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**Research Article**

# Industry 4.0 Courses Offered by Higher Education Institutes through Certificate Programs Help Industry Professionals Boost Career Opportunities.

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**ABSTRACT**

The purpose of this study is to investigate how degree programs in Industry 4.0 that are provided by universities might improve job prospects for graduates. To adapt to the ever-changing industrial landscape, these programs provide the specific skills that are in high demand, including those in automation, data analytics, and the Internet of Things.

Objective: Investigate how degree programs in Industry 4.0 improve graduates' job prospects, focusing on skills like automation, data analytics, and IoT.

Scope: Examine program accessibility, curriculum design, and the impact on job advancement. The study also highlights vocational education's role in equipping professionals with Industry 4.0-relevant skills.

Research Context: Conducted in Malaysia's higher education institutions and cybercities, with data from 293 employees.

Variables Analysed:

- Dependent: Certificate Program
- Independent: Employee Intention, Industry 4.0, Educator Intention
- Mediating: Higher Education Institutions (HEIs)

Methodology: Structural Equation Modelling (using SMART PLS 3.0) was employed for analysis.

Key Outcome: The certificate programs were found to be successful, thanks to contributions from academic professionals and industry experts.

Professionals boost their employability, climb the corporate ladder, and aid in the creative expansion of their fields by obtaining these in-demand talents. The study crucial in bridging the skills gap and ensuring that education aligns with the demands of Industry 4.0.

**Keywords:** Digital Courses, Industry 4.0, Higher Education, Business Management

## 1. INTRODUCTION

Industry 4.0, the Fourth Industrial Revolution, has significantly altered the educational and occupational prerequisites for today's workers. Internet of Things (IoT), artificial intelligence (AI), and cyber-physical systems are

just a few examples of how digital technologies are changing the face of work and what skillsets are required of industry experts to keep up. The stated source is from Spoettl et al., (2020), Bouwmans et al., (2024). Considering these shifting expectations, universities and colleges have begun to revise their programs and courses to better equip students to take advantage of the possibilities and overcome the threats posed by Industry 4.0. Bouwmans et al., (2024), One such effort is the creation of credentialing programs that teach workers the fundamentals of the increasingly digitalized workplace. By completing one of these certificate programs, working professionals in the field can improve their employability by learning how to deal with the challenges posed by Industry 4.0. Professionals can be better prepared to take advantage of new possibilities, adjust to changing work environments, and embrace technology improvements with these programs' emphasis on industry-relevant training. The results of several research highlight the significance of these certificate programs. Industry 4.0 presents new technical difficulties, and researchers have stressed the need of vocational education and training systems in meeting these demands. To successfully respond to the needs of the Fourth Industrial Revolution, these systems must prioritize the creation of curricula, the training of educators, and the cultivation of highly trained labourers. The stated source is from Spoettl et al., (2020), Tūtlys et al., (2020). Higher education certificate programs provide an important link between academia and business, helping working individuals acquire the skills they need to succeed in today's increasingly digitalized workplace. In addition to imparting technical know-how, these programs encourage the growth of transferable skills that are vital in today's increasingly complicated and interdependent business environments: the ability to work effectively across disciplines. Madhur, (2019) The stated source is from Spoettl et al., (2020), Tūtlys et al., (2020). Research by Masrifah et al., (2020). The significance of these certificate programs in enhancing the career prospects of industry professionals is immense, especially given the ongoing digital revolution that is changing the face of industry, Turlapati et al (2024). These programs enable professionals to contribute to the innovation and competitiveness of their industries by providing them with the skills and information needed to succeed in the industry 4.0 age, Mishra et al., (2024).

Colleges and universities often provide the following Industry 4.0 certificate programs: Programs like "Digital Transformation Essentials" and "Industry 4.0 Essentials" provide students a head start in comprehending the digital revolution by outlining the fundamental ideas, technology, and tactics that make up Industry 4.0. Earning a certificate in data analytics and business intelligence will help you become a better data analyst, data visualizer, and user of business intelligence tools—all of which are essential for making decisions in an Industry 4.0 setting. Robotics and Automation: Students enrolled in these programs learn how to design, build, and oversee complex robotic and automation systems—essential for the linked and digitalized production processes of Industry 4.0. Given the increased cyber dangers in the industry 4.0 environment, these certifications include the abilities needed to detect, reduce, and react to security issues, as well as to guarantee that digital systems are resilient. Programs in Industrial Internet of Things (IIoT) and Connectivity teach students how to build, deploy, and manage IIoT systems, so they may increase efficiency and productivity by making use of data-driven insights and linked devices (Marniati & Wibawa, 2020) (Masrifah & Sudira, 2020) (Spoettl & Tūtlys, 2020). Project Management and Change Leadership: These certifications provide individuals the tools they need to lead organizations through change and the implementation of Industry 4.0 projects, thanks to an emphasis on agile and adaptive management practices. Offering a variety of certificate programs focused on Industry 4.0, higher education institutions are helping industry professionals get the skills they need to succeed in the digitalized industrial landscape. This boosts their career prospects and makes their industries more competitive.

## 2. REVIEW OF LITERATURE:

According to the research that is already out there, universities play a key role in preparing working-age adults for the opportunities and threats posed by Industry 4.0. (Correa and Rodríguez-Abitia, 2021) A study conducted by Masrifah and Sudira in 2020 demonstrated "Reddy" (2019) means. The demands of the industry 4.0 period—defined by cyber-physical systems, artificial intelligence, and the Internet of Things—have prompted researchers to stress the importance of updating engineering curriculum to meet these demands. Because of this, we need an interdisciplinary strategy that helps students and professionals build their inter- and multi-disciplinary competences. To successfully execute Industry 4.0 initiatives, it is essential to train and further qualify people, especially in areas like cooperation, digitalization, automation, sustainability, and new technologies. It is crucial to ensure that industry experts continuously professionalize and expand their competence through the methodical planning and implementation of educational initiatives, such as certificate programs.

Industry 4.0's central idea is cyber-physical systems, which emphasize the integration of computation, networking, and physical processes (Shahbazi & Byun, 2021; Zakoldaev et al., 2019). The necessity for experts capable of managing these intricate systems and the interconnection of smart factories are both based on CPS.

An extension of CPS, the Internet of Things (IoT) is the system of networked computing devices, sensors, and software that allows for the automation and data interchange characteristic of Industry 4.0 settings (Shahbazi & Byun, 2021). Experts in smart manufacturing technologies must have a firm grasp of Internet of Things (IoT) concepts:- Organizational operations and the value they provide to consumers are radically altered by digital transformation, which is a more general term for the widespread use of digital technology across all parts of a company (Florea, 2019). One way of looking at the digital revolution in production is via the lens of Industry 4.0.

Human Capital Theory: This school of thought in economics posits that the best way to boost output and expansion is to put money into people's education and experience. According to this hypothesis, firms in the 4.0 industry need a workforce that can successfully use new technologies, which is why programs for upskilling and reskilling are necessary (Masrifah & Sudira, 2020). Finding out what people in the workforce don't have that will be needed for future occupations is what a skills gap analysis is all about. To create efficient educational and training programs, it is essential to comprehend the skills gap in relation to Industry 4.0 (Florea, 2019). All these ideas are related. Industry 4.0, propelled by innovations like as CPS and the Internet of Things, demands a complete digitization of the production process. This leads to a shortage of qualified workers, which in turn necessitates spending money on training and education programs like the certificate ones you're looking into. Organizations must address this gap if they want to be competitive and if they want individuals to prosper in the changing work market, Venice et al (2022).

The authors Woschank and Pacher (2020), Several studies have shown that certificate programs that focus on Industry 4.0 may greatly benefit participants' careers and employment prospects. Not only do these courses teach you the technical skills you need for digital transformation, but they also teach you how to be a change agent and an adaptable leader. Nevertheless, the literature also emphasizes the difficulties that industry professionals have while trying to get additional certifications, such as the lack of time flexibility and the difficulty in juggling job and school obligations. By and large, the available research supports the idea that universities should provide certificate programs tailored to specific industries so that working professionals can improve their employability in the age of Industry 4.0, which in turn boosts industry competitiveness. Programs for Industry 4.0 Certification: Equipping Workers for the Digital Era. The industrial environment has been drastically changed by the emergence of Industry 4.0, which is defined by the integration of cyber-physical systems, artificial intelligence, and the Internet of Things. Adaptability and the acquisition of new competences are essential for success in today's digitalized workplace. The supply of certificate programs centered on Industry 4.0 by higher education institutions may greatly enhance the employment options of industry experts and empower them. Vocational systems need to adapt to meet the demands and expectations of new technological challenges, and the relevance of vocational education and training for workers depends on how far down the path to Industry 4.0 a company is. Along with technical abilities, educational offers in the field of Industry 4.0 should prioritize the development of multidisciplinary and soft skills, including problem-solving, change management, and critical thinking. Higher education institutions often provide certificate programs in Industry 4.0 that encompass a broad variety of specialist subjects, such as: Offering a variety of certificate programs focused on Industry 4.0, higher education institutions are helping industry professionals get the skills they need to succeed in the digitalized industrial landscape. This boosts their career prospects and makes their industries more competitive. To guarantee that industry professionals are prepared to face the problems and seize the possibilities given by Industry 4.0, this method of curriculum creation and educational offers is vital.

## 3. CHANGE MANAGEMENT AND ORGANIZATIONAL TRANSFORMATION:

Higher education institutions may provide industry professionals the tools they need to face the difficulties and seize the possibilities of Industry 4.0 by delivering programs that are relevant to the industry. Professionals in the field can reap several benefits by pursuing Industry 4.0 certificate programs. Critical thinking, problem-solving, and change management are just a few examples of the multidisciplinary and soft skills that students in these programs hone; they are all necessities in today's increasingly digitalized workplace. Certificate programs are a great way for working people to improve their skills and develop in their professions without leaving their existing jobs. They are commonly provided through online or hybrid learning formats, so it's easy for them to fit them into their busy schedules.

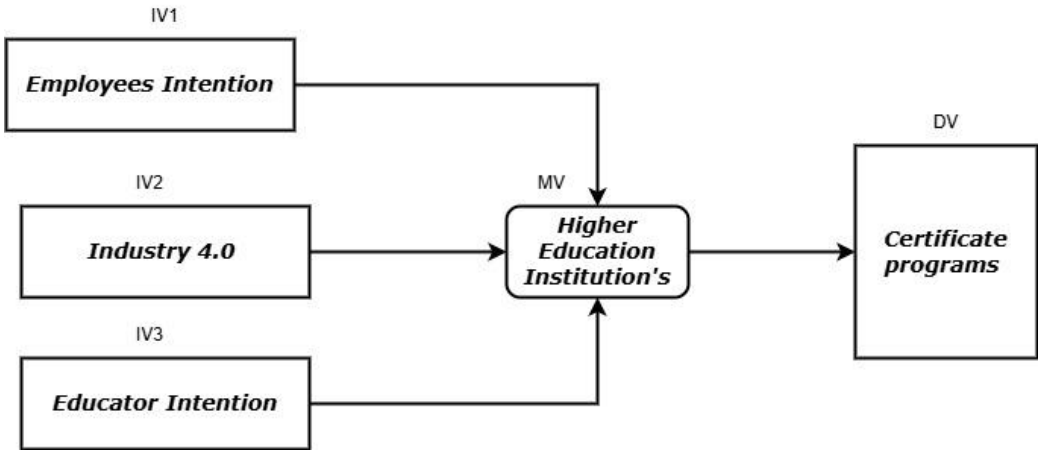
## 4. OBJECTIVE:

This study aims to analyse how universities may best serve the needs of working professionals by developing and delivering certificate programs with an emphasis on Infrastructure 4.0.

## 5. SCOPE OF THE STUDY:

- Higher education institutions must adapt their curricula and course offerings to reflect the needs of industry 4.0 to keep up with the ever-changing standards for professional competence.
- The effect of Industry 4.0 certification programs on workers' ability to advance in their careers and advance in their craft.
- Learn to create and execute high-quality Industry 4.0 certificate programs at the university level, including common pitfalls and solutions.

**Concept Framework:**




Dependent variable: Certificate Program, Independent variables: Employee Intention, Industry 4.0, educator Intention & Mediating Variable: Higher Education Institution's (HEI's)

## 6. SIGNIFICANCE OF THE STUDY

The study is essential since it explains how universities are changing the job market for those working in the sector by creating certificate programs that are tied to sector 4.0. Examining the obstacles and solutions to curriculum creation, pedagogical techniques, and industry-academia collaboration, the study sheds light on the critical components of designing and implementing effective Industry 4.0 certificate programs. A key finding of the study is that higher education institutions play a pivotal role in helping industry professionals close the skills gap and adapt to the digital era.



Using quantitative research i.e., collect the data from the employees working in Malaysian industries, universities, Autonomous higher education institution and lecturers/ faculty working in the institutions. The data use for testing the variable Dependent variable: Certificate Program, Independent variables: Employee Intention, Industry 4.0, educator Intention & Intervening Variable: Higher Education Institution's (HEI's) for better understand how to design and execute certificate programs in Industry 4.0 in higher education, we combed through the chosen sources to extract important themes, obstacles, and recommendations. The questionnaires are prepared using the 5-point Likert scale. The target group for data collection was employee working in Industries and teaching faculty working in higher education institutions. The total number of samples was 293 was collected and test using the reliability, validity and structure equation modelling methods.

## 7. DATA ANALYSIS

Reliability Test: The Cronbach's alpha value for the all the five variables is 0.752 i.e., according to the Mohd Arof et al., 2018, the value is above to 0.70, it indicates the instrument used for the study was significant and approved to use the data for analysis.

Testing the interrelationship between the variables using SEM through SmartPLS

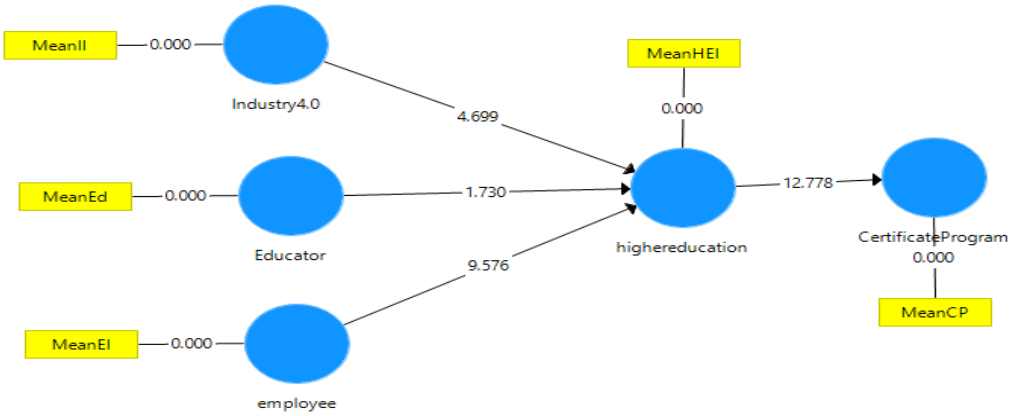



Table No. 1: Testing of the variable using SmartPLS

| | Original Sample (O) | Sample Mean (M) | Standard Deviation (STDEV) | T Statistics (\|O/STDEV\|) | P Values |
|---|---|---|---|---|---|
| Educator -> higher education | 0.108 | 0.107 | 0.062 | 1.730 | 0.084 |
| Industry4.0 -> higher education | 0.190 | 0.190 | 0.040 | 4.699 | 0.000 |
| employee -> higher education | 0.549 | 0.548 | 0.057 | 9.576 | 0.000 |
| Higher education -> Certificate Program | 0.575 | 0.573 | 0.045 | 12.778 | 0.000 |

According to the above table, to find the relationship between the Independent, Department variables. The relationship between the education intention and higher education intention to start the industry 4.0 was not significant because the T values was less than 1.96 (1.648), and P value was more than 0.05 (0.100). The relation between the industry 4.0 and higher education was significant and for design the certification program in the industry 4.0 offering by the higher education has impact on the certificate program design by the HEI's. The relationship between employee intention and higher education was significant and higher education institutions offering the certificate program with the support by the industry employees and employers as stack holder.

## 8. FINDING:

Workers have demonstrated a desire to acquire new knowledge and hone their existing abilities in data analytics, automation, robotics, and other fields pertinent to industry 4.0. The authors Woschank and Pacher (2020) According to Ishak and Sukardi (2020), One of the most crucial prerequisites for the effective implementation of Industry 4.0 initiatives is the training and further certification of personnel in relation to digitalization, automation, sustainability, and new technologies. To meet this need, universities must provide certificate programs with an emphasis on Industry 4.0 so that working professionals in this field can adapt to and succeed in the modern digital economy. Digital transformation and process automation are among the many specialist subjects usually covered by these certificate programs (Woschank & Pacher, 2020; Masrifah & Sudira, 2020; Spoettl & Tūtlys, 2020). Cyber-physical systems and the Industrial Internet of Things. AI, robotics, and sophisticated manufacturing processes. Big data analytics and data-driven decision-making. Eco-friendly and regenerative business practices.

## 9. CONCLUSION

Higher education institutions play a crucial role in providing industry experts with certificate programs focusing on Industry 4.0, according to this study's conclusions. These customized educational programs provide industry experts with the specific information, abilities, and competences needed to adapt to the ever-changing digital world. This boosts their job prospects and makes their industries more competitive. To keep up with the ever-changing demands of Industry 4.0 and produce qualified workers, universities and colleges must continually revise their course

offerings, teaching methods, and collaborations with businesses. They may help the workforce become more skilled and facilitate the widespread adoption of Industry 4.0 methods by taking this step. Higher education institutions' responsibilities in creating and administering Industry 4.0 certificate programs were examined in this study, as was the connection between employee intention and Industry 4.0. To compile the quantitative data, we surveyed lecturers and faculty members as well as workers in Malaysian businesses and educational institutions. "Certificate Program" was the dependent variable in this study, while "Employee Intention," "Industry 4.0," and "Educator Intention" were the independent factors, and "HEI" was the intervening variable. There is a strong correlation between employee intention, Industry 4.0, adoption of certificate programs, and universities, according to the results. This shows that workers are looking to progress their careers by acquiring new skills in areas connected to Industry 4.0, and that higher education institutions are vital in meeting this need by providing appropriate certificate programs. The programs' effectiveness is further enhanced by the fact that instructor goals are in line with business requirements. To close the skills gap and satisfy business expectations, this study is important because it sheds light on how higher education institutions might implement certificate programs in business 4.0 (Reddy, 2019; Mokhtar & Noordin, 2019). According to Wahju (2018), these findings are even more significant in the Malaysian context, where the goal is to become internationally competitive. Somoro et al. (2021) note that this study adds to what is already known about the state of preparation for Industry 4.0 and what it means for partnerships between businesses and universities. Program design aspects, instructional methods, and the programs' effects on participants' professional paths in the long run may all benefit from more investigation in future studies, Raj et al (2024).

The purpose of this study was to identify the characteristics that contribute to certificate program performance by investigating the link between employee intention, instructor intention, and Industry 4.0. The study also included higher education institutions as an intervening variable. The findings-based conclusion should highlight the noteworthy correlation found among certificate program efficacy, employee intention, Industry 4.0, and educational institutions. This section should emphasize how these programs are in demand due to employee interest and the changing requirements of Industry 4.0. An important starting point should be the responsibility of educational institutions to close the skills gap through the provision of appropriate training and certification. In addition, the last section ought to address what these results mean. For instance, it may propose ways for universities to adapt their curricula to meet the demands of businesses or urge lawmakers to back such efforts. You might want to think about adding a section on the study's limitations and possible future research directions. Include a reference to the Malaysian Education Blueprint 2013–2025 (Halili et al., 2021) and how it aligns with Industry 4.0 objectives to bolster your conclusion, considering the Malaysian context of your study. You may also discuss the general methods for Malaysian higher educational institutions (Mokhtar & Noordin, 2019; Rahman et al., 2020) and the readiness of Malaysian companies (Soomro et al., 2021). To offer a more balanced view, it is helpful to note the difficulties encountered by Malaysian HEIs while implementing Industry 4.0 (Mokhtar & Noordin, 2019).

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