Analyzing the Effects of Digital Learning on Worker Performance via Capability Development: The Functions of Digital Transformation and HRD Support in Malaysia's Urban Development Industry

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ABSTRACT

The digital technologies have dramatically transformed organizational learning, workforce development and performance management in any industry mainly due to the rapid growth of the same. Digital learning has become a strategic instrument to improve worker capability and productivity in the urban development sphere in Malaysia in terms of infrastructure growth, smart city projects, and changes in the work process based on technology. This paper investigates the relationship between digital learning and worker performance which is mediated by the capability development, as well as it evaluates the moderating effect of digital transformation and Human Resource Development (HRD) support. Based on a conceptual and empirical framework, which rests on human capital theory and dynamic capability theory, the research examines the role of digital learning efforts in skill improvement, flexibility, and employment performance. Structural equation modeling was used to analyze data gathered on professionals, who were employed in the urban development industry in Malaysia. The results indicate that online learning has a positive impact on the performance of workers, and capability building is a strong mediator. Moreover, the connection between digital learning and the development of a capability is reinforced by organizational digital transformation and HRD assistance. The research provides good insights to policy makers, human resource practitioners and urban development companies that want to maximize the performance of their workforce in digitally changing settings

Keywords: - Digital Learning, Capability Development, Worker Performance, Digital Transformation, HRD Support, Urban Development, Economic Productivity, Malaysia.

INTRODUCTION:

The world is undergoing extensive renovations in its urban development sectors due to the accelerating digitalization, the growing sustainability pressures, and the unanimous urbanization accelerating (Yu et al., 2024; Gazi et al., 2025). Cities are ceasing to be built in traditional construction and planning methods and are starting to be more influenced by digital ecosystems, which combine technology, data, and human wisdom (Balogun et al., 2022). Within this changing environment, the field of urban development is now a very knowledge-intensive industry and workers now have to have not only technical construction abilities but also digital, analytical, and adaptable expertise (Tandon et al., 2022). This has created an ongoing disposition as the potential of organizations to create and maintain such capabilities within the workforce as a critical factor in determining the efficiency of projects, innovation, and competitiveness in the long term (Shiva Shankar, 2025; Field, 2025; Mani et al., 2023). The urban development sector in Malaysia

has been experiencing a significant increase in growth as well as national policies that encourage smart cities, sustainable infrastructure, and digital transformation (Bageis et al., 2023). The use of smart technologies e.g. Building Information Modeling (BIM), geographic information system (GIS), digital project management systems, Internet of Things (IoT) based monitoring, and data-driven urban planning tools is becoming more common in major urban projects (Ni et al., 2020). The technologies are expected to enhance the coordination of projects, minimize expenses, increase the sustainability outcomes, and facilitate the decision-making process using evidence (Giménez et al., 2019). Nevertheless, one of the crucial requirements of the successful implementation of such digital tools is the abilities of workers, who design, run, and control them. This has made workforce readiness a major issue in companies within the urban development industry in Malaysia (Bamgbade et al., 2022).

The shift to the digitalized urbanization has largely changed the skills requirement. Employees are now

supposed to be digitally literate, systematically minded, problem solvers and constantly learning oriented besides the conventional area knowledge (Alqarni et al., 2023). Besides, the projects related to urban development are usually multi-stakeholder, complicated and time-related, which further increases the necessity of flexible and performance-based human capital. In such an environment, organizations can no longer afford to depend on traditional forms of training in a classroom environment or the periodic skills development programs. Conventional approaches to training are quite strict, time-consuming, and do not correspond appropriately to the technological requirements and expectations that develop rapidly, making their use in terms of equipping employees with the requirements of the contemporary work rather limited (Savalskii, 2025). To address these restrictions, online education has been in the limelight to serve as a strategic workforce development tool. Digital learning is broadly understood to be the technology based learning modalities such as e- Learning platforms, simulation with virtual reality and augmented reality, mobile learning apps, learning management systems, and AI based custom training solutions. These eLearning tools are flexible, scalable, and accessible and enable employees to study at a pace that suits them, and they can continue working on the current projects (Attah et al., 2024). In the case of organizations in the urban development sector, digital learning offers a platform to offer specific and up to date training, which is quite relevant to the changing project demands and technological advancements.

In addition to the competence acquisition, digital learning facilitates overall ability training (Yu et al., 2025). Capability development is the advancement of combined abilities of the employees such as technical skills, digital skills, cognitive agility, and behavioral skills such as cooperation and creativity. Online learning spaces facilitate experiential and problem-based education, whereby workers can directly translate the new knowledge to project situations in the real world. Consequently, digital learning can enhance the capacity of employees to react well to complex, uncertain, and dynamic work-related contexts that are a common feature of contemporary urban development projects. An essential outcome of interest in this situation is worker performance (Ghaderi and Ghaderi, 2025). In urban development, the characteristics of worker performance are noticeable in efficiency of tasks, the quality of the output, adherence to the project standards, innovation and responsiveness to the new technologies and procedures. The performance rates of workers are high and lead to compliance with the schedule of project completion, cost management, enhanced safety, and sustainability results (Gautam et al., n.d.). Although the available literature has determined that training and learning programs could have a positive impact on performance, the empirical understanding of how digital learning can be specifically converted into enhanced performance outcomes is still unclear, especially in developing and emergent economies.

The role of the capability development as an intervening variable between the digital learning and worker performance is one of the main gaps in the literature (Mazzetto, 2024). In the context of technology being less embraced by organizations, as digital learning programs are increasingly embraced, organizations have difficulty in making sure that learning outcomes are translated successfully into practicable skills that can support daily work performance (Solutions, 2024). The key in comprehending this transformation process is required to design learning strategies that can bring organizational value in a tangible way. In addition, the efficacy of digital learning is a factor that is not working in a vacuum; the efficacy of digital learning is influenced by wider organizational considerations such as degree of digitalization and the level of Human Resource Development (HRD) enabling the process. Digital transformation is the extent to which organizations embrace digital technologies in their operational procedures, strategic decision making and organizational culture (Li et al., 2024). An organization with a high degree of digital maturity stands a better chance of offering the infrastructure, commitment of the leadership, and the climate of innovation that digital learning would thrive. Likewise, HRD assistance in the form of supportive policies, leadership support, learning incentives, and performance-based developmental systems are critical in encouraging employees to use digital learning and implement learnt skills in their job descriptions (Al-Rimawi and Nadler, 2025).

Although these factors became increasingly relevant, there is a lack of empirical research looking at the effects of digital learning and development of capabilities in conjunction with digital transformation and support of HRD in the urban development sector (Jafarov, 2025). This is especially so in the Malaysian environment whereby the rapid urbanization and national digitalization agendas are coupled with varying organizational capabilities and the level of workforce preparedness. This gap should be filled both to promote academic knowledge and to contribute to managerial practice and policy development (Zervas and Stiakakis, 2024). It is against this background that the current study will analyse the impacts of digital learning on worker performance mediated by capability development and also seek to identify the moderating role of digital transformation and HRD support in the urban development industry in Malaysia (Marlapudi and Lenka, 2024). The study aims at adding value to the existing body of knowledge on digital learning and human capital development, and delivering practical recommendations to organizations in need of developing a high-performing and future-ready workforce in an ever-increasing digital city development environment.

2. LITERATURE REVIEW

The analyzed literature work, on the whole, helps highlight the paramount role of digital transformation as a critical factor in transforming the human resource development, talent management, and employee performance in various organizational and national settings, especially in Malaysia and other similar developing economies. Kudus et al. (2025) highlight that the inclusion of digital technologies, including artificial intelligence, HR analytics, and e-learning in the

development of the halal workforce will allow organizations to improve the competencies of the workforce and still be close to the Shariah principles, proving that the effective use of technology and ethical standards do not necessarily contradict each other. In line with this argument, Yunus et al. (2024) point out the strategic value of Technical and Vocational Education and Training (TVET) in building future-ready talent, and state that a digitally-integrated TVET system is necessary in creating sustainable economic growth and narrowing the skills gap through lifelong learning. At the employee level, Chong and Zainal (2024) reveal that digital literacy, employee vitality, and transformational leadership have a significant positive effect on job performance, and employee agility is an important mediating factor. On this note, Wang et al. (2024) build up on the discussion by unveiling the fact that high-involvement HRM practices indirectly affect employee digital performance via the competitive attitudes, behaviors, and, above all, dynamic capabilities, which is synonymous with flexibility as a determining factor in digital environments. Applying the sustainability and engagement lens, Hizam et al. (2023) show that knowledge sharing, employee mobility, training and development, and psychological empowerment play a significant role in employee engagement in digital transformation, which supports the explanatory value of the social exchange theory in digital workplaces. Alzadjali et al. (2023) also ensure that the digital HRM practices that are supported by a learning organization view significantly contribute to the increase in employee performance and quality HR services. Wider ecosystem-level knowledge is provided by Waqar et al. (2023), who find that digital twins are considered the most important barriers to advanced digital technologies in smart city projects, and it is important that the context be ready and personalized. Previous research by Ismail et al. (2021) and Akoi and Yesiltas (2020) supports the mediating variables of employee creativity and human capital in the relations between HR practices and organizational performance, especially when digital disruption is present. Lastly, Low et al. (2020) demonstrate how the strategic use of digital tools can increase organizational competences and sustainability and propose that digital transformation, when properly coordinated with human resource and ability development, can be a core driver of performance, resilience, and long-term competitiveness.

4. Research Methodology

4.1 Research Design

The current research will use a cross-sectional, quantitative research design in order to empirically test the connections between digital learning, capability development, worker performance, digital transformation, and HRD support in the urban development sector. As a qualitative method, it was deemed suitable because it facilitates a systematic measurement of variables, hypothesis testing by statistical means, and generalization of results to the rest of a larger population. The cross-sectional type will entail a one time collection of data, enabling the research to generate current perceptions and practices of digital learning and workforce performance in organizations that are going through the digital transition.

The survey-based research was chosen as the major data collection tool to be effective to collect standardized responses of a large and diverse respondent group. This design is consistent with the previous empirical research in the area of human resource development, digital transformation and organizational learning, where structured questionnaires are often used to investigate complex behavioral and organizational constructs.

4.2 Sample and Data Collection

This research was targeted on the employees in the urban development sector in Malaysia. In particular, the respondents were selected among construction companies, urban planning agencies, infrastructure consultancies, real estate development companies, and smart city development organizations based on big cities. The choice of these organizations was due to the fact that it is leading the way of implementing the digital technologies and digital learning programs, keeping up with the pace of rapid urbanization and technological breakthrough.

The structured self-administered questionnaire was used to collect the data, which was administered electronically and in printed form to guarantee the availability to more participants and access to data. The online survey was used to conduct an efficient data collection of respondents in a geographically scattered area, whereas the physical distribution was used to incorporate employees with low accessibility to digital devices. The survey was optional and the respondents were guaranteed of confidentiality and anonymity so as to influence them to be honest and unbiased. To gauge the perceptions of the respondents in all the variables of the study, the questionnaire used Likert-scale format which usually scaled between 1 (strongly disagree) and 5 (strongly agree). The use of this scaling method is popular in social science and management research studies because it is simple, reliable, and can be statistically analyzed, specifically Structural Equation Modeling.

4.3 Measurement of Variables

Multi-item scales derived by the authors of the existing literature were used to measure all constructs of the study, which were adjusted to the conditions of the urban development industry.

Digital Learning has been evaluated using measures reflecting the experience that the employees have in the technology-facilitated learning systems. These involve accessibility of online learning platforms, usability and easiness, applicability of learning material to work position, and the degree of interaction provided by online learning resources. These dimensions represent how many of the dimensions the digital learning systems cover can facilitate effective and engaging learning experiences.

The concept of Capability Development was evaluated as a multidimensional construct that implied the improvement of the competencies of employees. The measurement items were technical skills in relation to the projects of urban development, digital competence in the use of sophisticated tools and systems, ability to solve problems in complicated work situations, and responsiveness to changes in technology and procedures.

Combined, these clues embody functional as well as dynamic aptitudes needed in digitally motivated workplaces.

Self-reported job effectiveness related indicators were used to measure Worker Performance. These were the perceived efficacy in fulfilling allocated tasks, quality of work output, capacity to be innovative and propose developments and reliability in meeting the project due dates and targets. The self-reported measures of performance are widely applied in organizational research, mainly where objective measures of performance are impractical to match across different positions.

Digital Transformation was measured using the way employees perceived their organizations to be digitally mature. Figure items included the level of technology adoption in work processes, a positive digital culture, and leadership dedication to digital projects. All these dimensions are the symptoms of the organizational environment which facilitates or limits the effectiveness of the digital learning.

HRD Support was evaluated in terms of items that evaluated the degree of organizational support to learning and development. Signs such as the managerial support of the training participation, access in learning incentives and compatibility of training programs to career development and performance management systems were used as indicators.

4.4 DATA ANALYSIS

The analysis of the collected data was performed through Structural Equation Modeling (SEM) that is highly appropriate to test complex models with multiple constructs, mediation-effects, and moderation relationships. SEM enables measurement model (validity and reliability of constructs) and structural model (put forward relationships among variables) to be evaluated simultaneously. Before the hypothesis testing, data screening activities were performed to extent to normality, missing values, and the possibility of outliers.

The criterion of reliability and validity was assessed in terms of such conventions like Cronbach alpha, composite reliability and average variance extracted (AVE). The role of the capability development in the relationship between digital learning and worker performance was analyzed using the mediation analysis, whereas the impact of digital transformation and HRD support was evaluated using the moderation analysis. Such an analytical strategy guaranteed the sound testing of the suggested research model and the increase of the validity of the research results.

5. RESULTS

This part describes empirical observations of the research on the basis of the data obtained on the employees employed in the sector of urban development in Malaysia. Structural Equation Modeling (SEM) was used to test the hypothesized hypotheses and to analyze the interrelations between the digital learning, development of capabilities, worker performance, digital transformation, and HRD support.

5.1 Demographic Profile of Respondents

Table 1 provides the demographic data of the respondents. The sample will reflect a wide range of workforce; it will consist of construction companies, urban planning organizations, infrastructure consultancies, and smart city development bodies of major cities in Malaysia. The variability of the respondents increases the representativeness and generalization of the results.

Table 1: Demographic Profile of Respondents (N = 312)

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	198	63.5
	Female	114	36.5
Age Group	Below 30 years	76	24.4
	31–40 years	124	39.7
	41–50 years	82	26.3
	Above 50 years	30	9.6
Work Experience	Below 5 years	88	28.2
	5–10 years	121	38.8
	Above 10 years	103	33.0
Organization Type	Construction & Infrastructure	134	42.9
	Urban Planning / Smart City	178	57.1

The demographic analysis suggests that the respondents have a wide cross-section of employees in the Malaysian urban development sector. The sample consists mainly of men (63.5%), which is typical of the distribution of the gender in the construction and infrastructure-associated industries. The majority of respondents are in the age range of 31-40 (39.7%) which indicates that it has a workforce that is in its mid-career period. Regarding experience, a considerable percentage of respondents have 5-10 years of working experience (38.8%), which means that they have sufficient exposure to practices in the organization and digital systems. Also, the sample was attracted to the construction and infrastructure companies (42.9) and urban planning or smart city institutions (57.1), which contributes to the increased representativeness and generalizability of the results.

5.2 Reliability and Validity Analysis

Before testing the structural relationships, the measurement model was tested with regard to reliability

and convergent validity. The alpha value and Composite Reliability (CR) were beyond the recommended value of 0.70 and the Average Variance Extracted (AVE) value was greater than 0.50, which means acceptable reliability and validity.

Table 2: Reliability and Convergent Validity Results

Construct	No. of Items	Cronbach's Alpha	Composite Reliability (CR)	AVE
Digital Learning (DL)	4	0.87	0.90	0.69
Capability Development (CD)	4	0.89	0.92	0.74
Worker Performance (WP)	4	0.86	0.89	0.67
Digital Transformation (DT)	3	0.84	0.88	0.70
HRD Support (HRD)	3	0.85	0.89	0.72

Results of reliability and validity show the strength of the measurement model. Cronbach's alpha and Composite Reliability values are all greater than the recommended value of 0.70, which shows that all constructs are strongly internally consistent. Moreover, the AVE values of all constructs are more than 0.50 and this indicates a satisfactory convergent validity. These results imply that the measurement items can effectively measure the underlying constructs and that further analysis can be done structurally.

5.3 Descriptive Statistics and Correlation Analysis

The average values, standard deviations and inter-construct correlation are given in table 3. The mean scores of all constructs are moderate to high which suggests that there is a positive picture of digital learning, organizational support, and performance among the respondents. The results of the correlation show that there are strong positive correlations between the most important variables, which preliminarily justify the hypotheses offered.

Table 3: Descriptive Statistics and Correlation Matrix

Construct	Mean	SD	DL	CD	WP	DT	HRD
Digital Learning (DL)	3.94	0.62	1				
Capability Development (CD)	4.02	0.58	0.63**	1			
Worker Performance (WP)	4.08	0.55	0.52**	0.68**	1		
Digital Transformation (DT)	3.88	0.61	0.56**	0.60**	0.54**	1	
HRD Support (HRD)	3.96	0.59	0.58**	0.62**	0.57**	0.59**	1

Note: p < 0.01

Descriptive statistics demonstrate that all constructs have moderate to high values of the mean, which presupposes the fact that respondents have quite positive perceptions of digital learning, organizational support, capability development, and worker performance. Correlation analysis indicates that the all important variables have significant positive relationships at the 0.01 level of significance. Notably, all the correlation coefficients are below 0.85, which proves that there is no multicollinearity and proves the uniqueness of the constructs employed in the research.

5.4 Structural Model and Hypothesis Testing

SEM was used to test the structural model to find out the direct correlations between the constructs. The model showed reasonable fit measures (2/df = 2.41, CFI = 0.94, TLI = 0.93, RMSEA = 0.068), which showed that the model perfectly fits the observed data.

Table 4: Structural Path Results

Hypothesis	Path	β Coefficient	t-value	p-value	Result
H1	DL → CD	0.47	7.86	<0.001	Supported
H2	CD → WP	0.53	8.92	<0.001	Supported
H3	DL → WP	0.21	3.94	<0.001	Supported

The structural model shows a reasonable level of fit, based on the normal goodness-of-fit measures. The results of the path analysis indicate that the impact of digital learning on the development of capabilities is considerable, and the impact of capabilities development on the worker performance is also significant. Also, online education has a direct positive influence on employee performance. These results allow verifying the

hypotheses suggested and approving the key role of capability development in improving the performance outcomes.

5.5 Mediation and Moderation Analysis

Bootstrapping procedures were utilized to test the mediating position of development of capabilities, the moderating impacts of digital transformation and HRD support. In the mediation of the hypothesis, it was found that the indirect impact of digital learning on employee performance via the development of capability was significant. Moreover, the interaction effects were that digital transformation and HRD reinforce the linkage between digital learning and capability development.

Table 5: Mediation and Moderation Results

Relationship	Effect Type	β	p-value	Interpretation
DL → CD → WP	Indirect (Mediation)	0.25	<0.001	Partial mediation supported
DL × DT → CD	Moderation	0.18	<0.01	DT strengthens DL–CD relationship
DL × HRD → CD	Moderation	0.22	<0.01	HRD strengthens DL–CD relationship

Mediation analysis shows that development of capability is partly the mediating variable that exists between digital learning and worker performance, and therefore digital learning improves performance directly and indirectly via capability development. The moderation analysis also indicates that digital transformation and HRD facilitate considerably the correlation between digital learning and capability development. These findings emphasize how a favorable digital and HRD environment can be used to the fullest to maximize the success of digital learning programs.

DISCUSSION

This research was aimed at investigating the impact of digital learning on worker performance due to capability development, and evaluating the mediating role played by digital transformation and HRD support in the Malaysian urban development sector. The results offer a good empirical evidence to the proposed research framework and are relevant to the current body of knowledge on digital learning, human capital development, and organizational performance within technologically advanced settings. The findings prove that digital learning possesses an influential and positive impact on capability development. This result confirms the existing studies that technology-mediated learning environments are associated with the rise of technical, digital, and cognitive capabilities of employees providing them with flexibility, interactivity, and work-related

learning possibilities. Digital learning is an important tool of providing the skills that employees need to deal with complicated and digitally mediated work processes in the framework of urban development where BIM, GIS, IoT, and data-driven planning tools are becoming more and more integrated into its everyday practice. This is in line with human capital theory which holds that investments in learning and skills development result in better abilities in the employees and better organizational performance. Capability development was also discovered to exert a great impact on the performance of workers. Those employees who posted greater technical capability, digital competency, flexibility as well as problem-solving skills proved to be more efficient in their tasks, quality of their work, creativity, and achievement of their goals. The discovery supports the claim that the digitization of industries intensifies performances in large part due to the breadth and relevance of the human abilities instead of adoption of technology. In the development of urban areas, where a single mistake, delay and inefficiency can cost the project a lot of money and even lives, good workers are particularly important in helping a project to succeed and be sustainable.

Notably, mediation analysis establishes that the development of capability mediates the relationship between digital learning and worker performance to some extent. This means that digital learning has a direct and indirect influence on the performance through increasing employee capabilities. According to the partial mediation, although digital learning can positively influence the performance due to the acquisition of more knowledge and awareness, it has the greatest significant effect when the learning results are successfully translated into practical and job-related skills. The results of this study fill one of the existing knowledge gaps in the literature by empirically confirming the role of capability development as one of the essential mechanisms to connect digital learning programs with performance results, especially in emerging economies. The outcomes of the moderation also demonstrate the situational factors according to which digital learning is most efficient. The relationship between digital learning and the capability development was observed to be greatly reinforced by digital transformation. Those organizations that are more digitally mature, i.e. have integrated digital systems, a supportive leadership culture, and a pro-innovation culture, are in a better position to translate digital learning investments into positive capability growth. This observation confirms the dynamic capability theory that highlights the effectiveness of organizational context in helping firms to sense, seize, and transform resources in response to environmental change.

On the same note, the HRD support was found to moderate the digital learning-capability development relationship positively. The greater the extent to which organizations support learning through incentives, as well as encouragement, and the alignment of training with career development and performance management systems, the more the employees will be willing to learn digitally and transfer the skills gained to their work positions. This finding highlights the strategic role of HRD systems in the maintenance of performance

improvements created through learning and is consistent with previous research focusing on the contribution of conducive HR practices in digital transformation projects. Altogether, the results indicate that digital learning may not be enough to ensure better performance of workers. Its success is based on the availability of supporting organizational factors, especially the digital transformation preparedness and robust HRD backup. The insights presented by urban development firms in Malaysia demonstrate that an integrated approach that incorporates the digital learning initiatives with organizational digital maturity and human resource development strategies is necessary.

CONCLUSION

This paper has discussed how digital learning can impact worker performance through the mediating role played by the capacity of development and that the moderating role of digital transformation and Human Resource Development (HRD) support in the urban development industry in Malaysia. The results emphasize that the use of digital learning forms a powerful empirical evidence that it is a key factor in influencing the worker performance in technology-intensive setting, especially when the learning programs are properly translated into improvement of employee abilities. The findings indicate that online education can be both directly involved in the improvement of performance and indirectly through the acquisition of technical, digital, cognitive, and adaptive skills that are instrumental in the management of complex forms of urban development. In addition, the research notes that the organizational environment is a significant factor that influences the success of digital learning programs. The more digital organizations are transformed, i.e., the integrated digital systems, enabling leadership, and the culture of innovation, the more opportunities organizations have to translate the investments in digital learning to achieve a significant development in capability. On the same note, a robust HRD support, comprising of managerial encouragement, learning incentives and match of training with career progression, have a huge supporting effect on digital learning and capacity building relationship. These results make it clear why a holistic method of workforce training, in which digital learning is applied with the aim of realizing organizational-wide strategies and human resource systems, is one worth adopting. Practically, the research provides useful information to the urban development companies, human resource managers and policymakers who would like to create a future ready workforce that can contribute to the smart city projects and sustainable urban development in Malaysia. Although the research is constrained by the fact that it is cross-sectional and it used self-reported data, it provides a solid basis of future studies to investigate longitudinal effects, objective performance outcomes, and cross-industry comparisons. Comprehensively, the paper finds that digital learning as a potential development enabler is a potent tool in facilitating sustainable performance of workers and organizational competitiveness in an urban development environment that is rapidly becoming digital.

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