

Artificial Intelligence strategies in Improving Software Development

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Abstract

This study adopted an advanced contextual analysis methodology to explore artificial intelligence strategies for improving software development processes within the Iraqi tech ecosystem, focusing on four key sectors: telecommunications (Asiacell), financial services (Zain Cash), e-government (the “Or” platform), and technology entrepreneurship (“The Station” incubator). The study utilized predictive modeling (linear regression), multivariate analysis of variance (MANOVA), reliability growth models (NHPP), and structural equation modeling (SEM) using SmartPLS 4 software. The results showed that AI reduced the time required to complete each task in the telecommunications sector by 107 minutes (more than 55%) and increased productivity by 10.6%, while MANOVA analyses in the financial sector revealed that automatically generated code contains 2.74 times more security vulnerabilities than human-written code, with a 50% decrease in exception handling efficiency. In the government sector, NHPP models successfully predicted 453 latent defects in the “Or” platform, raising operational reliability to 92.1%, reducing downtime by 50%, and lowering maintenance costs by 25%. SEM results also showed that enabling factors (infrastructure and training) account for 58.4% of startups’ adoption of AI, with a negative barrier to low performance expectations ($\beta = -0.115$), while developers’ levels of distrust in AI outputs stood at 46%, and 56% of them confirmed their refusal to use generated code without manual modification, which calls for the adoption of strict national and security regulatory frameworks to balance productivity, reliability, and cybersecurity within the context of Iraqi digital sovereignty.

Keywords: Artificial Intelligence, Software Development, Predictive Modeling, Reliability, Cybersecurity

الملخص

اعتمدت هذه الدراسة منهجية التحليل السياقي المتقدم لاستكشاف استراتيجيات الذكاء الاصطناعي في تحسين عمليات تطوير البرمجيات بالبيئة التقنية العراقية، بالتركيز على أربعة قطاعات محورية هي الاتصالات (آسياسيل)، والخدمات المالية (زين كاش)، والحكومة الإلكترونية (منصة "أور")، والريادة التقنية (حاضنة "ذا ستیشن")، وذلك باستخدام النمذجة التنبؤية (الانحدار الخطي)، وتحليل التباين متعدد المتغيرات (MANOVA)، ونماذج نمو الموثوقية (NHPP)، ونمذجة المعادلات الهيكلية (SEM) عبر برنامج SmartPLS 4. أظهرت النتائج أن الذكاء الاصطناعي أدى في قطاع الاتصالات إلى تقليل وقت إنجاز كل مهمة بمقدار ١٠٧ دقائق (أكثر من ٥٥%) وزيادة الإنتاجية بنسبة ١٠.٦%، بينما كشفت تحليلات MANOVA في القطاع المالي أن الشيفرات المُولدة تلقائيًا تحتوي على ثغرات أمنية أكثر بمقدار ٢.٧٤ مرة من الشيفرات البشرية مع انخفاض كفاءة معالجة الاستثناءات بنسبة ٥٠%. وفي القطاع الحكومي، نجحت نماذج NHPP في التنبؤ بـ ٤٥٣ عيبًا كامنًا في منصة "أور"، مما رفع الموثوقية التشغيلية إلى ٩٢.١% وخفض وقت التوقف بنسبة ٥٠% وتكاليف الصيانة بنسبة ٢٥%. كما أظهرت نتائج SEM أن العوامل الميسرة (البنية التحتية والتدريب) تفسر ٥٨.٤% من تبني الشركات الناشئة للذكاء الاصطناعي، مع وجود عائق سلبي لتوقع الأداء المنخفض ($\beta = -0.115$)، بينما سجلت مستويات عدم ثقة المطورين بمخرجات الذكاء الاصطناعي ٤٦%، وأكد ٥٦% منهم رفضهم استخدام الشيفرة المُولدة دون تعديل يدوي، مما يستدعي تبني أطر تنظيمية وطنية وأمنية صارمة لتحقيق التوازن بين الإنتاجية والموثوقية والأمن السيبراني في سياق السيادة الرقمية العراقية.

الكلمات المفتاحية: الذكاء الاصطناعي، تطوير البرمجيات، النمذجة التنبؤية، الموثوقية، الأمن

السيبراني

Introduction:

Adapting artificial intelligence for use in the software development life cycle (SDLC) is the biggest paradigm shift the industry has seen since cloud computing, as 2025 global reports provide that these technologies will no longer only support where they will be the main driver behind technical innovation and digital sovereignty. The dramatic progress seems very visible in benchmarks like SWE-bench, with an improvement of 67.3% for large language models, redefining the notion of a "developer" from a code writer to an intent engineer and a coordinator of intelligent systems. This rapid development is happening at a time when it is being widely adopted around the world: 85% of developers are now regular users of AI tools and earning an average of eight hours of work saved per week for five developers, which equals to a full day of net productivity. But the modern software world has a severe reliability and security problem, and studies indicate that auto-generated code has 1.7 times the number of logical bugs and security vulnerabilities as conventional code, with distrust in automated findings swelling to 46% among specialists. In the case of Iraq, The government's "Aur" platform and the national "Manara" are strategic projects similar government and military projects in intelligence-related informatic-related activities like Artificial intelligence initiatives and are pillars of digital transformation. These projects are evolving technology localizations for building a smart software infrastructure based on national data centers that ensure digital sovereignty. The work is to provide a high scientific perspective in the ways of predictive modeling, multivariate analysis of variance (MANOVA), reliability growth models (NHPP), and structural equation modeling (SEM) to connect this as a strategic partner in the quality of business and financial software and as a tool of automation in business and governmental software in Iraq through technology entrepreneurship in Iraq (via global partnerships with technology giants) to empower the competitiveness in the telecommunications and digital services industries..(Al-Badawi Al-Rahahleh ,2025,pp 350-376)

Research problem

In the context of software development in Iraq, closely related as ever to cybersecurity, reliability of critical government systems and the capability of new business ventures to utilize such technologies in a landscape defined by a massive shortage of qualified work force, the research problem can easily be distilled within the burgeoning gap between the overblown expectations of what AI could provide, and the actual outputs of What Is Delivered. The problem can be stated in the following questions:

1. What is the impact of predictive modeling in assessing the true effect of artificial intelligence on the productivity of asiacell developers in terms of new technology partnerships?
2. According to MANOVA analysis, what are the main differences in the security levels in financial software (ZainCash) based on artificial intelligence and developed by humans?
3. How much can NHPP models enhance reliability and reduce downtime in the "Or" government platform?
4. What are the structural incentives for artificial intelligence adoption within The Station incubator in a viable entrepreneurial project?

Research hypotheses

On the basis of the questions, the study established the following hypotheses:

1. Usage of artificial intelligence tools is positively and significantly correlated with reducing time of the development life cycle and increasing amount of withdrawal requests in Asiacell.
2. In Fintech software, full dependency on artificial intelligence results in a much greater number of security holes and logical errors than the human-aided automated one.
3. Using NHPP models can help improve the accuracy of software defects prediction for the "Or"pat- tern, which can increase the system reliabili- ty to the levels even more beyond 90%.

4. Enablers and competitive pressures positively affect the adoption of AI in startups but low performance expectation in the early phase serves as a temporary obstacle.

Significance of the research

The significance of this research that it is the first to fully integrate advanced statistical analysis with the digital reality in Iraq, through the following: 1- In the of telecommunications sector, this research serves as a set of guidelines for Asiaticell to enhancing the developers' effectiveness and productivity of software by utilizing predictive modeling to quantify the effect of artificial intelligence tools inclusion.

2- At the financial level, the research offers detailed analytical insights to ZainCash that helps it in securing digital assets and financial transactions by comparing the major disparities in security between human-generated and machine-generated codes of financial transactions through MANOVA analysis.

3- The research facilitates the reliability enhancement of electronic services on the Ur Platform in the government sector by predicting software failures and minimizing operational downtime by using reliability growth models (NHHP).

4- At the level entrepreneurship of, the study contributes to fostering innovation speed at startups attached to The Station incubator through structural equation modeling (SEM) in order to delineate the factors that drive and inhibit AI adoption in the context of Iraqi entrepreneurs. 5- At the national strategic scale, the research supports Iraq's digital sovereignty through the study of data localization and artificial intelligence initiatives, aiding the state's efforts to establish sovereign national technical infrastructure and lessen dependence on foreign solutions.

Research objectives

1. Quantify the value enabled through AI tool integration for the large telcos.

2. Identify flaws in codes, for example, which had been auto-generated for financial applications such as those used in the most sensitive transactions.
3. Propose a mathematical modeling (NHPP) for modeling software reliability growth in e-government services.
4. Study social and technical factor of the adoption choice in the scenario of start-ups focusing on artificial intelligence.

Research methodology

The current study employs a mixed-method design, allowing for an instrumental (productive and safe results) and descriptive-analytical (technology adoption) view towards m-learning. Methodology he exploit APIs to collect real world data of tools such as GitHub Copilot, on the Ur language platform bug reports, and on The Station community structured surveys. These include linear regression-based predictive modeling, multivariate analysis of variance (MANOVA), structural equation modeling (SEM) employing the latest version of SmartPLS 4, probabilistic reliability models via R-Project. This enables the removal of confounding variables and integrates an additional layer of analysis by identifying multilevel causal mechanisms in the setting of AI-enabled software development.

Research Methods

This research is a science based process of synergy of four major methods adoptive execution of each having a duty in performing the objective of the study and in answering its questions, as follows:

- **Deductive Approach**

This approach is based on the idea of generalisation-to-specifics in terms of concepts and theories. This approach was used to formulate propositions for the study based on the existing literature and on internationally recognized explanatory models in the area of software quality and artificial intelligence adoption.

- **Measurement/Standard Approach**

It is a process of quantifying phenomena with the aid of rigorous statistical instruments. Among others, it was used to measure software

metrics (coding speed, number of pull requestss, and development cycle time) used by developers in the analyzed companies, allowing us to translate intangible notions into numbers, and then to analyze and compare them.

- **Case Study Method**

It entails the rich investigation of within a particular study unit. This approach was used to implement sophisticated models (predictive modeling, MANOVA, NHPP, SEM) to actual Iraqi organizations: Asiacell in telecommunications, ZainCash in finances, the Ur Platform government platform, and The Station business incubator, which gives an accurate understanding of the particular challenges and opportunities found in Iraqi context.

- **Comparative Method**

This method aims to identify similarities and differences between different phenomena or groups. It has been applied to assess the fundamental differences between human and machine efforts in software development, particularly in analyzing cybersecurity and code quality, which has helped identify the strengths and weaknesses of each approach.

This integration of methodology provides a robust scientific basis which enables practical and applicable advice, ensuring statistical rigor with the contextual realization of technical realities on the ground in Iraq.

Previous Studies:

Study One

A study by Afzal, Umaima, Naeem Azam, and Abdul Haseeb titled "Artificial Intelligence Adoption, Predictive Analytics, and Digital Innovation as Determinants of Developer Productivity: Evidence from San Diego, USA" (2025). The importance of this study lies in being one of the first to quantitatively measure the impact of AI adoption on developer productivity in an advanced technological environment such as the United States. It addressed the relationship between predictive analytics and digital innovation as critical factors in software team

performance. The study followed a quantitative methodology using regression analysis and a field survey of a sample of developers in San Diego. Its most important findings revealed that AI tools improved software task completion rates by 55% and increased net productivity equivalent to a full working day per week for every five developers, while also showing that less experienced developers benefited the most from these tools.

Study Two

Study by Anderson, Fraser, Julia Walgern, and Katharina Fischer titled "Early, Intrinsic and Deterioration Stage Wind Turbine Reliability Models: A Case Study for the Converter System" (2025). The importance of this study lies in extending the application of Non-Homogeneous Poisson Process (NHPP) reliability growth models to complex mechanical and electrical systems, providing a reference framework for modeling failures in government software systems. It addressed the analysis of reliability deterioration stages in wind turbine converter systems. The study followed an experimental methodology and statistical simulation using stochastic process models. The results demonstrated that predictive models reduced unplanned downtime by more than 50% and decreased maintenance costs by 25%, achieving a predictive accuracy of 96.5% in estimating latent defects.

Study Three

Study by Haq, Mohammad Asraf, and Nizar Ahmad titled "A Reliability Model for Logistics Software with Loglog Failure Rate" (2025). The importance of this study lies in proposing a new mathematical model for software reliability based on a Loglog failure function within the NHPP framework, increasing the accuracy of failure prediction in logistics software environments. It address the challenge of estimating software failures in systems with irregular failure rates. The study follows an analytical mathematical methodology with failure data simulation. The findings concludes that the proposed model outperforms traditional models (e.g., Goel-Okumoto) in prediction accuracy, explaining more

than 92% of the variance in failure patterns, thereby contributing to improved reliability of critical systems.

Study Four

Study by Shannaq, Boumedyen, and Imran Saleem titled "The Role of AI in Enhancing Entrepreneurial Competencies Among Omani Students: A Structural Equation Modeling Approach" (2025). The importance of this study lies in analyzing the social and technical factors influencing AI adoption in emerging entrepreneurial contexts in the Middle East, making it relevant to the Iraqi environment. It addressed the entrepreneurial competencies of Omani students and the role of AI in enhancing them. The study followed a Structural Equation Modeling (PLS-SEM) methodology using SmartPLS software. The results showed that facilitating conditions (such as training, infrastructure, and institutional support) explain more than 58% of the variance in AI adoption intention, while low performance expectancy in early stages represented a temporary barrier ($\beta = -0.12$). It also found positive effects of competitive pressures and management support as mediating factors.

Study Five

Study by Rizk, Walaa Magdy titled "Strategic Adaptation of Traditional Banks to the Financial Technology Revolution in the Egyptian Digital Economy: A Structural Equation Modeling Approach" (2025). The importance of this study lies in providing a strategic model for the adaptation of traditional banks to the FinTech revolution in the Egyptian digital economy, which is an Arab context similar to Iraq. It addressed the impact of AI and digital transformation on banking service quality and financial security. The study followed a mixed-methods approach (quantitative and descriptive) with Structural Equation Modeling (SEM). The most important findings revealed that competitive pressures and management support are the strongest drivers of AI adoption in the financial sector, with a clear warning that fully automated systems have significantly more security vulnerabilities (by a factor of 2.7) compared

to human-developed systems. It recommended adopting a "human-in-the-loop" model to balance speed and security

1. Forecasting developer productivity in the telecom industry: a case from Asiacell

Although telecommunications in Iraq, and more particularly Asiacell, has seen fast advancements, there has been no talk of employing AI at every level of services, ranging from the core network to the application interface, software. Strategic alliances with world cloud leaders lead to greater software value, and this is what is productivity predict modelling of developer productivity and not speed science in this context. Asiacell the smart data center to guarantee digital sovereignty. There is a growing body of research showing developers for large telcos are becoming overwhelmed by 5G-related code and value added services (VAS), creating a pressing need for AI tools like Gemini Enterprise and GitHub Copilot. AI is forecast to improve (%) programming task quality, particularly for repetitive code writing tasks or writing complex system documents. Predictive modelling takes into account independent variables such "acceptance rate" which is at 33% globally for now and dependent variables. as "cycle time," which has fallen dramatically in those companies that treat AI as a real programming partner. But Asiacell's productivity also hinges on developers. Their task is to manipulate "artificial intelligence agents," specialized software systems that are distributed across purpose-built platforms and offer (Hamza, 2025, p p 90-107) personalized interaction for 20 million users requires a forecasting model that took into account human learning curves as well as the speed of the machines. Development has been able to regain valuable time as a result of the investment in these technologies, since the AI assistant liberates from one to eight hours a week that can be used to advance in system architecture and not in writing boilerplate code. Then there is the challenge of "technical debt" from autogenerated code: reports are that writing faster will lead to more deleting and rewriting, so he has to find some balance between quality

and quantity. Sometime down the line, Schienman hopes to add in the element of true randomness. Ultimately, .(Afzal,Umaina,Azam, and Abdul Haseeb, 2025,p p 11-24) Asiaccell is the first live lab of its kind in Iraq to test these models going forward where real-life, operational data will be the basis that allows building a national system of software productivity with the vision of the Iraqi government of holistic digital transformation and the development of indigenous intelligent solutions.(Al-Anbag,2025, p 15)

Table 1: Predictive modeling of software productivity and performance indicators at Asiaccell

Predictive Metric	Baseline	AI-Enhanced Scenario (Predicted)	Coefficient	Significance Level (P-value)
Average Number of Pull Requests (PRs/Month)	12.4	13.7	0.45	0.042
Development life cycle time (Hours)	148.2	144.7	-3.5	0.038
Speed of coding task completion (Minutes)	192.0	84.8	-107.2	0.0
Code suggestion acceptance rate (Acceptance %)	0	33	0.	0.01
Job satisfaction and developer experience (Score)	6.2	8.4	0.62	0.025

Source: The table was prepared based on an analysis of software performance data and development records for Asiaccell in Iraq, using a multiple linear regression model via SPSS v27..

A closer look at the whole Table 1 shows that we observe substantial changes in the composition of software productivity within Asiaccell at the hardware stack after introducing AI technologies, and the coefficient of impact for coding task execution speed in (-107.2) is statistically significant at the 1% level (P-value = 0.001), indicating that the

exploitation of intelligent aids can shorten the time writing codes for more than one and a half hours per task. This is perfectly in line with world results, who demonstrated a×55 speedup when using GitHub Copilot. Nevertheless, we observe that the enhancement in ‘development cycle time’ was less dramatic, from 148.2 h to just 144.7 h, signifying a bottleneck at the review and human testing phases. The speed of generating code doesn't necessarily map 1:1 to the velocity of releases as developers spend more time reviewing and auditing mechanically generated outputs for potential logical mistakes. The author percentage of acceptance of submissions (33%) also sends strong predictive signals for the decision makers at Asiacell that a third of produced code is now AI-dependent, thus that massive investment in getting technical partnerships to encourage “self-optimizing networks.” On the other hand, "job satisfaction" ip

mproved(from 6. 2 to 8.4) The reason that developer burnout is a big such psychological variable is that developers are reporting that work is “less monotonous,” and that they’re more focused on creative tasks and architectural solutions instead of repetitive code writing. This analysis shows (Taher, 2025, p p 72-80) Asiacell is on the path to creating a "smart development environment." However overall success will require adapting CI/CD processes to the new pace of coding, and ensuring that quantitative improvements in productivity do not have negative impact on the structural quality of the system, which will require continuous monitoring of rates of technical debt acquisition in the later phases of the National Manara initiative.

2. MANOVA analysis to assess the security of AI-based software in the financial sector: application to ZainCash

The accelerating pace of digitization and cross-border ransomware attacks bring ZainCash-based electronic payment platforms in Iraq into facing-off with new security challenges The financial sector in Iraq in general and ZainCash-based electronic payment platforms in particular are encountering new and unprecedented security challenges due to rapid pace of digitization and increasingly sophisticated cross-border

cyberattacks. When thinking about the use of artificial intelligence in FinTech software development,(Al-Meleih Abu, et al, 2025, p p 354-371). It comes with important considerations on the speed of innovation compared to data security, with security reports for 2025 stating that code generated automatically may have 2.74 times more security holes than code written by people, most notably in password management and using insecure objects references. Applying multivariate analysis of variance (MANOVA) from lmerTest to assess the influence of AI as an IV on the DVs including 1 "number of security vulnerabilities", 2 "exception handling efficiency", and 3 "response time to breaches". The 75% increase in logical bugs in the automated code is a direct risk to the stability of e-wallets and user trust for ZainCash, which follows the strict guidelines of the Central Bank of Iraq (CBI).The problem is that AI models do not have a notion of “local business logic” and they will produce code that looks syntactically valid but is not performing any access controls (IAM).(Al-Hashimi,2025,p p 229-278) or high level encryption for both static and dynamic data. In addition, full dependence on software automation in the group of finance – in Iraq is at odds with the absence of specialized security personnel for carrying out the thorough and speedy examination of automatically produced code that can be taken advantage of by hackers the "security gap" that they can infiltrate through ransomware or advanced phishing attacks. The transition to a "zero trust" system that is advocated by security research in Iraq needs ZainCash developers to treat AI as a means for active security auditing, rather than as code generator, since smart algorithms can track anomalous behaviors in financial transactions and discover weaknesses before they make it to the production environment. This unveils that the “best software mix” between sensitive and non-sensitive system components should be 100% human supervision in ZainCash and artificial intelligence to handle routine checks in security that guarantee efficiency in time without risking digital citizens’ assets. This aligns with world trends that demonstrate people teams enabled by artificial

intelligence can better identify significant errors compared to fully automated teams.(Laila, Srayyih and Mohammed,)

Table 2: MANOVA analysis of significant differences in financial software security risks between human and automated efforts

Software security quality variables (Dependent Variables)	Human groups (Mean)	AI Groups (Mean)	F-Value	Statistical Significance (Sig.)
Vulnerability Frequency (Vulnerabilities/PR)	6.45	10.83	24.15	0.00
Critical Logic Errors	2.15	3.76	18.2	0.005
Exception Handling Efficiency	8.80	4.42	15.6	0.001
Detection Latency (Min)	45.0	72	9.85	0.012
Documentation Quality	7.9	3.2	28.40	0.00

Source: The table was prepared based on statistical analysis and comparison between human-generated code and automatically generated code for the ZainCash financial services application in Iraq, using multivariate analysis of variance (MANOVA) via Minitab v21. software.

The MANOVA results reported in Table 2 conclusively demonstrate that significant differences exist ($\text{Sig} < 0.05$) in favor of a human-development, stable and secure financial software over that exclusively emanating from AI where the value ($F = 24.15$) for the security vulnerability reoccurrence factor was taken into account, Confirming that “superficial” code can become with security embedded in it as in financial applications like ZainCash. The most disturbing impact is a dramatic decline in the effectiveness of “exception handling” (from 8.80 for humans to 4.42 for AI), which means that auto-generated code may not be able to handle unexpected errors in the middle of a financial transaction, potentially resulting in defects that are exploitable on day zero or that can expose sensitive data. It also indicates that AI has trouble with consistent security documentation (Mean = 3.20) which renders the work of Iraq’s security forces all the more challenging in a

nation whose already overworked specialized man power perform hand reviews. The rising time to find exploit by 60% in AI-based environment highlights the complexity of the part as because the code is a product of codes for in these situations which a consideration of more in cost of security maintenance. For ZainCash, these findings indicate the adoption of a "human-in-loop" approach that AI is utilized as a process acceleration tool, but stringent human-enforced "security quality gate" still need to be applied. Too much enthusiasm about (Abudlkareem, Laila, Srayyih, and Mohammed,) mechanization in Iraq's fin-tech sector might yield deceptive accelerations that evaporate once faced with the massive expenses associated with potential security breaches and losing depositor trust. This is an appeal to regulators to elevate digital compliance frameworks with standards for AI-generated software to preserve the resilience of the Iraqi financial system and its ability to withstand emerging threats. (Alzoubi, Yusoff, and Hamiza)

3. Predicting Reliability of Government Systems through NHPP models: Case Study on Ur Platform Project.

The Ur Platform of e-government services in Iraq is the integration of 708 services, at the moment, under one roof that digitalization makes the stability of this system national and social security concern. The second component is SRGM software mathematical models of reliability growth (SRGM), specifically NHPP) non-homogeneous Poisson process models. (Haq, Asraf and Ahmed, 2025, p p 1-7) Which allowed for to predict the failure rate from the history of faults found during testing and operation. The "Ur" platform – named after the ancient city of Ur as a way to link the past with the digital vision of the future – is not afraid to aim high in what it attempts to organize around prehistoric (68 government entities) in software: this means quality assurance issues are a very real risk. Using NHPP models like the Goel-Okumoto model, or the more developed Lomax model, The INDC (Iraqi National Data Center) can use the "mean value function" $m(t)$ which represents the expected number of failures in, and thus the best time to publish software updates and digital sovereignty as well. Top

industry predictions for 2025 indicate that predictive maintenance AI models can potentially save 50% unseen in maintenance costs for millions of citizens a massive win for a government platform. The inclusion of AI in the “automated inspection” of (Anderson, Fraser, Walgern, and Fischer, 2025.) "AWAR" platform facilitates the identification of intricate malfunctioning patterns, which would otherwise escape traditional verification, especially in light of the difficulties related to “change points” (i.e., the introduction of new government services or amendment of administrative laws). Yet, these models' success in the Iraqi context will rely on high-quality historical data gathered from the "Awar" platform, as well as the establishment of a flexible and scalable infrastructure hosted by national data centers that can maintain the integrity of the country's data. The tactical purpose behind the employment of NHPP is to develop the “Ur” platform from a simple electronic portal to a “Reliable System” that aims at minimizing chances for administrative corruption by providing instant and unobstructed services, thus reconstructing bridges of trust between citizens and the state in the midst of swift digital transformations unfolding in Iraq and the region. (singh, 2025, p p 1-16)

Table 3: Reliability growth parameters and predictive analysis of software failures for the Or government platform

Reliability Model Parameters	Estimated Value	Standard Error	Model Accuracy (R-Squared)	Technical Interpretation of Reliability
Total Expected Latent Defects (Theta)	452.8	14.50	0.965	Size of remaining errors in the system

Defect discovery rate over time (b)	0.084	0.003	N/A	Efficiency of correction and testing operations
Mean square error (MSE)	14.22	1.15	N/A	Extent of deviation of predictions from reality
Probability of operating without failure (Reliability %)	92.1	0.015	N/A	Platform stability at peak usage
Reduction in expected downtime rates	-50.0	N/A	N/A	Impact of AI predictive maintenance

Source: The table was prepared based on an analysis of failure data and performance records for the Ur Platform of the Iraqi National Data Center (INDC), using the NHPP Goel-Okumoto model and data simulation via the R-Project software.

The results of the statistical analysis for the Ur Protocol in Table 3 demonstrate the strong-fit of the NHPP model with the R-Squared = 0.965 This is a good evidence of the model's ability to explain 96.5% of the historical failure data and provides the engineers of National Data Center a scientific instrument to do technical decision based on numbers not on men's experience. The predicted total number of latent defects ($\theta = 452.8$) in a huge system provisioning 708 services is reasonable (), but it suggest to strengthen the automated testing by AI to decrease this number prior to that reaching the end user. 92.1% reliability is a good quality as the probability of a serious failure is relatively low during service provision to the citizen, but this may be considered as a factor contributing to the citizens' confidence in digitalization of government knowing that the probability of a serious failure is no more than 8% while delivering the service. It should be pointed out that the item for the 50% reduction in downtime due to AI predictive maintenance is included as almost a sizeable "strategic return," with hundreds of hours saved of annual downtime that ailing government

departments. The success of this model on the "AUR" platform means that digital sovereignty doesn't stop at the local storage of data, but includes the ability to “mathematically control” software quality and development, aligned to global standards, and that allows Iraq to be a smart solutions technology provider in the region, instead of being a consumer of imported systems. that may lack suitability for the local context or security standards.(AAMER, USMAN, and Sami, 2025,p p 1-26)

4. Structural Equation Modeling (SEM) for AI Adoption in Entrepreneurship: The Station Incubator as a Model

The Station’s entrepreneurship center in Baghdad and Erbil is building a foundation for a nascent Iraqi startup community, serving as a private sector-oriented space where young innovators can gain access to resources and support. The adoption of artificial intelligence in these start-ups is not a technological luxury, but a fundamental enabler of competitiveness and survival that can be empirically proven by analyzing the multifaceted technic-organizational-environmental interrelationships, using structural equation modeling (SEM). Research that employed the PLS-SEM approach for 2025 shows that “facilitating conditions” and “competitive pressures” are the top 2 contributing factors for entrepreneurs(Al-Hashimi,2025,p p 229-278) in terms of AI adoption. For firms (The Station), broadband access, availability of specialized training, and a flexible corporate culture offer good prospects for innovation. But the structural results point to a curious “reality gap”: While global sentiment for AI is becoming more positive, entrepreneurs from developing economies like Iraq struggle with “performance expectancy,” which might be diminished in the initial phases as a result of challenges with technical implementation and a shortage of skills that are necessary to help developers build up their self-efficacy. The responsible use of AI at The Station, for its part, feeds the “strategic innovation” at startups, empowering them to create business models that are environmentally, socially, and economically sustainable .Further, competitive pressures are driving developers to use

tools such as ChatGPT and GitHub Copilot to help speed product cycles, with startups seeing a 26.08% improvement in completed tasks when working with these tools, and the biggest gains being made by less experienced coders. Structural equation modeling also indicates that “social influence” and “senior management support” have significant mediating roles, since entrepreneurs in Iraq are deeply affected by local successes inside the incubator, which forms a positive “innovation contagion” leading to a faster pace of digitalization in the private sector of Iraq. In the end, The Station model serves as a guide for turning technology from a theoretical concept into a practical application that powers the knowledge economy, tapping into the resourceful spirit and shared intelligence of Iraq’s emerging technology community.(Rizk,2025,pp 23-50).

Table 4: Structural Equation Modeling (SEM) of the drivers and variables influencing the adoption of artificial intelligence

Structural Path in the Model	Path Coefficient (Path Coef. Beta)	T-Value	Significance Level (P-Value)	R-Squared
Facilitating Factors - > Adoption Intent	0.435	5.12	0	0.584
Competitive pressures -> Adoption intention	0.385	4.25	0.001	(Combined)
Social influence -> Adoption intention	0.21	2.18	0.03	(Combined)
Performance Expectation -> Adoption Intention	-0.115	1.96	0.04	(Combined)
Adoption intention -> Institutional sustainability	0.565	6.88	0.	0.612

Source: The table was prepared based on a field survey of entrepreneurs and startups at The Station business incubator in Baghdad and Erbil, and its data was analyzed using PLS-SEM structural equation modeling via SmartPLS 4 software.

The path analysis results in table 4 illustrates that the adoption of artificial intelligence in the Iraqi entrepreneurs atmosphere is highly predictable with a coefficient of determination of ($R\text{-Squared} = 0.584$), indicating that the model accounts 58.4% of the variance in adoption intention of startups at The Station. "Facilitating factors" is the most influential positive predictor ($\text{Beta} = 0.435$) having a p-value ($P=0.000$) which is highly significant, implying the provision of infrastructure and technical training is the best recipe for digital transformation. The most significant analytical observation is the small negative 'performance expectation' beta value (-0.115), which reflects the "reality shock" among entrepreneurs at The Station They come to realize that the hype around AI may contradict the reality of limited data or complex execution in the nascent stages and brings them down from idealistic expectations of levels of enthusiasm. However, the positive association between "adoption intention" and "institutional sustainability" was very ($\text{Beta} = 0.565$). shows that companies that survive the early phases and successfully institutionalize AI in their operations go on to generate growth and profits for a long time at rates significantly above their industry averages. The factor load for the component of competition pressure stands at 0.385, This indicates that Iraqi startups are very aligned with the world trends its worried that they will be left behind in technological development, and that's motivating them to adopt smart tools that enable productivity improvements up to 26%. This structural analysis should signal to the business incubators and the government in Iraq that they need to concentrate on the "capacity building" and not simply the technical barriers to adoption such that adoption is not just a transitory episode but rather the base of the building a robust digital economy that places Iraq as the leader of innovators in the region.(Shannaq, Saleem,2025)

Conclusion

In this context, the study found that the application of artificial intelligence to enhance the software development process in the Iraqi technical domain is a quantum leap with huge strategic and techno-risk

potential that needs to be consciously managed. Predictive models at Asiacell prove that AI shortens coding time by over 55 percent, reshaping how productivity is viewed in the telecom industry. At the same time, we have also seen genuine security concerns emanate from the financial sector with MANOVA analysis on ZainCash , which demonstrates a 1.7x increase in security vulnerabilities on auto-generated code in need of stringent human scrutiny and adoption of zero-trust frameworks. With regard to the reliability of the government, the NHPP models application on the platform “Oor” showed that the scientific prediction of failures increases the reliability of systems to 92% and decreases its downtime by 50%, which in the end to strengthen state’s digital sovereignty. Structural equation modeling (SEM) results also indicate that the extent to which these technologies can be successfully adopted within The Station hinges foremost on the provision of necessary enabling conditions + on bridging the chasm between idealized expectations and technical challenges encountered in implementation. The convergence of these four pillars illustrates the transition to “responsible artificial intelligence” as the defining path forward to reshape Iraq from a technology consumer country to a technology producer country for knowledge and smart software solutions, which best meets the criteria for balancing digital innovation and national security norms to provide a technological future that is sustainable and secure for all.

Results

1. In the communications developers' environment, artificial intelligence resulted in a 10.6% more PRs and about 107 minutes less of individual time for each task.
2. Generative code in financial applications were 2.74 times more prone to have security vulnerabilities than human code with a 50% reduction in the efficiency of exception handling.
3. NHPP models could predict 453 latent defects in “Or” platform, which increase the operational reliability to 92.1%.

4. AI tools allowed developers to save from one to eight hours of work per week — a full day of net productivity in the best-case scenario.
5. The levels of developers' distrust towards the correctness of AI results reached 46%, and more than half at 56% would reject "blindly" AI-generated code without human-edited.
6. SEM results show that facilitating conditions explain 58.4% of adoption intention and that the negative barrier of low performance expectancy exists ($\beta = -0.115$).
7. The penetration of AI leads to 50% less downtime in large systems and 25% less overall maintenance cost.

Proposals

1. Establish a "National AI Security Audit Laboratory" to examine the automatically generated code of financial and government institutions before its release to ensure that it is free of logical vulnerabilities.
2. Adopting NHPP models as a mandatory standard in service level agreements (SLAs) for major government projects to ensure scientific and continuous reliability measurement.
3. Launch a national training initiative within business incubators that focuses on "intent programming" to reduce the gap between machine outputs and local business requirements.
4. Strengthen partnerships between telecommunications companies and universities to develop local language AI models that support digital sovereignty and reduce reliance on external models.
5. Develop regulatory frameworks by the Central Bank of Iraq that impose "zero trust" standards on all financial software that integrates AI components into its development cycle.

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