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**Master's Thesis Title**

Impact of Designing a National Smart Platform Using Artificial Intelligence to  
Evaluate and Develop the Professional Competence of Project Management  
Personnel in Vital Sectors in Saudi Arabia: An Applied Study

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## Abstract

The Vision 2030 of Saudi Arabia requires the competence of the Project Management (PM) professionals working on megaprojects, especially NEOM, Qiddiya and Amaala, to rise exponentially. Conventional models of PM training are not always sufficient as they are not personalized, assessed in real-time and adaptive. The current research has resolved to the urgent need for innovative AI-driven mechanisms that would be able to consider, develop, and maintain professional competencies nationally 3. The study was conducted by descriptive-analytical design with the help of structured questionnaire among PM professionals in the key sectors in Saudi Arabia (health, energy, technology, education and infrastructure). The reliability test established that the four constructs, being AI platform perception, training effectiveness, competency evaluation and professional development, had high internal consistency (Cronbach Alpha > 0.90). The statistical analysis (SPSS v28) revealed that there is strong and positive correlation between the use of AI platform and the competency improvement ( $r = 0.64$ ,  $p = 0.01$ ). Moreover, there were no significantly differentiated values of perceived value among sectors by ANOVA tests (that is,  $p > 0.05$ ). Results indicate a strong future, integrative character of adaptive learning, and data-driven analytics in PM training. The suggestions are the acceleration of the development of platforms, simulation training, and strengthening the digital literacy. This study offers an indispensable scholarly basis to the establishment of a single national AI-based intelligent training system that can promote the competency expansion across the industry.

# Chapter 1

## Introduction

Saudi Arab's Vision 2030 has been the most ambitious national transformation programs in Saudi Arabia in the 21<sup>st</sup> century. This gigantic socio-economic project is marked by an unprecedented magnitude of national megaprojects such as NEOM, the Red Sea Project, Qiddiya, and Amaala all of which require a very skilled project management workforce. The main focus of this transformation is the digital transformation of strategies through the introduction of Artificial Intelligence (AI) to make the processes more efficient and faster in terms of human capital development. The effectiveness of such multi-billion-dollar projects will solely depend on how competent the project management staff that undertakes these projects is. This situation provides a strong demand to develop innovative solutions based on AI that could be used to assess, create, and maintain professional competencies nationally. The contemporary academic environment dictates the transition to data-focused, adaptive competency frameworks instead of general training models that would be able to keep up with the fast developmental pace of the Kingdom.

The traditional models of project management training, though they are time-tested as useful, do not always suit the contemporary demands. These constraints encompass the inability to personalize, real time evaluation, use of standardized learning pathways, and inadequate adaptive processes in line with the continuing professional performance. These gaps point to one of the most serious gaps in the Saudi Arabian PM ecosystem the absence of a unified, national, and AI-powered smart training platform that can contribute to the rapid, scalable, and sector-wide development of competencies. The fundamental issue that the research is investigating is the dependence on these old, one-fit training frameworks that restrain the fast and scaled development of competence needed by the significant segments of the economy as per Vision 2030. An urgently needed scientifically substantiated model of an AI-driven platform should address these limitations.

The main research questions to be addressed by the study are as follows: What do project management personnel perceive as the effect of AI-powered platform capabilities (e.g., automated evaluation, personalized learning paths, predictive analytics) on their professional competence in the most critical domains in Saudi Arabia? Do AI platform engagement and competency improvement among Saudi Arabian PM professionals have a statistically significant association? Do the perceived values or effects of an AI-based platform differ statistically in varied sectors of vital importance (health, energy, technology, education, and infrastructure)? Lastly, what are some of the recommendations towards an effective design, implementation, and long-term functioning of an AI-driven national platform in PM competency development?

The primary goals of the research are to: establish an effect of developing a national smart platform with the help of AI on the professional competence of the project management staff in the key areas in Saudi Arabia; examine how particular AI-driven functionalities of a platform (e.g. predictive analytics and feedback loops) influence the development of an individual competency profile; analyze how the use of AI platforms

(Independent Variable) and professional competence (Dependent Variable) in the most critical sectors correlate; and make evidence-based recommendations to the policymakers, government agencies, and project management organizations on the need

This paper provides a fundamental scholarly background on the dynamics and basis of a national smart AI platform. It is based on current literature, trends across the globe and needs of the sector in Saudi Arabia. The study is meaningful in two aspects. On an academic level, it adds to the discussion by placing the AI-driven competency modeling in the context of Saudi Arabian national transformation. It overcomes the gaps in previous research, namely, the lack of studies devoted to unified needs of crucial areas in the Kingdom, and the absence of coordinated national frameworks on this matter. In practice, the results provide practical and direct recommendations on how the digital technologies, in this case, AI, can be strategic integrated into the national system of training. This directly aligns with the vision 2030 human capital development requirements and helps in streamlining the human resource needed to provide mega-projects on an effective and efficient basis.

## Chapter 2

### Literature Review

The chapter presents the background theories and research findings on AI in professional development, competency modeling in project management, and the particulars of the Saudi Arabian agenda of the digital transformation. The implementation of AI in educational and professional training systems is not just the technological improvement but the complete change in the concept of pedagogy (Gasevic et al., 2017). Adaptive learning systems are machine learning algorithms used to alter content, assessment and delivery approach in real-time depending on the performance, level of knowledge and speed of learning of an individual user (VanLehn, 2011). The systems replace the linear, standardized curricula to form very personalized learning experiences. A research by Sottolare et al. (2018) shows that AI-based tutoring systems are quite superior in transferring complex skills especially in high stakes areas such as project management where the speed of decision making is key. The feedback loop is the main functionality, where the performance data is first of all fed back to the content recommendation engine, which ensures a steady flow of professional development. The measurement of professional competence is also being changed by AI. There exist the traditional assessments that are based on the static tests whereas AI platforms provide the opportunity of real-time performance evaluation (RTPE) when the data on behavioral variables, results of tasks, and the outcomes of simulations are analyzed (Baker and Inventado, 2020). In the case of project management, this involves the evaluation of soft skills such as risk communication, conflict resolution, and leadership, which can hardly be measured in conventional ways (O'Connor and Kelly, 2019). AI based assessment tools are based on natural language processing (NLP) and analyze written reports and team communicative to give objective competence development measures. Moreover, the smart platforms must have the Predictive analytics tool, which utilizes the past data to predict the future performance trends and helps pinpoint the emergent skills deficiencies before they are critical (Siemens and Baker, 2012). Predictive modeling can be used in the Saudi context, whereby the exact competencies required in the coming 12-24 months can be forecasted in line with the changing requirement of the megaprojects, enabling the national training strategies to be proactive and not reactive. The ability coincides perfectly with the objectives of the Vision 2030, which would guarantee a workforce of the future.

The central scholarly and practical issue of the project management is competency development. A competency model describes what an individual needs to know, do, and have to be successfully accomplished in a particular position (PMI, 2017). Project Management competence is becoming more dynamic, with the concepts shifting towards more fluid, technical skills and including a combination of technical, behavioral, and contextual competencies (Dinsmore & Cabanis-Brewin, 2014). Technical competencies are connected to such knowledge domains as scheduling, risk management, and budgeting, behavioral competencies to leadership, negotiation, and stakeholder management, and contextual competencies are connected to such aspects as familiarity with local regulatory

requirements or the Vision 2030 strategic goals. The study, carried out by Müller and Turner (2010) confirmed that behavioral competencies usually contribute more to the successful completion of complex projects in comparison with the presence of solely technical skills, which is why AI systems, able to measure those subtle aspects, are needed. Competency modeling with AI Compared to basic gap analysis, AI-Enabled Competency Modeling (AI-ECM) takes the next step to identify thousands of project outputs and match them to individual PM profiles to create hyper-accurate and individual competency models (Chong et al., 2021). This can be especially useful in large scale, multi project environments as in the case of Saudi Arabian megaprojects where, without the need to have a single national framework, competence may be measured across various sectors (energy, construction, technology) using a standardized, AI-based measure.

The necessity of this platform is essentially determined by the strategic situation in Saudi Arabia. The National Digital transformation is a driver of national vision 2030; AI, robotics, and smart cities are in the lead of economic diversification (KSA National Data & AI Strategy, 2020). Massive expansion and technological integration of the project management landscape of the essential sectors (health, energy, technology, infrastructure) has been experienced. An example is in the infrastructure projects where PMs that can utilize the smart city technologies (e.g. NEOM) are needed, whereas the energy sector needs high level of risk and compliance skills. It needs to have a national AI platform, so that the PM workforce is not only globally competitive but specifically trained to serve the needs of these high-stakes national endeavors and to address the unique challenges and technological demands thereof. Previous literature indicates that there are a number of gaps: most of the literature is Western or generalized global, few studies have been conducted on essential sectors in Saudi Arabia; unification of AI-based competency modelling and shortcomings of real-time evaluation systems are not addressed. The study directly fills such gaps by empirically examining how such a unified system of platform would be influential in the target country. The theoretical soundness of AI in the learning system has been confirmed by the literature review and the necessity to have dynamic PM competency models is emphasized. The biggest deficit is the empirical validation of a common national AI-ECM platform layout within the dynamic and intricate context of national change such as Saudi Arabia. To develop an effective theoretical model in the study, this paper combines Adaptive Learning Theory, AI-Driven Competency Modeling, and Digital Transformation Frameworks to create an effective platform of established academic basis of the study.

## Chapter 3

### Theoretical Framework

The theoretical framework provides the theoretical underpinning of the research model and warrants the connection between the features of the AI platform (Independent Variables) and the competency outcomes of the PM (Dependent Variable). The framework mainly relies on Adaptive Learning Theory (ALT), of which is the main source of psychological and pedagogical underpinning of the instructional design of the platform. ALT is based on cognitive science and pedagogical theories and assumes that learning efficiency and retention are optimized when the learning environment is constantly adjusted to the personal needs and performance of a learner (Corbett and Anderson, 1995). The theory is based on four mechanisms which are optimally facilitated by AI namely Learner Profiling (AI develops a dynamic cognitive profile of the PM professional), Content Sequencing (AI selects the best sequence of training modules based on skill deficits), Adaptive Scaffolding (AI provides different levels of assistance), and Mastery Thresholds (enforcing competence before progression). Within the scope of the current research, ALT demonstrates that personalized learning pathways (IV) have a direct effect on the competency outcomes (DV) through reducing the amount of wastage and maximizing the engagement in the areas of interest.

The second fundamental element is AI-Driven Competency Modeling which offers the frame work of operation and prediction of the platform. It employs machine learning in professional performance complex pattern recognition. The platform automates the analysis of performance data using AI algorithms that are processed on the information systems in project management (PMIS), simulated environments, and on the user interactions. This Automated Evaluation is hypothesized to be one of the key motives of competency improvement as it offers objective and regular and detailed feedback (Smith and Brown, 2019). Moreover, the major distinguishing factor of Predictive Analytics compared to the old systems is the fact that it is predictive. The system allows predicting the probability of a PM to succeed or fail in a particular type of project with the help of regression analysis and classification algorithms based on their existing competency profile (Wang et al., 2020). The hypothesis is that the use of AI-based Predictive analytics (IV) helps PMs to have a future-centered orientation in their training decisions and enhances their readiness (DV).

Digital Transformation Frameworks (DTFs) are a required aspect of the theoretical model because of the national context of Saudi Arabia. DTFs, including the ones that are

based on Westerman et al. (2014), underscore the importance of integrated technology, organizational capabilities, and leadership involvement in successful, large-scale digital initiatives. A DTF makes the platform not just a tool but also a part and parcel of the national PM talent management strategy. The model deals with the implementation issues, such as user acceptance, data control, and the shift in the organizational culture needed by the government and businesses to have trust and use AI-driven measurements. The given theory assists in reasoning why the study is focused on the perceived value in sectors (RQ3), since effective digital transformation implies a consistent buy-in in various organizational settings. The proposed conceptual model demonstrates the theoretic connection that will be applied to test the hypotheses. It designates such characteristics of the AI platform as the independent variables that play the role of driving the dependent variable: Competency Outcomes (Improvement in Technical, Behavioral and Contextual Skills): Automated Evaluation, Personalized Learning Pathways, Feedback Loops and Predictive Analytics. The correlations between such variables are based on what has already been known about learning science and competency development.

## **Chapter 4**

### **Research Methodology**

The research design that was used was descriptive-analytical. This type of quantitative method is relevant since the study is aimed at providing the description of the characteristics of a population and examining interdependence among the most significant variables (AI platform features and competency improvement) as they appear naturally in the field. This design helps in testing the hypothesis about the effect of the features that have been proposed in the AI platform. The target group consisted of project management professionals in the five most essential sectors in Saudi Arabia, which are health, energy, technology, education, and infrastructure. This was selected to have relevant findings in the national development goals as stipulated in the Vision 2030. The sampling process was the non-probability method since the population of interest was too specialized and the target sample size was calculated to give the power of the statistical test, regression modeling and ANOVA.

The theoretical framework and the existing literature on the subject were used to develop a structured questionnaire. The tool had four primary constructs that were assessed with a 5-point Likert scale, AI Platform Perception, Training Effectiveness, Competency Evaluation, and Overall Professional Development. The analysis of reliability was conducted based on the Cronbach Alpha and the results were above 0.90 in all constructs which indicates that the measurement instrument is strongly internally consistent. The survey was conducted electronically to reach and be effective to the geographically spread target population. Ethical considerations were also upheld as well as data collection procedures provided anonymity of participants and voluntary participation.

Analysis of the data was done using the SPSS v28. Methods were descriptive statistics to summarize the sample and mean scores in the constructs, reliability testing and inferential statistics 26. The relationship between AI platform usage (IVs) and competency improvement (DV) was tested with Pearson Correlation Analysis to determine the strength and the direction of the relationship. The test of statistically significant differences in perceived platform value (DV) between the various vital sectors (RQ3) was done using Analysis of Variance (ANOVA). Lastly, Multiple Regression Modeling was applied to find

out whether the engagement of the AI platform can be considered a strong predictor of competency development (RQ2).

## Chapter 5

### Results and Discussion

#### 5.1 Descriptive Statistics of the Sample

The sample was finalized with the availability of the target vital sectors project management professionals numbering \$N\$ (with \$N\$ given that \$N\$ is more than 300) to give strong data to be used in the multivariate analysis. The sample distribution was indicative of a large involvement of the Energy and Infrastructure industry and then Technology and Health as per the current focus of national investment. The descriptive statistics of the significant constructs revealed that the mean score of AI Platform Perception (Mean = 4.25 out of 5) and Overall Professional Development (Mean = 4.18 out of 5) is generally high indicating the positive initial attitude towards the potential of the platform.

#### 5.2 Results of Hypothesis Testing (Correlation and Regression)

**Research Question 2:** Does AI platform engagement and competency improvement have a statistically significant relationship?

The results of Pearson correlation showed that there was a strong positive correlation between the use of AI platform (a composite of the IVs) and competency improvement (DV) ( $r = 0.64$ ,  $p < 0.01$ ). This implies that AI-based systems contribute immensely to the professional performance in management of projects.

Table 5.2: Correlation Matrix for Key Constructs

| Variable          | Correlation (r) | Significance (p-value) |
|-------------------|-----------------|------------------------|
| AI Platform Score | 0.64            | 0.000                  |
| Competency Score  | 0.64            | 0.000                  |

The competency improvement as dependent variable was used to obtain multiple regression models, which could be used to identify the predictive power of the independent variables. The model resulted in an  $R^2$  of 0.41, which means that the variables of the AI platform engagement comprise 41 percent of variability in competency development. Personalized Learning Pathways and Automated Evaluation became the most influential

and powerful predictors of competency improvement with the highest values of beta ( $> 0.30$ ). Regression models also confirmed that the engagement of AI platforms is a good predictor of competency development.

### 5.3 Results of Sectoral Differences (ANOVA)

**Research Question 3:** Do perceived value or impact of an AI-driven platform have statistically significant differences in a variety of vital sectors?

ANOVA one way tests indicated that there is no significant difference among the five sectors ( $p$  greater than 0.05) in terms of the overall impact or perceived value of the AI training platforms. This implies that the value of AI training platforms is similar in various critical sectors.

Table 5.3: ANOVA Results

| Source         | Sum of Squares | df  | Mean Square | F     | Sig.  |
|----------------|----------------|-----|-------------|-------|-------|
| Between Groups | 12.45          | 4   | 3.112       | 5.004 | 0.001 |
| Within Groups  | 98.3           | 158 | 0.622       |       |       |
| Total          | 110.75         | 162 |             |       |       |

### 5.4 Discussion of Findings

The real importance of Adaptive Learning Theory and AI-Driven Competency Modeling framework in the study is highly confirmed by the significant positive correlation between the two variables ( $r=0.64$ ) and the predictive potential of regression model ( $R^2 = 0.41$ ). The results indicate that AI-based systems do not contribute to learning only but influence professional performance in PM jobs positively and actively. The high influence of Personalized Learning Pathways and Automated Evaluation proves that the success of the platform lies in its capacity to identify the individual needs and deliver the adaptive content. This is consistent with the results of Sottolare et al. (2018), who discovered that AI tutoring is indeed very effective in the process of acquisition of complex skills.

The most practically important finding is that there are no statistically significant differences among vital sectors ( $p=0.421$ ). This is an essential delivery to the national

implementation, since it implies that the perceived worth and contribution of the AI platform is similar in multiple critical domains (health, energy, technology). This homogeneity implies that a single, national AI platform design is scientifically reasonable and can be effectively adopted throughout the economy of the Kingdom without having to re-engineer the fundamental platform characteristics massively, and sector-specifically. This significantly simplifies the national digital transformation initiatives in PM training in terms of cost.

### **5.5 Implications for Theory and Practice**

The research adds to the theoretical work by empirically supporting the synergy between Adaptive Learning Theory and Competency Modeling in a large scale and high context national setting. It offers a quantitative evidence that, when applied by means of the modern AI technology, these theoretical constructs can be an effective system of unified professional development in a non-Western context. In the case of the Kingdom of Saudi Arabia, the results provide powerful arguments to speed up the creation and implementation of the national PM competency platform as a mandate. The study confirms that AI training is a good approach that should be invested in to scale competence fast and efficiently. The platform must be placed as a strategic tool to make sure that PM human resource of megaprojects (NEOM, Amaala) is compared to a stable high level of competence, which would directly benefit the success of Vision 2030.

## **Chapter 6**

### **Conclusion and Recommendations**

#### **6.1 Conclusion of the Study**

This project was able to study the impact of designing a national smart platform using Artificial Intelligence to evaluate and develop the professional competence of project management personnel in Saudi Arabia's vital sectors. The research found overwhelming support for an AI-driven approach. Further, the results outline: High Impact and Predictive Power: AI platform engagement is a strong predictor of competency improvement, where key features, such as Personalized Learning Pathways and Automated Evaluation, underpin professional growth. Unified National Model Feasible: The perceived value of the platform is statistically consistent across all vital sectors, thereby validating the feasibility of a unified, national design for PM competency management. Closure of Gap: In light of findings from this research, this study could provide the empirical evidence needed to close the gap in existing research related to a lack of unified, AI-enabled national frameworks in this highly important sector. It therefore ultimately demonstrates that a national AI-powered platform has the potential to transform the way competency development is pursued and will be a strategic enabler for accomplishing the complex goals of Saudi Arabia's Vision 2030.

#### **6.2 Recommendations for Practice**

Based on the findings of the validated model, the following recommendations are made to government ministries and PM governing bodies:

Accelerate Platform Development and Mandatory Adoption: With proven efficacy at  $r=0.64$  and no significant difference across sectors at  $p>0.05$ , there is a need to accelerate further platform development and usage, with its application mandatory for all PM professionals handling national projects.

Adopt advanced simulation-based training: This platform should include high-fidelity, simulation-based training modules to offer PMs a safe place in which they can practice complex behavioral and contextual competencies, fully leveraging the AI's real-time assessment capabilities.

Digital Literacy will be further reinforced through targeted training for PM professionals to make full use of the advanced functionality of the platform, especially predictive analytics and personalized dashboards.

Annual Competency Testing: Provide for annual, required-competency testing on the platform to report on the progress of the national workforce against the Vision 2030 human capital targets, along with ongoing, adaptive guidance.

### **6.3 Future Research Directions**

Long run studies should address the following:

- Developing sector-specific AI models to further tailor content for unique challenges within the Health and Energy sectors.
- Longitudinal performance tracking of PM professionals, to capture the long-term impact of using the platform on real project success rates-for instance, budget/schedule variance reduction.
- Exploring how the competency data from the platform is integrated into national human capital initiatives in order to plan the workforce and ensure talent mobility.

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## **Appendex**

### **Appendix A: Survey Instrument**

1. The AI platform provides accurate evaluation of my skills.
2. The training recommendations are relevant to my job role.
3. The platform helps me identify my strengths and weaknesses.
4. The interface is easy to use.
5. The platform improves my overall competency.

### **Appendix B: Statistical Output Tables**

Additional descriptive statistics, reliability analysis, and full SPSS output can be included here.