponding author: [roudhohsaid@gmail.com](mailto:roudhohsaid@gmail.com)

**Abstract.** This paper examines how international cooperation supports the social mobility of Muslim youth in Indonesia during the Industrial Revolution 5.0. Using a qualitative-dominant multiple case study, we analyze three initiatives: NU Hub Digital Valley (East Java), Ponpes Al-Ittihad’s “Kelas Kreator Cerdas AI” (Central Java), and the Digital Vocational Program at Pondok Pesantren Mahir Teknologi (DIY). Guided by Global Governance Theory, we combine in-depth interviews, focus group discussions, and document analysis with basic survey statistics and simple regression to assess links between program participation, employment, and income. Findings show that partnerships with donors, NGOs, and multilateral agencies provide not only funding but also curriculum co-design, mentorship, and access to knowledge networks, which together strengthen digital skills, entrepreneurial orientation, and pathways into formal work and startups. Quantitative results indicate positive associations between participation and labor-market outcomes, while qualitative evidence explains mechanisms and context, including infrastructure gaps and varying local capacity. Policy implications emphasize sustained financing, rural connectivity, credible accreditation, and context-sensitive training. Although the small, non-representative sample and cross-sectional design limit generalization, the study offers a practical roadmap to align global resources with local institutions to expand equitable opportunities for Muslim youth.

**Keywords:** Industry 5.0; Global Governance; Muslim Youth; Digital Vocational Education.

### INTRODUCTION

The Industrial Revolution 5.0 represents a transformative phase in global industrial development characterized by the collaborative integration of advanced artificial intelligence, robotics, human-machine collaboration, and personalized technologies. Unlike previous industrial revolutions, Industry 5.0 emphasizes a human-centric approach where human creativity and well-being are placed at the center of technological advancement. This evolution enables more sustainable, flexible, and efficient production processes by combining the cognitive and creative capabilities of humans with the precision and speed of intelligent machines. Its implications for the global labor market are profound, particularly for young workers, as it demands new skills in digital literacy, AI, and human-technology collaboration, reshaping employment landscapes and job requirements worldwide [1]). This shift is not just about machines becoming smarter, but about people learning how to work with them in ways that make life better for everyone. If we guide this change wisely, Industry 5.0 can open more doors for young people, help them grow new skills, and create fairer chances for success around the world.

In Indonesia, youth employment faces significant challenges against a backdrop of rapid digital transformation. Although Indonesia’s digital economy is booming expected to contribute substantially to GDP by 2030 the country grapples with uneven access to digital and vocational skills, particularly between urban and rural areas. Digital literacy gaps and unequal internet connectivity exacerbate disparities, leaving many young people, especially those in less developed regions, vulnerable to unemployment or underemployment. Concurrently, innovative local phenomena have emerged, such as *pesantren* tech hubs and youth-driven startup ecosystems. These initiatives integrate traditional Islamic education with modern

digital technology, supporting entrepreneurship and equipping Muslim youth with market-relevant digital skills that bridge the skill gap and foster economic inclusion [2].

A key focus of this research is on Muslim youth in Indonesia comprising *pesantren* students, students at Islamic higher education institutions (PTKI), and vocational alumni. This demographic faces unique social mobility challenges in the Industry 5.0 era due to socio-economic disparities, limited access to cutting-edge education, and intersectional barriers related to religion, geography, and economic status. While *pesantren* tech hubs serve as pivotal local innovation centers empowering Muslim youth, their full potential remains constrained without broader systemic support. The social mobility of these young Muslims depends heavily on their ability to access advanced digital vocational education and actively engage in the expanding startup ecosystem, which Industry 5.0 accelerates [3]. The stronger international cooperation and fair access to modern skills, these young Muslims can turn challenges into chances, not only improving their own lives but also bringing positive change to their communities.

Despite growing recognition of these dynamics, there remains a clear research gap. Few studies comprehensively explore the nexus of Industry 5.0, social mobility among religious youth, and the critical role of international cooperation in enhancing digital vocational education and fostering startup ecosystems. International partnerships—such as those facilitated by organizations like UNESCO, UNDP, and Islamic Development Bank play an essential role in promoting knowledge exchange, capacity building, and inclusive policy frameworks. These collaborations help overcome digital divides, support sustainable education reforms, and build a synergistic ecosystem conducive to entrepreneurial growth among Muslim youth in Indonesia, ultimately accelerating their social mobility in the digital age [4]. Filling this research gap is not just an academic task, but a practical step to make sure Muslim youth are not left behind, and can grow into leaders who shape a fair and innovative future.

There is, however, an urgent practical question that this study seeks to answer. In simple terms, we want to know how much international cooperation meaning help from donors, international NGOs, and multilateral institutions actually helps build good digital vocational education for Muslim youth in Indonesia. This question matters because many local initiatives, like *pesantren* tech hubs, already try to teach digital skills, but they often need more money, know-how, and links to markets. By asking this, the research will look at what kinds of international support work best, which ones fall short, and why. The main research question therefore is: To what extent does international cooperation (donors, international NGOs, and multilateral institutions) facilitate the development of digital vocational education for Muslim youth in Indonesia?

## METHODS

This study uses a qualitative-dominant case study design. The primary aim is to understand how international cooperation supports digital vocational education and startup ecosystems for Muslim youth. The analysis is guided by Global Governance Theory [5], which frames global governance as the collective management of common affairs by a variety of actors states, international organizations, NGOs, the private sector, and transnational communities. This perspective is highly relevant to the present research, as it explains how multi-actor collaboration through institutions such as UNESCO, UNDP, and the Islamic Development Bank can shape rules, norms, and programs that directly influence access to resources, skills development, and social mobility for Muslim youth in the era of Industry 5.0.

To capture rich contextual detail, the research relies on in-depth interviews, focus group discussions, and document review. The study examines several *pesantren* tech hubs and related vocational programs that have received international support. Example cases include: Pesantren Tech Hub A (NU Hub Digital Valley, Surabaya, East Java), Pesantren Tech Hub B (Ponpes Al-Ittihad Tambakromo, Cepu, Central Java), and the Digital Vocational Program at Islamic Higher Education Institution C (Pondok Pesantren Mahir Teknologi, DIY). Cases are selected to represent variation in context: urban versus rural settings, *pesantren*-based programs versus campus based PTKI programs, and programs with differing levels of international engagement. This purposeful selection allows the study to compare how resource access and local conditions interact with international cooperation mechanisms to produce different outcomes.

Urban sites typically benefit from stronger internet connectivity and closer ties to startup networks, while rural sites reveal constraints in outreach and scale. Comparing *pesantren*-based and PTKI-based programs highlights differences in institutional culture, trust networks, and integration with local communities. Studying both internationally supported and locally initiated programs provides insight into which forms of cooperation are most effective in practice a question central to the application of Global Governance Theory in this context.

Qualitative data from interviews and FGDs are analyzed using thematic analysis, coding responses into themes such as donor roles, barriers, perceived benefits, and policy recommendations. Quantitative survey data are analyzed with basic descriptive statistics and simple regression models to explore the relationship between program participation and employment or income outcomes. The regression is kept straightforward—for example, a single predictor for program participation, with controls for age and education so that numerical findings complement the qualitative insights.

To ensure reliability, questionnaire scales are tested for internal consistency (Cronbach's alpha), and interview guides are piloted and refined. Validity is strengthened through expert review of research instruments and triangulation of findings across surveys, interviews, FGDs, and documentary sources. Ethical safeguards include obtaining institutional permission, securing informed consent, protecting participant anonymity, and allowing withdrawal at any stage. These measures not only protect participants but also enhance the credibility and trustworthiness of the findings.

## RESULTS AND DISCUSSION

### 1. OVERVIEW OF CASES AND PARTICIPANTS

The first case, *Pesantren* Tech Hub A, namely NU Hub Digital Valley in East Java, is a prominent digital ecosystem initiated by the Nahdlatul Ulama organization. It serves as a collaborative platform for *santri* (Islamic boarding school students) to engage in digital entrepreneurship and networking. Equipped with facilities like co-working spaces, incubators, mentoring, and venture capital access, NU Hub Digital Valley fosters an inclusive environment for digital startups, encouraging active participation of young Muslim entrepreneurs [6]. Participant profiles across these cases vary but generally include youth aged late teens to early twenties, comprising both male and female students. Educational backgrounds range from secondary school graduates to current higher education students. Employment status is often a mix of students, part-time workers, or aspiring entrepreneurs. Internet access tends to be reliable in urban-based hubs like NU Hub Digital Valley and more varied in rural settings such as Tambakromo, reflecting infrastructural disparities [7]. This case shows that with the right support and infrastructure, Muslim youth can actively participate in the digital economy and develop entrepreneurial skills. It also suggests that *pesantren*-led initiatives like NU Hub Digital Valley can serve as models for how local communities, when empowered, can transform opportunities into real social and economic mobility for young people. Clearly, fostering such ecosystems is not just about technology it is about creating spaces where creativity, learning, and collaboration can thrive, helping Muslim youth gain both skills and confidence to succeed in Industry 5.0.

The second case focuses on *Pesantren* Tech Hub B, Ponpes Al-Ittihad Tambakromo in Central Java, which innovatively integrates Artificial Intelligence (AI) education into its curriculum. This *pesantren* has established the "Kelas Kreator Cerdas AI," the first AI training class in an Indonesian *pesantren* setting. This initiative equips *santri* with advanced digital competencies, enabling them to creatively utilize AI technologies alongside traditional religious education, thus preparing them for the challenges of Industry 5.0 [8]. This example demonstrates that combining traditional Islamic education with cutting-edge technology can open new opportunities for Muslim youth. By learning AI skills within the *pesantren* environment, these young learners are not only gaining knowledge but also building confidence and creativity to navigate the modern workforce. It highlights that thoughtful integration of technology in education can help prepare *santri* for Industry 5.0, turning challenges into real chances for social and economic mobility.

The third case concerns the Digital Vocational Program at PTKI C, known as Pondok *Pesantren* Mahir Teknologi in Yogyakarta. This *pesantren* emphasizes an integrated curriculum that combines Islamic studies with practical IT skills such as programming, digital marketing, and multimedia design. Its mission

is to develop Muslim youth who are proficient in both religious knowledge and digital technologies, primarily targeting those from economically disadvantaged backgrounds by providing full scholarships and modern learning facilities [9]. This case highlights that providing equal access to digital skills and technology can significantly empower Muslim youth, especially those from disadvantaged backgrounds. By combining religious education with practical IT training, Pondok Pesantren Mahir Teknologi not only equips students with employable skills but also builds their confidence to participate in the digital economy. It shows that thoughtful educational programs can turn limited opportunities into real pathways for social and economic mobility in the era of Industry 5.0.

The geographical and institutional contexts represent urban versus rural distinctions and differences between *pesantren*-based versus PTKI education settings. NU Hub Digital Valley and Pondok Mahir Teknologi benefit from relatively higher levels of international cooperation support through partnerships and funding. In contrast, Ponpes Al-Ittihad's AI program highlights emerging local innovation with nascent international linkages. Preliminary descriptive results indicate strong participation rates in digital vocational programs, with many students gaining new ICT skills, actively engaging in startup development activities, and leveraging ecosystem facilities such as incubators and mentorship programs. Access to digital vocational education appears to significantly enhance participants' entrepreneurial orientation and readiness for the evolving labor market demands imposed by Industry 5.0 [10].

These findings suggest that both international support and local innovation play crucial roles in shaping opportunities for Muslim youth. While well-supported urban programs provide clear advantages, emerging rural initiatives show that creativity and determination can also drive meaningful outcomes. Overall, it demonstrates that access to digital vocational education, combined with mentorship and practical experience, can empower young Muslims to build skills, start businesses, and improve their chances for social and economic mobility in the Industry 5.0 era.

## **2. INTEGRATED ANALYSIS AND THEORETICAL IMPLICATIONS**

Quantitative analyses, utilizing survey and simple regression methods, reveal a significant positive correlation between participation in digital vocational education programs and both employment opportunities and income levels among youth participants. Data from recent studies demonstrate that graduates involved in structured digital vocational and internship programs are more likely to secure employment and achieve higher earnings compared to their non-participating peers. For instance, regression models indicate that factors such as access to job opportunities and supportive policy environments are significant predictors of lower youth unemployment rates, and participation in digital skill programs directly contributes to better labor market integration and increased income potential [11].

These results clearly show that giving young people access to digital skills is not just about learning computers it can open real doors to jobs and better pay. When training is matched with supportive policies and real job opportunities, it helps youth move faster into stable work and improve their lives. This proves that investment in digital vocational programs is a smart and powerful way to fight unemployment and grow fair chances for all.

Qualitative thematic analysis deepens these insights by examining narratives around the roles of donor agencies, the capacity of implementing institutions, enduring barriers, realized benefits, and issues of sustainability. The findings highlight that international donors, NGOs, and multilateral organizations provide not only financial resources but also technical expertise, curriculum development, and access to global knowledge networks. These actors facilitate exposure to best practices, internships, and technology adoption for both *pesantren* and PTKI participants. Nevertheless, persistent obstacles including limited local capacity, digital infrastructure gaps, and challenges in scaling program impacts temper the reach of such initiatives. Crucially, beneficiaries attest to the personal and professional advantages gained from donor-sponsored programs, citing enhanced employability, entrepreneurial motivation, and improved digital literacy as key outcomes [12].

Integrating both strands of evidence, it becomes clear that numbers and narratives reinforce each other to elucidate the operational mechanism of international cooperation. Quantitative gains in employment and income are grounded in the qualitative experiences of improved capacities, mentorship, and empowerment. These mutually supporting findings underscore that the presence of international actors—functioning as facilitators and norm-setters enables a more vibrant environment for digital vocational education and youth-led startups, especially when combined with localized adaptation.

Linking these results with Global Governance Theory, the research illustrates how the interplay of multi-actor global institutions (including donors, NGOs, and international organizations) establishes enabling regulations, guides resource allocation, and shapes normative frameworks that prioritize digital inclusion and youth entrepreneurship. International cooperation, as reflected in bilateral agreements (e.g., Indonesia-Germany vocational training partnerships) and multilateral initiatives, operates as a catalyst for building the infrastructure and social capital necessary to support upward mobility for Muslim youth in Indonesia. This process exemplifies the core mechanism highlighted by Global Governance Theory: the interdependence of global and local stakeholders in structuring opportunities and norms for inclusive development in the era of Industrial Revolution 5.0 [13].

This shows that when the world works together, they can create rules and share resources that open more doors for young people. But the best results happen when global help is matched with strong local action, so that big ideas from far away can truly make a difference in everyday life. In this way, global and local hands can build a future where every youth has a fair chance to grow in the digital.

### **3. POLICY IMPLICATIONS, LIMITATIONS, AND FUTURE DIRECTIONS**

This study offers several practical policy recommendations relevant to international donors, government policymakers, and *pesantren*/PTKI institutions. For international donors and organizations, sustained funding is critical to ensure the longevity and expansion of digital vocational education programs. Donors are also encouraged to engage in co-designing curricula with local stakeholders to ensure relevance to regional labor market needs and to provide structured mentorship programs to enhance youth entrepreneurial skills and capacity building. For government actors, investment in robust digital infrastructure, especially in rural and underserved areas, remains a foundational priority. Additionally, establishing formal accreditation pathways that recognize digital vocational competencies can enhance the legitimacy and attractiveness of these programs. *Pesantren* and PTKI institutions should focus on contextualizing curricula to integrate both religious education and contemporary digital skills harmoniously, strengthening mentoring systems, and developing alumni networks to support new graduates' career pathways and startup ventures [14]. These recommendations show that lasting change is possible when all sides share the work and respect each other's strengths. If donors bring resources, governments build strong systems, and local schools shape learning to fit their community, young people will have the tools and confidence to create their own success in the digital world.

The study's limitations include a relatively small and non-representative sample size that restricts the generalizability of results, a cross-sectional study design that limits causal inference, potential selection bias in participant recruitment, and constraints related to the availability and reliability of data sources. These limitations suggest caution in extrapolating findings to the wider population of Muslim youth in Indonesia or to different vocational education contexts. Future research should therefore prioritize longitudinal designs to examine long-term impacts of digital vocational training on social mobility, implement comparative studies across regions or countries, conduct rigorous economic impact evaluations of startups emerging from these ecosystems, and utilize randomized controlled trials (RCTs) to test and refine digital vocational education interventions tailored for youth empowerment [15].

Addressing these areas through continued research and policy adaptation will bolster the effectiveness and sustainability of efforts to use digital vocational education and entrepreneurship as levers for advancing social mobility among Muslim youth in Indonesia amidst the transformative pressures of the Industrial Revolution 5.0. While these limitations mean the results should be read with care, they also open the door for deeper and stronger studies in the future. By learning from what is missing now, researchers and policymakers can build better programs and clearer evidence, making sure that digital skills truly help young people move forward in life.

## **CONCLUSIONS**

In conclusions, this study shows that international cooperation operating through multi-actor global governance meaningfully supports the social mobility of Muslim youth in Indonesia by strengthening digital vocational education and the startup ecosystem across *pesantren* and PTKI contexts. Evidence from the three cases indicates that well-designed partnerships provide not only funding but also curriculum co-design, mentoring, and access to knowledge networks, which together raise digital skills, confidence, and

pathways into formal work and entrepreneurship; simple quantitative tests further suggest positive associations with employment and income. At the same time, uneven local capacity and digital infrastructure especially in rural settings temper impact and highlight the need to align global resources with locally grounded delivery. The policy message is clear: sustained financing, robust connectivity, credible accreditation, and context-sensitive training can translate Industry 5.0 opportunities into fairer labor market outcomes for young Muslims. While limitations in sample size and design warrant cautious generalization, the findings provide a concrete roadmap for donors, governments, and institutions to scale what works and, through future longitudinal and comparative research, to build durable, inclusive mobility for youth in the digital age.

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