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# Construction Workers' Skills, Competencies, Knowledge and Job Satisfaction in Industry 4.0 Technologies

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**Abstract:** This study aimed to assess the competencies and job satisfaction of construction workers in a developing country. Data were collected through a survey of 200 construction workers, including engineers and human resource personnel. The study used a competency framework to evaluate respondents' job performance across different dimensions. The results showed that construction workers' competencies were moderately effective across all competency dimensions. Moreover, job satisfaction was found to be moderate, with the majority of respondents reporting satisfaction with their salary and benefits. The study highlights the importance of developing training and development programs that focus on enhancing construction workers' competencies to improve their job performance and job satisfaction.

**Key words:** Competencies, job satisfaction, construction workers, developing country, competency framework, job performance, training and development programs.

## INTRODUCTION

The goal of industry revolution 4.0 at present is to rapidly change technology to enhance productivity, improve the customer experience, productivity automation, achieving manufacturing and supply change integration. The consequence is to increase human productivity (AC Pereira et al., 2017).

The construction industry today has encountered problems with skilled workers' demand to lead the activities to accomplish the work assignment specified in the work breakdown schedules (JR Turner, 1999). The status of the construction workers in the workplace needs to upgrade based on the standards. The workers' income is meagre due to acquired skills and knowledge (K Healy, 2004). The work experience of the workers was also required to develop by attending proper training.

The construction workers were handling a variety of construction tools and equipment such as a rammer compactor, plate compactor, generator set, compressor, walk-behind roller, earthmoving equipment, rigging and lifting equipment, fast-moving vehicle equipment, and civil works equipment (V Paquet et al., 2009). These are the equipment utilized by the construction workers on the construction project sites (CC Hassan et al., 2007).

The construction workers were dissatisfied with their skills and knowledge due to a lack of supporting learning in performing the required equipment tasks (RD Pea, 2018). The construction workers needed comprehensive skills training using Technical Education and Skills Development Authority (TESDA) training regulation standards. The Technical Education and Skills Development Authority (TESDA) training regulation is a training guide emphasizing the basic, common, and core competencies that can be used during acquiring national competency assessment (M Dumaua-Cabauatan et al., 2018).

The issue of the construction workers in the project site was to acquire the proper way of handling the equipment, parts identification and familiarization, do's and don'ts, maintenance, and equipment safety operations (PCE Trust's). It needs to make progress reports and fill up daily utilization reports submitted to the supervisor (R Simons, 1994).

From the problem encountered during the tour of the construction workplaces to solve the issues and create productive construction activity in the different workplaces, the construction human resource management office will recommend a comprehensive strategic plan to achieve and practice the 4.0 Industry Revolution (M Greif, 2017).

These 4IR intend to increase productivity, improve quality of life, acquires new markets, lower barriers to entrepreneurship, inequality, cyber security risk, core industry disruption, and ethical issues (A Selama et al., 2017).

The main objectives of the research were to evaluate the skills and knowledge in performance of the utilization of the machine operators and helpers. It includes the age and gender of the identified respondent groups, the educational attainment of the respondents, related work experience, monthly income and seminars/training attended. The status of the educational development of the workers given by the human resource program, the availability of the light tender equipment and civil works for skills and knowledge development, the learning competencies applied during the construction operations, the performance of the human resources training plan and strategies, issues and concern during the implementation of training programs, and the training development strategies.

## LITERATURE REVIEW

The literature review of this research focusing on the development of the construction sector specifically in the human resource management and the logistics area.

### Industry Revolution 4.0

The Fourth Industrial Revolution or Industry 4.0 is an umbrella term that refers to modifications in the industrial value chain process. Those modifications become stronger by emerging technologies and by providing better techniques to arrange and handle regular procedures (prototyping, progression, production, coordination, supply etc.) within the manufacturing industry (Culot, Orzes, Sartor & Nassimbeni, 2020). In short, it involves all the additional computerization firms now deploy to increase their manufacturing cycles and combine various aspects of work into a linked digital ecosystem (Bragagnolo, 2017). The use of technology in the industry is associated with evolution 3.0, in which automation, computers, and electronics characterized this stage (Bawany, 2019; Bragagnolo, 2017). Nonetheless, the new digital systems, materializing as part of Industry 4.0, instrument data for both physical and digital resources through emerging Industrial IoT tools; Robotics resources and autonomous robots; Big Data analytics devices; Artificial Intelligence and Cognitive systems; and Augmented Reality (Zheng et al., 2018). The significant difference between the current and the previous stage is that these digital technologies strengthen the physical part of development, production, distribution, and performance within one ongoing Physical-Digital-Physical (PDP) round (Đuričin & Herceg, 2019).

### Challenges of Industry

Revolution 4.0 Industry 4.0 is a brand new standard of hooked up and digitized manufacturing. It participates in a significant part in changing well-known manufacturing plants into smart and self-governing manufacturing. Typically, Industry 4.0 produces a lot of brand new options for firms; however, all at once, numerous difficulties are emerging coming from the continuous hands-free operation and digitization (Alhosani, Ahamat, & Ismail, 2021). Industry 4.0 is a sight for the future because it entails several components and encounters numerous forms of difficulties and troubles, featuring technological obstacles, economic challenges, political concerns, and social issues (Zhou, Liu, & Zhou, (2015, August). Some of the critical influencing challenges are social problems, including demographic improvement, worker qualifications, digital skills, and new modern technologies. Shortage of digital culture and skills and skills are the main obstacles from the employees' perspective. Companies require to bring in, retain, and qualify their employees

who are comfortable doing work in a vibrant ecological community. Business' effectiveness, along with Industry 4.0, will depend upon their staff members' skills and knowledge. The most significant constraint might be helping and supporting the workforce needed to place digitization into the workplace (Alhosani, Ahamat, & Ismail, 2021). The current work in manufacturing deals with a high risk of being automated to a considerable extent because the jobs will be decreased. Keeping manufacturing jobs will include even more knowledge and more hard-to-plan and temporary duties. The employees significantly have to monitor computerized devices. The decision-making method is necessary to be decentralized since all staff members should participate in design tasks as an end-to-end design aspect. In the short term, the trend towards more significant computerization will remove several of the often low-skilled workers who conduct easy, repeated tasks (Rawlinson, 2019). Simultaneously, the increasing use of software applications, connectivity, and analytics will undoubtedly improve the demand for workers and competencies in software program growth and IT modern technologies. New task profiles, along with novel requirements for instruction and learning, are expected to emerge and reduce the relevance of manual work instead of IT-skills. Additionally, procedures are even more intricate, which brings about an increase of work with more essential qualifications and a loss in projects requiring lesser credentials. Therefore, providers need to certify their workers for an additional key, teaming up, and imaginative tasks along with more significant accountabilities (Bonekamp & Sure, 2015). Economic Challenges Concerning the ongoing globalization approach, firms have to reduce time-to-market, much shorter item lifecycles, and the necessity to cut prices to keep reasonable. Furthermore, markets have ended up being heterogeneous and considerably unpredictable. Industry 4.0 practices have several obstacles and occur in a vibrant, affordable environment. The features of Industry 4.0 re-design the industry boundaries, creates entirely brand-new industries and reveals reputable manufacturing providers to new reasonable challenges (Tariq & KHAN, 2022). Subsequently, the need for cooperation is an essential matter now and cannot survive without effective networking.

The business currently has to enter into crucial collaborations with their suppliers or competitors to remain competitive. That leads to the relationship of entire market value chains, and therefore, raises the complexity of processes and monetary constraints (Goerzen, Iskander & Hofstetter, 2021). Technological Challenges Digital connectivity indicates the sharing of data and opening up to a competitive market atmosphere, causing straightforward company ecosystems that are mainly helped with online systems. Appropriately, companies need to handle two issues. A very high degree of clarity reveals companies to the risks of cyber-attacks and industrial snooping, and the obstacle of protecting data civil liberties and gain access to (Krämer, Schnurr & Wohlfarth, 2019). Second, a business that establishes system standards might hinder the working contemporary business solutions for repositories and finally steer them away from the marketplace. Various other difficulties describe the shortage of global requirements and data discussing the process and inadequate existing data premium. To deal with these difficulties, historians recommend providers to demonstrate and methodically introduce their current company models (Cavalieri & Pezzotta, 2012). Political Challenges Political problems describe legal concerns and issues of synchronization and partnerships. Federal governments need to support institutions and the progression of innovations and integrate those technological devices in the existing environment. Moreover, governments must develop lawful specifications for the use of big data, considering that one of the essential concerns is privacy, and data compilation will be crucial while socializing with smart devices. Developing work flexibility further demands policies for job opportunities and security to guard workers (Wang, Demerouti, Blanc & Lu, 2018). Skills and Competencies Two of the main building blocks of any learning process is skills and competencies (Figure 1). Skills are specific learning activities that require abilities or mastery cultivated through training (Sanghi, 2016). In the business domain, a skill is a physical task that helps perform one or more of the job assignments. Skills allow to apply knowledge and use proficiency for finishing well-defined tasks. In general, it recognizes that a person can perform within a specific circumstance (Ala-Mutka, 2011; Sanghi, 2016). Skills can be intellectual (meaning that it involves the use of thinking styles)

or practical (entailing physical dexterity and making use of materials, techniques, and tools) (Mäkiö-Marusik, 2017; Mäkiö-Marusik, Ahmad, Harrison, Mäkiö & Walter, 2018).

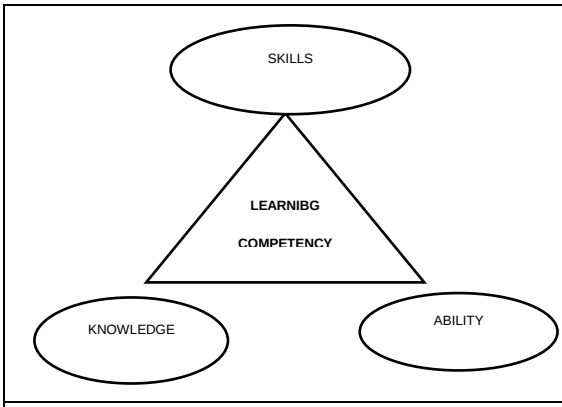


Figure 1
Learning Competency

McClelland (1973) was the first to define competencies; the author stated a competency as "A personal quality that results in a high quality or more effective performance". A competency is a collection of skills, capabilities, and knowledge that permit an individual to perform appropriately in a job. From a business perspective, competencies describe the skills, abilities, as the knowledge that every individual needs to complete a task (Winterton, Delamare-Le Deist & Stringfellow, 2006). Competence is the individual's ability to manage a specific scenario or perform a task properly. This ability might be related to cognitive factors (e.g. different kinds of knowledge), perceptual and intellectual leadership skills (e.g. dexterity), efficient factors (e.g. behaviors, values, motivation etc.), personality traits (e.g. confidence), and social skills (e.g. communicative and participating skills) (Pejic-Bach, Bertoncel, Meško, & Krstić, 2020). Competency Models A competency model is a compilation of competencies that, when put together can determine effective performance in a particular job environment. These competency models are the base for substantial HR tasks such as hiring, training and development, and managing performance (Campion et al., 2011; Stevens, 2013). Over the years, several competency models have been developed. One of these models is the basal theory of (Erpenbeck & Von Rosenstiel, 2007). This basic model mapped between theory and practice. The model identifies four competence-classifications, which are (A) activity and realization orientated, (P) personal, (S) social-communicative competencies, and (F) specialized-methodical. In addition to competence types advancement and gradient strategies (Figure 2).

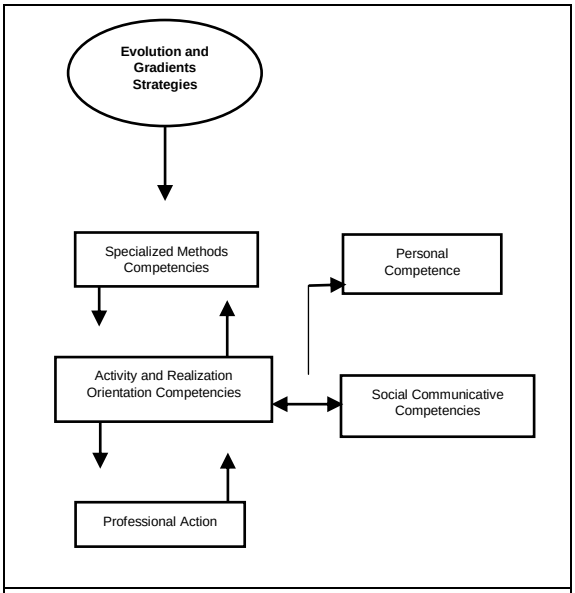


Figure 2.Model of competencies referring to Erpenbeck & Rosenstiel (2007)

Egeling & Nippa (2009) added another classification by dividing competencies into meta, method, domain, and social competencies. Additional competency models have been designed for leadership and management (Prifti, Knigge, Kienegger & Krcmar, 2017). CEB Inc. is a leading international company that provides a comprehensive Universal Competency Framework (UCF) known as SHL competency framework. The model is designed based on behavioral-based orientation and was derived by analyzing practitioners and academic approaches. It includes three hierarchical levels, starting with the "Great Eight" as the first level that assists work performance and defines the eight primary groups of competencies. The second level is composed of twenty competency dimensions that further divide these eight groups into additional categories. The third level is comprised of 112 element competencies. All of the available competencies are explained at this level, and each one may be matched at any of the 112 components (Figure 3).

| GREAT EIGHT-FACTOR LEVEL | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 LEADING & DECIDING | 2 SUPPORTING & COOPERATING | 3 INTERACTING & PRESENTING | 4 ANALYZING & INTERPRETING | 5 CREATING & CONCEPT-UALIZING | 6 ORGANIZING & EXECUTING | 7 ADAPTING & COPING | 8 ENTERPRIZING & PERFORMING |
| DIMENSIONS TWENTY-COMPETENCY LEVEL ⇩ ⇩ ⇩ ⇩ ⇩ ⇩ ⇩ ⇩ | | | | | | | |
| 1.1 | 2.1 | 3.1 | 4.1 | 5.1 | 6.1 | 7.1 | 8.1 |
| Deciding and Initiating Action | Adhering to Principles and Values | Relating & Networking | Writing & Reporting | Learning & Researching | Delivering & Meeting Expectations | Coping with Pressure | Achieving goals & Objectives |
| | | | | | | | |
| 1.2 | 2.2 | 3.2 | 4.2 | 5.2 | 6.2 | 7.2 | 8.2 |
| Leading and Supervising | Working with people | Persuading & Influencing | Applying Expertise and Technology | Creating & Innovating | Following Instructions & Procedures | Adapting & Responding to change | Entrepreneurial & Commercial Thinking |
| | | | | | | | |
| | | 3.3. | 4.3 | 5.3 | 6.3 | | |
| | | Presenting & Communicating | Analyzing | Formulating Concepts & Strategies | Planning & Organizing | | |

**Figure 3. Matrix of Universal Competencies Frameworks**
(shl.com, 2020)

This model gives a detailed level of information. This framework provides an overview of competencies, which allows the development of competency models for specific topics. For this particular study, the proposed model is adapted using the "Great Eight" as the first level and the twenty competencies dimensions as the second level. However, the third level is accumulated through published articles and literature reviews. The proposed competency model is adapted for

the required competencies at the behavioral and IR4.0 requirements (Bartram et al., 2012). Choosing the SHL universal competency model as a foundation for this research contributes to the linkage between practice and academic knowledge. Companies commonly use the model to develop their competencies schema and HR practices (Hensel & Nilsson, 2019).

Previous Studies in IR4.0 Competence Framework

Some recent studies try to propose other industry revolution 4.0 competencies framework. Some of it is comprehensive and general, and others are oriented or adapted to a specific domain. The following is an illustration of some recently proposed frameworks for IR 4.0 competencies. Fitsilis, Tsoutsa & Gerogiannis (2018) conducted a study to present an initial competence model to respond to the need for comprehensive competence and skills model for IR4.0 in the industry. The developed model considered into account that "there is no 'technological determinism, there is need to address different skills needs according to the specific Industry 4.0 'biotopes,' there are different workforce segments, various sectors are using different subsets of the technologies under consideration, there are various product lifecycles according to which additional development and operation processes need to be supported". The identified skills are classified as "technical, behavioral and contextual". Technical skills are nine technological areas that are energetic growths in Industry 4.0 advantages. These key technologies are "Big data and analytics; Autonomous robots; Simulation; Horizontal and vertical system integration; The industrial Internet of Things; Cybersecurity; The cloud; Additive manufacturing; Augmented reality". Contextual skills are related to the industry's specific production practices, standards, guidelines, and organizational structure.

These processes may be allocated to management processes or production processes. Business Planning and Logistics are examples of management processes, and product design is an example of production processes. Transversal skills refer to "Skills that are typically considered as not specifically related to a particular job, task, academic discipline or area of knowledge and that can be used in a wide variety of situations and work settings (for example, organizational skills)". This contains personal competencies, social and interpersonal competencies, action-related competencies, and methodological competencies. Decision making and analytical skills are examples of methodological competencies (Fitsilis, Tsoutsa & Gerogiannis, 2018).

Flores, Xu & Lu (2020) conducted a study to "raise and address an important change for the human capital in the future of Industry 4.0, and to propose a human-focused perspective for companies underneath the new Industrial Revolution". One of the objectives is to propose a framework for the inclusion of the Industry 4.0 organizations' competencies. The taxonomy of competencies is based on analyzing the information from other research done by Hecklau, Orth, Kidschun & Kohl (2017). The proposed framework has 14 essential competencies and five main dimensions; soft workforce, challenging workforce, cognitive workforce, intelligent, emotional workforce, and the digital workforce.

The dimension of soft workforce competence includes flexibility and social; these skills are "communication, teamwork or cooperation, leadership, willingness to learn, self-development, negotiation and flexibility or adaptability". The dimension of hard workforce competence includes skills professional and dexterous; The pool covers "industrial organization, industrial processes, standards understanding, problem-solving techniques, designing with software, human-machine interactions, digital network settings, digital security, and coding or programming." The dimension of cognitive workforce competence includes the skills of intelligence and analytical. Within this category, skills are divided into three facets: facet one, "verbal aptitude (i.e., vocabulary, spelling, and reading)," facet two, "numerical aptitude (i.e., math, arithmetic)" and facet three, "spatial aptitude (i.e., coordination, memory, decision-making, problem-solving thinking, abstract reasoning, and analytical thinking)." The dimension of emotional intelligent workforce competence includes self-awareness and empathy; the skills have "self-awareness, self-control, positive outlook, empathy, achievement orientation, and motivation." The dimension of the digital workforce competence includes skills of digital literate and digital interaction; the list

consists of "programming, cybersecurity, digital networks, cloud computing, databases, web development and also the management of Industry 4.0 technologies (i.e., IoT, big data analytics, 3D printing, simulation, augmented and virtual reality)" (Flores, Xu & Lu, 2020).

Simic & Nedelko (2019) provides a comprehensive framework for employees' competencies in the IR 4.0 era. The proposed results are based on critical analysis for recent relevant studies. The authors revealed four categories of competencies; social competencies, personal competencies, managerial competencies, and professional competencies. Social competencies include the following; "building a relationship, sharing knowledge and experience identification with the company, communication, customer orientation, teamwork/team collaboration, solving the conflict, cooperation within the company, and exert influence."

Personal competencies include the following; "pursuit of results (entrepreneurship) innovativeness and flexibility, analytical thinking, self-reliance, decision-making, troubleshooting, thoroughness/reliability, professional development/ readiness to learn, and managing each other." Managerial competencies include the following; "building an efficient organization team building, ability to delegate, motivating, strategic thinking, planning, leadership, project management, and team management." Professional competencies include the following; "administering/maintaining documentation, negotiating, orientation in business, procedures – knowledge and application, IT skills, technical skills, professional knowledge, process management, and knowledge of foreign languages" (Simic & Nedelko, 2019).

Hecklau, et al., (2017) conducted a study funded by EU H2020 within the project "Excellence Center for Production Informatics and Control" to examine the IR 4.0 revolution's influence on the employees' competencies. The study makes a critical review of 12 studies chosen from a different location in the world. The proposed framework called "job-specific and job family competencies," are a cross-classification approach from three levels. At the highest level, all competencies should be either behavioral (cognitive, social, and personality) or technical (know-how). At the second level, the behavior could have motivation, attitudes, and abilities; and technology could have skills and knowledge. There are four categories, personal, domain, social, and methodological, at the third level, which can be allocated to more than one of the higher levels. One sill can be assigned to more than one category.

The job-family framework is a comprehensive approach that interrelates all the common competencies that logically related to the majority of a career path at IR 4.0 organizations; thus, every employee within the job family shares these competencies. Behavioral competencies are the majority of the skills. However, employees have no choice, and without the technical competencies, they cannot perform their job in IR4.0 organizations. In particular, the category of social competencies include Communication, cooperation, and leadership; the category of methodological competencies include analytics, complex problem solving, and decision making; the category of personal competencies include creativity, willingness to learn, and flexibility and adaptability; the category of social competencies include digital networks, digital security, coding, process understanding, and interdisciplinary competence (Hecklau et al., 2017).

Bermúdez & Juárez (2017) conducted a study to identify the required operational management personnel competencies at automotive part suppliers in Nuevo Leon to generate a transition for Industry 4.0. The qualitative results from interviewing 15 managers from 10 operational managements revealed that IR4.0 competencies are allocated into four dimensions; information and communication technologies, Innovation management, organizational learning, and environment. Dimension one is related to "the knowledge and management of software and interfaces that support operations management (resources, people, production)". Dimension 2 is connected to "knowledge and management of simulation systems." Dimension 3 is related to "develop in the employees' skills, capacities, and processes of improvement". And dimension four is connected to "creativity in designing strategies to introduce new practices". Additional competencies had been suggested from the interviewees and found to be relevant; "leadership skills, financial analysis skills, and critical and disruptive thinking" (Bermúdez & Juárez, 2017).

Grzybowska & Lupicka (2017) conducted a study to provide a framework for contemporary managers' competencies to deal with the new challenges of the IR 4.0 revolution. The study does an empirical survey for managers in the automotive industry. The result revealed eight essential competencies, which are supposed to be possessed by contemporary managers to deal with the new challenges of IR 4.0. Those competencies are creativity, entrepreneurial thinking, problem-solving, conflict solving, decision making, analytical skills, research skills, and efficiency orientation. This study is specific to managerial skills only. The technical skills were not explored because the study focuses only on the manager's level (Grzybowska & Łupicka, 2017).

Sakuneka, Marnewick & Pretorius (2019) conducted a study to provide a specific competencies framework for control system engineers that fit with the IR 4.0 requirements. The study makes a critical analysis of 18 relevant previous studies. Authors can identify 69 relevant competencies to IR4.0, but the majority are multi-disciplined competencies. The specific discipline competencies to control system engineers are 15 and include the following; computer programming (coding) skills, CPS development, and testing, Data processing analytics (Big Data), digital competency, embedded software design, humanities, IT technical abilities, modern IT solutions capabilities, negotiation, network technology competency, new technology competency (3D, IoT), new-media literacy skill, radio technology competency, robot control via production servers, robot programming abilities, sense-making skill, transmission technology competency, virtual collaboration competency (Remote), working with modern interfaces. This study is specific to technical-based competencies; the revealed that nine competencies are completely new to the current competencies framework of control system engineers, and the other ten competencies have partly existed before. However, the study provides a list of the competencies gap to the existing framework and include the following; advanced programming, new technology e.g. CPS, new technology e.g. big data analytics, new technology and devices, advanced control i.e., coding, humanities, advanced programming, evolving technology, negotiation, New technology e.g. Zig Bee, Evolving technology e.g. IPv6, cloud computing, new technology e.g. NFC, robot control via production servers, robotics programming, and other modern technology use competencies (Sakuneka, Marnewick & Pretorius, 2019).

## MATERIALS AND METHODS

Technology has become more advanced than ever, and companies can now produce items and interior solutions that were difficult to envision a decade ago (Urbinati, Bogers, Chiesa & Frattini, 2019). The manufacturing industry markets may have been behind on keeping up with all those innovations. Identified respondents were taught of the required learning competencies for the development in preparations for industrial revolution 4.0. These Eight Great factors of competencies includes: Leading & Deciding, Supporting & Cooperating, Interacting & Presenting, Analyzing & Interpreting, Creating & Conceptualizing, Organizing & Executing, Adapting & Coping, Enterprising, and Performing.

The human resource management planned, organized and implement the necessary equipment, tools and materials to enhance the knowledge and skills in construction sectors.

The methods of the study were the researcher conduct a survey to the construction workers, supervisors, human resource management and the construction engineers. The researcher reviews the learning competencies from the Technical Education and Skills Development Authority-TESDA. The researcher sequences the necessary competencies such as basic, common and core competencies.

## RESULTS AND DISCUSSION

Generally, this research study highlights the significance of employees' competencies to overcome the changes happening towards IR 4.0 successfully.

Findings from the literature review were mainly about behavioral competencies and a little about knowledge and technology competencies.

The training of more competencies is still restricted to teamwork situations or further discussions.

The mentioned examples reveal that the focus in today's economy is on domain knowledge. At the same time, IR4.0 mostly affects work environments, and behavioral competencies are essential competencies for employees.

Therefore, research must center on studying exactly how today's and future employees' competency profiles can be conformed for IR4.0. This may include requirements' definition educational programs for IR4.0.

This study will open the way for more research to be done on this topic. This study was based on a literature review.

To enrich the results, further information can be collected through expert interviews and focus groups. Besides, further studies on IR 4.0 are needed to investigate other competencies and find a way to apply the model in practice, such as setting a competency profile for a specific job description.

Profile of the respondent groups as to age and gender

**Table 1. Profile of the respondent groups**

N=200

| Age and Gender of the Respondents | Construction Workers (180) | | Construction Human Resource Personnel (10) | | Construction Engineers (10) | |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female |
| *41 years old and above* | 20 | 5 | 0 | 1 | 1 | 2 |
| *31 to 40 years old* | 40 | 25 | 0 | 2 | 2 | 1 |
| *21 to 30 years old* | 40 | 15 | 3 | 1 | 2 | 0 |
| *20 years old and below* | 20 | 15 | 1 | 2 | 1 | 1 |
| *Sum:* | 120 | 60 | 4 | 6 | 6 | 4 |
| *%:* | | | 100 | | | |

Table 1 shows the demographic profile of respondents grouped by their occupation in the construction industry. The total number of respondents is 200. Among them, 180 are construction workers, 10 are human resource personnel, and the remaining 10 are construction engineers.

The table also shows the distribution of respondents by age and gender. Among the construction workers, the majority (40%) are between the ages of 31 and 40, while 20% are aged 41 and above, 20% are 21 to 30 years old, and the remaining 20% are 20 years old and below. The gender distribution among construction workers is predominantly male, with 120 male workers and 60 female workers.

Among the human resource personnel, only four respondents are male, while the remaining six are female. In terms of age distribution, there are no respondents aged 41 and above, and only two respondents aged 31 to 40. The majority of human resource personnel are between 21 and 30 years old, with three male and one female respondents falling into this age group. Two female respondents are aged 20 years old and below.

Finally, among the construction engineers, the majority (40%) are aged 31 to 40, while one male and two female respondents are aged 21 to 30. One male and one female respondent are aged 20 years old and below.

The implications of this table are that the construction industry is predominantly male, with a significant gender imbalance among construction workers. Additionally, the age distribution among construction workers is quite diverse, with a relatively even distribution across all age groups. However, there are very few female human resource personnel and construction engineers, indicating a need for more diversity and representation in these fields. Overall, this table

highlights the importance of promoting diversity and inclusion in the construction industry to create a more equitable and sustainable workforce.

**Table 2. Educational qualification of the respondents**

N=200

| Highest Educational Attainment | Construction Workers (180) | | Construction Human Resource Personnel (10) | | Construction Engineers (10) | |
|---|---|---|---|---|---|---|
| | X | % | X | % | X | % |
| *Bachelor's Degree* | 10 | 5.55 | 9 | 90 | 10 | 100 |
| *Vocational Graduate* | 40 | 22.22 | 1 | 10 | 0 | 0 |
| *High School Graduate* | 40 | 22.22 | 0 | 0 | 0 | 0 |
| *Alternative Learning System* | 20 | 11.10 | 0 | 0 | 0 | 0 |
| *Elementary Graduate* | 20 | 11.10 | 0 | 0 | 0 | 0 |
| *Others* | 50 | 27.75 | 0 | 0 | 0 | 0 |
| *Sum:* | 180 | 100 | 10 | 100 | 10 | 100 |

Table 2 provides information on the educational qualifications of the respondents of the study. The study includes 200 participants, out of which 180 are construction workers, 10 are construction human resource personnel, and the remaining 10 are construction engineers.

The table shows that all of the construction engineers have a Bachelor's degree, indicating that this level of education is necessary to become a construction engineer. In contrast, the construction workers have a diverse range of educational backgrounds, with the highest percentage of respondents having a vocational graduate degree (22.22%) followed by high school graduates (22.22%). Only a small percentage of construction workers have a Bachelor's degree (5.55%).

It is interesting to note that none of the respondents who identified as "others" have any formal educational qualifications, making it unclear what their educational background is. Additionally, there are no respondents who have completed alternative learning systems, such as GED or equivalency programs.

The implications of these findings are significant. They suggest that there may be a lack of education and training opportunities for construction workers, which could have an impact on the quality and safety of construction projects. The results also highlight the need for more educational programs and training opportunities for workers in the construction industry. It is also worth considering how the educational backgrounds of construction personnel may affect their job performance and responsibilities. For example, workers with higher levels of education may be better suited for managerial roles or more technical aspects of construction work.

**Table 3. Related work experience**

N=200

| Related work experience | Construction Workers (180) | | Construction Human Resource Personnel (10) | | Construction Engineers (10) | |
|---|---|---|---|---|---|---|
| | X | % | X | % | X | % |
| *Civil works* | 40 | 22.22 | 1 | 10 | 2 | 20 |
| *Light Equipment Tender* | 60 | 33.33 | 9 | 90 | 6 | 60 |
| *Heavy Equipment Operator* | 20 | 11.11 | 0 | 0 | 2 | 20 |
| *Fast Moving Operator* | 20 | 11.11 | 0 | 0 | 0 | 0 |
| *Rigging and Lifting Operator* | 20 | 11.11 | 0 | 0 | 0 | 0 |
| *Other* | 20 | 11.11 | 0 | 0 | 0 | 0 |
| *Sum:* | 180 | 100 | 10 | 100 | 10 | 100 |

Table 3 provides information on the related work experience of the respondents in the study. The study includes 200 participants, out of which 180 are construction workers, 10 are construction human resource personnel, and the remaining 10 are construction engineers.

The table shows that the majority of construction workers have experience in light equipment tender (33.33%), followed by civil works (22.22%). Heavy equipment operation and fast-moving operation are less common among construction workers, with only 11.11% of respondents having experience in each area. There are also 11.11% of respondents who identified as "other," making it unclear what type of work experience they have.

All of the construction human resource personnel have experience in light equipment tender, while none have experience in heavy equipment operation or fast-moving operation. This suggests that human resource personnel may have a more administrative role in construction projects, as opposed to being directly involved in the physical labor.

All of the construction engineers have experience in civil works, and a significant portion (60%) have experience in light equipment tender. This indicates that engineers may have a more specialized role in construction projects, requiring specific technical expertise.

The implications of these findings are significant as they suggest that different roles in construction projects require different types of work experience. Employers in the construction industry should be mindful of the specific work experience requirements for different roles and ensure that they hire individuals with relevant experience. Additionally, it may be beneficial for individuals interested in the construction industry to gain experience in multiple areas to increase their employability.

**Table 4. Monthly salary of the respondents**

N=200

| Salary of the respondents per month | Construction Workers (180) | | Construction Human Resource Personnel (10) | | Construction Engineers (10) | |
|---|---|---|---|---|---|---|
| | X | % | X | % | X | % |
| *50,001 and above* | 0 | 0 | 0 | 0 | 0 | 0 |
| *30,001 to 50,000* | 0 | 0 | 0 | 0 | 1 | 10 |
| *20,001 to 30,000* | 0 | 0 | 0 | 0 | 2 | 20 |
| *10,001 to 20,000* | 50 | 27.77 | 10 | 100 | 7 | 70 |
| *5,001 to 10,000* | 130 | 72.22 | 0 | 0 | 0 | 0 |
| *5,000 and below* | 0 | 0 | 0 | 0 | 0 | 0 |
| *Sum:* | 180 | 100 | 10 | 100 | 10 | 100 |

Table 4 provides information on the monthly salary of the respondents in the study. The study includes 200 participants, out of which 180 are construction workers, 10 are construction human resource personnel, and the remaining 10 are construction engineers.

The table shows that the majority of construction workers (72.22%) earn between 5,001 to 10,000 pesos per month, while 27.77% earn between 10,001 to 20,000 pesos per month. None of the construction workers earn 30,001 pesos or above per month. This indicates that construction workers in the study are earning low wages, which could be a cause for concern in terms of their living standards and job satisfaction.

All of the construction human resource personnel earn between 10,001 to 20,000 pesos per month, while only one of the construction engineers earns between 30,001 to 50,000 pesos per month, and the remaining two engineers earn between 20,001 to 30,000 pesos per month. This suggests that construction engineers may earn higher salaries compared to construction workers and human resource personnel, which is consistent with their specialized roles in construction projects.

The implications of these findings are significant as they suggest that there may be a need to improve the wages of construction workers in the industry. Low wages could result in lower job satisfaction and may even discourage workers from pursuing a career in construction. Furthermore, the lack of a higher salary for workers with more experience or expertise may also discourage workers from investing in their education and training to progress in their careers. Employers in the construction industry should consider reviewing their salary structures to ensure that they are offering fair and competitive wages for their employees.

**Table 5. Leading & Deciding**

N=200

| Competency Dimensions | Respondent Groups | |
|---|---|---|
| | WM | VD |
| *Deciding and Initiating Action* | 2.62 | Moderately Effective |
| *Leading and Supervision* | 2.68 | Moderately Effective |
| *Sum:* | 2.64 | |
| *Interpretation:* | Moderately Effective | |

Legend:

| Scale | Range | Code | Verbal Description |
|---|---|---|---|
| 5 | 4.21-5.80 | VHE | Very Highly Effective |
| 4 | 3.41-4.20 | HE | Highly Effective |
| 3 | 2.61-3.40 | ME | Moderately Effective |
| 2 | 1.81-2.60 | E | Effective |
| 1 | 1.00-1.80 | LE | Less Effective |

Table 5 presents the results of the respondents' ratings on two competency dimensions related to Leading and Deciding, namely "Deciding and Initiating Action" and "Leading and Supervision". The study includes 200 participants and the ratings were done on a 4-point scale: 1 (not effective), 2 (somewhat effective), 3 (moderately effective), and 4 (highly effective).

The table shows that the mean rating for "Deciding and Initiating Action" was 2.62, while the mean rating for "Leading and Supervision" was 2.68. The overall mean rating for the two dimensions was 2.64, which indicates a moderately effective level of performance.

The interpretation of these findings is that the respondents have rated themselves as being moderately effective in the competency dimensions related to Leading and Deciding. This suggests that there is room for improvement in these areas, which could be addressed through training and development programs for employees in the construction industry.

The implications of these findings are significant as effective leadership and decision-making are critical for the success of construction projects. Leaders who are effective in these areas can help to improve project efficiency, reduce costs, and improve overall quality. Therefore, employers in the construction industry should consider investing in training and development programs to improve the competency of their employees in the areas of Leading and Deciding. This could help to enhance the performance of construction projects and increase the likelihood of their success.

**Table 6. Supporting & Cooperating**

N=200

| Competency Dimensions | Respondent Groups | |
|---|---|---|
| | WM | VD |
| *Working with People* | 2.64 | Moderately Effective |
| *Adhering to Principles* | 2.72 | Moderately Effective |
| *Values* | 2.68 | |
| *Sum:* | 2.253 | |
| *Interpretation:* | Moderately Effective | |

Table 6 shows the results of the respondents' ratings on two competency dimensions related to Supporting and Cooperating, namely "Working with People" and "Adhering to Principles". The study includes 200 participants and the ratings were done on a 4-point scale: 1 (not effective), 2 (somewhat effective), 3 (moderately effective), and 4 (highly effective).

The table shows that the mean rating for "Working with People" was 2.64, while the mean rating for "Adhering to Principles" was 2.72. The overall mean rating for the two dimensions was 2.68, which indicates a moderately effective level of performance.

The interpretation of these findings is that the respondents have rated themselves as being moderately effective in the competency dimensions related to Supporting and Cooperating. This suggests that there is room for improvement in these areas, which could be addressed through training and development programs for employees in the construction industry.

The implications of these findings are significant as effective collaboration and cooperation are crucial for the success of construction projects. The ability to work well with others and adhere to ethical principles can help to improve project efficiency, reduce costs, and improve overall quality. Therefore, employers in the construction industry should consider investing in training and development programs to improve the competency of their employees in the areas of Supporting and Cooperating. This could help to enhance the performance of construction projects and increase the likelihood of their success.

**Table 7. Interacting & Presenting**

N=200

| Competency Dimensions | Respondent Groups | |
|---|---|---|
| | WM | VD |
| *Relating and Networking* | 2.67 | Moderately Effective |
| *Persuading and Influencing* | 2.73 | Moderately Effective |
| *Presenting* | 2.67 | Moderately Effective |
| *Communicating Information* | 2.67 | Moderately Effective |
| *Sum:* | 2.885 | |
| *Interpretation:* | Moderately Effective | |

Table 7 shows the results of the respondents' ratings on four competency dimensions related to Interacting and Presenting, namely "Relating and Networking", "Persuading and Influencing", "Presenting", and "Communicating Information". The study includes 200 participants and the ratings were done on a 4-point scale: 1 (not effective), 2 (somewhat effective), 3 (moderately effective), and 4 (highly effective).

The table shows that the mean rating for all four dimensions was 2.67 or 2.73, which indicates a moderately effective level of performance. The overall mean rating for the four dimensions was 2.885, which also indicates a moderately effective level of performance.

The interpretation of these findings is that the respondents have rated themselves as being moderately effective in the competency dimensions related to Interacting and Presenting. This suggests that there is room for improvement in these areas, which could be addressed through training and development programs for employees in the construction industry.

The implications of these findings are significant as effective communication and networking are crucial for the success of construction projects. The ability to persuade and influence others, as well as to present information effectively, can help to improve project efficiency, reduce costs, and improve overall quality. Therefore, employers in the construction industry should consider investing in training and development programs to improve the competency of their employees in the areas of Interacting and Presenting. This could help to enhance the performance of construction projects and increase the likelihood of their success.

**Table 8. Analyzing & Interpreting**

N=200

| Competency Dimensions | Respondent Groups | |
|---|---|---|
| | WM | VD |
| *Writing and Reporting* | 2.66 | Moderately Effective |
| *Analyzing* | 2.78 | Moderately Effective |
| *Applying Expertise and Technology* | 2.62 | Moderately Effective |
| *Sum:* | 2.686 | |
| *Interpretation:* | Moderately Effective | |

Table 8 presents data on the competency dimensions of Analyzing and Interpreting among the respondents, as assessed by the WM and VD groups. The results show that the mean scores for each competency dimension were 2.66, 2.78, and 2.62 for Writing and Reporting, Analyzing, and Applying Expertise and Technology, respectively. The overall mean score for the competency dimension of Analyzing and Interpreting was 2.686, which is interpreted as Moderately Effective.

The competency dimension of Analyzing and Interpreting involves the ability to gather and make sense of information, as well as the ability to use knowledge and expertise to solve problems. The moderate level of effectiveness in this competency dimension suggests that the respondents have some level of skill and knowledge in analyzing and interpreting information, but there is still room for improvement.

The implications of these findings are that construction workers, human resource personnel, and engineers should continue to develop their skills in analyzing and interpreting information, particularly in the areas of writing and reporting and applying expertise and technology. This can be achieved through training and development programs that focus on improving analytical skills, using technology to gather and analyze data, and communicating findings effectively. By improving their skills in Analyzing and Interpreting, these professionals can make more informed decisions and contribute to the success of their organizations.

**Table 9. Creating & Conceptualizing**

N=200

| Competency Dimensions | Respondent Groups | |
|---|---|---|
| | WM | VD |
| *Learning and Researching* | 2.66 | Moderately Effective |
| *Creating and Innovating* | 2.73 | Moderately Effective |
| *Formulating Strategies and Concepts* | 2.64 | Moderately Effective |
| *Sum:* | 2.676 | |
| *Interpretation:* | Moderately Effective | |

Table 9 presents data on the Creating & Conceptualizing competency dimension of the respondents. The competency dimensions include Learning and Researching, Creating and Innovating, and Formulating Strategies and Concepts. The data shows that both WM and VD groups rated the competency dimensions as Moderately Effective, with a mean score of 2.676.

This implies that the respondents have some level of competency in creating and conceptualizing activities related to their work. They have the ability to learn and research, generate new ideas, and formulate strategies and concepts. However, there is still room for improvement, and they can enhance their skills and knowledge further to increase their effectiveness in this area.

Employers can use this information to identify areas where their employees need training and development to improve their competency levels. They can provide training programs to enhance their employees' skills in creating and conceptualizing activities related to their work, which can lead to more innovative and effective work practices. This can also improve the overall productivity and efficiency of the organization.

**Table 10. Organizing & Executing**

N=200

| Competency Dimensions | Respondent Groups | |
|---|---|---|
| | WM | VD |
| *Planning and Organizing* | 2.67 | Moderately Effective |
| *Delivering Results* | 2.73 | Moderately Effective |
| *Meeting Customer Expectations* | 2.64 | Moderately Effective |
| *Instructions* | 2.73 | Moderately Effective |
| *Procedures* | 2.62 | Moderately Effective |
| *Sum:* | 2.678 | |
| *Interpretation:* | Moderately Effective | |

Table 10 presents the data on the competency dimensions of Organizing & Executing, based on the responses of 200 participants. The results show that the mean scores for each dimension are within the Moderately Effective range, with scores ranging from 2.62 to 2.73.

The dimension of Delivering Results has the highest mean score of 2.73, indicating that the respondents are moderately effective in achieving their goals and objectives. The dimension of Procedures has the lowest mean score of 2.62, which suggests that the respondents need some improvement in following established procedures.

The overall mean score for this competency dimension is 2.678, which also falls within the Moderately Effective range. This implies that the respondents are able to perform their tasks at a satisfactory level, but there is still room for improvement in terms of efficiency and effectiveness.

These results have several implications for the construction industry. First, it suggests that the respondents have a good understanding of the importance of planning and organizing tasks to meet customer expectations. However, they need to improve in following established procedures to ensure that tasks are completed efficiently and effectively.

Second, it implies that there is a need for training and development programs to improve the competency levels of workers in the construction industry. This will enable them to execute tasks more effectively and efficiently, which can lead to increased productivity and profitability for construction companies.

Overall, the data in Table 10 highlights the importance of effective planning and execution in the construction industry and the need for continuous training and development programs to enhance the competency levels of workers in this field.

**Table 11. Adapting & Coping**

N=200

| Competency Dimensions | Respondent Groups | |
|---|---|---|
| | WM | VD |
| *Adapting* | 2.67 | Moderately Effective |
| *Responding to Change* | 2.73 | Moderately Effective |
| *Persuading* | 2.64 | Moderately Effective |
| *Influencing* | 2.73 | Moderately Effective |
| *Sum:* | 2.692 | |
| *Interpretation:* | Moderately Effective | |

Table 11 presents the results of the competencies related to Adapting & Coping. The respondents rated their proficiency level in each competency dimension, and the weighted mean (WM) and verbal description (VD) are presented for each dimension.

The results indicate that the respondents perceive themselves to be moderately effective in the Adapting & Coping competencies. The highest-rated competency dimension is Responding to Change, with a WM of 2.73, indicating that the respondents perceive themselves to be moderately effective in responding to changes in the workplace. Persuading and Influencing are also rated as

moderately effective, with a WM of 2.64 and 2.73, respectively. Adapting has a WM of 2.67, indicating that the respondents perceive themselves to be moderately effective in adapting to new situations.

Overall, the results suggest that the respondents have a moderate level of proficiency in the Adapting & Coping competencies. This may imply that they have some level of flexibility in adapting to changes and new situations in the workplace, but there is room for improvement in the area of persuading and influencing others. Organizations can provide training and development programs to improve these competencies and help their employees become more effective in coping with changes and challenges in the workplace.

**Table 12. Enterprising and Performing**

N=200

| Competency Dimensions | Respondent Groups | |
|---|---|---|
| | WM | VD |
| *Achieving Personal Work Goals and Objectives* | 2.67 | Moderately Effective |
| *Entrepreneurial and Commercial Thinking* | 2.73 | Moderately Effective |
| *Sum:* | 2.70 | |
| *Interpretation:* | Moderately Effective | |

Table 12 presents the data for the competency dimensions related to Enterprising and Performing, with a total of 200 respondents. The two competency dimensions included are "Achieving Personal Work Goals and Objectives" and "Entrepreneurial and Commercial Thinking".

The results indicate that both WM and VD groups scored 2.67 and 2.73, respectively, in the competency dimension of "Achieving Personal Work Goals and Objectives". Similarly, in the competency dimension of "Entrepreneurial and Commercial Thinking", both WM and VD groups scored 2.73.

The overall score for the Enterprising and Performing competency is 2.70, which indicates that both WM and VD groups are moderately effective in these areas.

The implication of these results is that the respondents possess the necessary skills and competencies related to Enterprising and Performing, but there is still room for improvement. To improve their performance in these areas, they can take relevant training and development programs or seek guidance from experienced professionals. Moreover, employers can encourage and provide opportunities to their employees to develop and apply these competencies in their work to increase their overall performance and productivity.

## CONCLUSION

Based on the data presented, the study provides insights into the competency levels of the construction workers, human resource personnel, and construction engineers in the Philippines. The respondents generally showed a moderate level of effectiveness in their competencies across the different dimensions, with an overall mean of 2.687.

In terms of demographics, the majority of the respondents were construction workers, and most of them had a monthly salary of 5,001 to 10,000 Philippine pesos. The data also revealed that the respondents had an average of 9.74 years of experience in their respective fields.

The study implies that there is room for improvement in the competencies of the construction workers, human resource personnel, and construction engineers in the Philippines. Organizations in the construction industry may consider investing in training and development programs to enhance the skills and knowledge of their employees, which may lead to better performance and productivity. Moreover, the study highlights the need for companies to provide fair compensation

to their employees, as the majority of the respondents had a monthly salary below 10,000 Philippine pesos.

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