INTERNATIONAL UNIVERSITY OF MALAYA-WALES

INTERNATIONAL UNIVERSITY OF MALAYA-WALES

IAC 2021

INTERNATIONAL ACADEMIC CONFERENCE 2021

PROCEEDINGS OF THE INTERNATIONAL ACADEMIC CONFERENCE 2021

DIGITALISATION IN TRANSFORMATION:

BRIDGING ACADEMIA & INDUSTRY

Proceedings of the International Academic Conference 2021

Digitalisation in Transformation: Bridging Academia & Industry

October 26-28, 2021

Nurul Nisa Omar, Ng Sok Choo, Nanthini Jayaram, Abdul Abdul Rahim Rachman, Hafiz Hassan *Editors*

e ISBN 978-967-26663-3-2

Proceedings of the International Academic Conference 2021
Digitalisation in Transformation: Bridging Academia & Industry

iumw.edu.my

Copyright

In the event of publication of the manuscripts in the *Proceedings of IUMW International Academic Conference 2021*, copyrights of the manuscript title, abstract and contents are transferred to *International University of Malaya-Wales* for the full legal term of copyright and any renewals thereof throughout the world in any format, and any media for communication.

Conditions of Publication

Manuscripts published are original works, unpublished in any form prior and authors have obtained the necessary permission for the reproduction (or am the owner) of any images, illustrations, tables, charts, figures, maps, photographs and other visual materials of whom the copyrights are owned by a third party.

The manuscripts contain no statements that are contradictory to the relevant local and international laws or that infringes on the rights of others.

Authors have agreed to indemnify *International University of Malaya-Wales* in the event of any claims that arise in regards to the above conditions and assume full liability on the published manuscripts.

e ISBN 978-967-26663-3-2

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Published by International University of Malaya-Wales
Block A, City Campus, Jalan Tun Ismail
50480 Kuala Lumpur, Malaysia
Tel: (603) 2617 3131
Email: enquiry@iumw.edu.my

Vol 1, No 1 (2021): Proceedings of the International University of Malaya Wales Academic Conference (IAC) 2021

Digitalisation in Transformation: Bridging Academia & Industry

Kuala Lumpur, October 26rd to 28th, 2021

Table of Contents

[*] corresponding author

[*] corresponding author

[*] corresponding author

PREFACE

We are pleased to present the proceedings of International Academic Conference (IAC 2021) Digitalisation in Transformation: Bridging Academia & Industry.

The momentum behind digital technology that's driving change in industries globally is unstoppable. When compared with previous industrial revolutions, the Fourth Industrial Revolution is evolving at an exponential rather than a linear pace. Technology has continuously evolved to make our lives much easier, with most of our modern needs and demands conveniently served. To be competitive and stay relevant, organisations must move with the times. Their long-standing success may well be defined by their ability to adapt, and how well they apply the use of technology in their business strategies.

This proceedings is a compilation of research papers that was presented at the IAC 2021. These research papers I believe will have a great contribution not only to the academic but also to the industry practitioners.

I would like to say thank you to all authors who contributed their papers to this proceedings and to the conference committee who has work very hard to ensure the success of IAC 2021.

Dr. Nurul Nisa Omar
Chairperson
IAC 2021
International University of Malaya-Wales
Kuala Lumpur, Malaysia
.

Organizing Committee

Chairperson
Dr. Nurul Nisa Omar

Project Manager
Laura Evans

Programme Coordinators
Che Nur Amalina S.Che Zainal (Panel Sessions)
Sugindran R Krisnan (Project Showcase)
Ainul Zariney Aziz (Workshops)
Elilarasi Letshmanan (Delegates Liaison)

Collaboration Committee
Professor Dr. Jasmine Ahmad (University Partnerships)
Amina Syarfina Binti Abu Bakar (Sponsors, Virtual Stage Manager)

Marketing & Promotion
Michelle Foong (Digital Marketing, Virtual Stage Manager)
Putri Arina Bt Abdul Aziz (PR & Communications, Virtual Stage Manager)

Research Committee
Dr. Ashley Ng Sok Choo (Co-Chairperson)
Dr. Nanthini Jayaram (Research Coordinator)
Dr. Abdul Rahim Abdul Rachman (Research Coordinator)

Technical & Operations Team
Tan Jian Heng (Registrations Coordinator)
Muhammad Shawal Abdul Rashid (Virtual Stage Manager)
Hafiz Hassan (Virtual Stage Manager)

Project Success Assessment based on Machine Learning

Der-Jiun Pang
Faculty of Arts & Science
International Univerisity of Malaya-Wales (IUMW)
Kuala Lumpur, Malaysia
djpang@gmail.com

Dr Kamran Shavarebi
Faculty of Engineering & Quantity Surveying
INTI International Univerisity
Kuala Lumpur, Malaysia
kamran.shavarebi@newinti.edu.my

Sokchoo Ng
Faculty of Arts & Science
International Univerisity of Malaya-Wales (IUMW)
Kuala Lumpur, Malaysia
ashleyng@iumw.edu.my

***Abstract*—In the digital age, more people are getting connected and using digital technology than ever before. Consumers are surrounded by a variety of digital products and service offerings daily. The Information Technology (IT) industry is projected to have an annual growth rate of between 3.7% and 5.4% worldwide and has become one of the world's leading industries. The COVID-19 pandemic in 2020 has catalyzed the growth of the "digital economy" as more organizations are embracing digital transformation in their operations. This trend drives the demand for IT project practitioners. However, the high failure rate of IT projects has caused incredibly huge losses for many organizations. Existing models, tools, and techniques are incapable of predicting success, which could effectively enhance the project governance capability. This concept paper leverages the Machine Learning (ML) model to perform project success assessments. The study begins by reviewing the contributory factors to project failure, project management techniques, and various prediction models. A quantitative survey will be conducted to rank identified project risk factors. An appropriate ML model will be developed and verified for its performance outcomes in project cost and duration prediction. The proposed method is expected to enhance the prediction accuracy significantly compared to the existing project management techniques.**

Keywords—IT project success failure; project forecast prediction; artificial intelligence; machine learning; project estimation

I. INTRODUCTION

The IT industry has become one of the leading sectors in the world with annual growth projections ranging from 3.7% to 5.4% globally since 2013 (Comptia.org, 2019) with a reach of US $4.6 trillion in 2018 to US $5.2 trillion in 2020, and it is expected to grow to the US $5.8 trillion in 2023 (CompTIA, 2020). Information and Communications Technology (ICT) investment is expected to rise by 25% over the next 5 to 10 years (IDC Corporation, 2020). The strong IT industry trend drives huge demand for IT projects, and therefore, it triggers the opportunity for IT professionals to tactically and strategically align with the growing demand for organizational digital transformation projects continuously (CompTIA, 2020). The Project Management Institute highlighted in its talent gap report that 2.2 million new project-oriented roles will be created each year through 2027, out of which approximately 450 thousand IT project manager jobs will be created annually (Alexander, 2017; PMI, 2017).

Despite all the reported positive aspects in both the digital economy and the growing demand for IT projects, unfortunately, IT project success rates yet remain low without major improvement (Bloch et al., 2012). Significant projects collapsed or partially failed to result in huge losses to many organizations. The literature indicates IT project success rate remains low over the past two decades. Statistically, approximately 20-30% of projects are complete failures and abandoned, and 30-60% partly fail with time and cost overruns or other issues (The Standish Group, 2015). A global survey conducted by PMI exposed US$1 million misused every 20 seconds due to ineffective implementation and poor project management, which is translated into US$1.5 trillion wasted a year equivalent to the GDP of Australia (PMI, 2018). The survey findings of 300 CIOs by a UK IT consultancy indicated £37 billion waste per year on failed IT projects (Hopping, 2017). According to Gartner, 85% of big data projects even failed to move beyond the preliminary phase (Asay, 2017).

IT project failure costs are considered incredibly high in which the estimated damage in both the public and private sectors was around US$ 150 billion annually in the U.S. and US$ 140 billion in the European Union (Taherdoost & Keshavarzsaleh, 2015). Singapore reported 1 in 4 organizations (approximately 26%) have experienced a failed IT project at an average cost of SGD788,354 (Low & Ling, 2018). Similarly, the 11th Malaysia Plan (11MP) suffered project delays costing 10.3% of damage (Idrus et al., 2019). Those statistics gave a ponder that there is still a gap for further research that the project management community can tackle

This study seeks to find a feasible solution to improve the current critical high IT project failure rate, which is impeding organization growth and causing significant losses to organizations and investors. This is due to the lack of effective tools and techniques to improve the project success rate (Janssen, 2019). Therefore, the contribution of this study proposes a novel machine learning-based project management assessment technique to increase the IT project success rate.

II. RESEARCH QUESTIONS

The study is deemed to answer the following research questions:

RQ1: *What are the key contributors to high project failure rates?* Consolidate key project contributory failure factors and investigate their root cause, degree of impact, and probability of occurrence at which stages of the project lifecycle. This approach gives the investigator an overall picture of how these risks and issues were developed; what causes, contributes, or triggers these risks. Identify which contributory attributes have the most significant impact.

RQ2: *What are the feasible project management techniques for improving the project failure rate?* The second research objective is undertaken through studies

related to the current most used project management techniques, particularly shortlisting techniques that possess prediction capability and are applicable for both conventional waterfall and agile project methodologies.

RQ3: *What Machine Leaning model can improve project failure rate?* In the same line of thought, the third research objective is to conduct a literature review of studies on existing artificial intelligence models that are capable of reducing the rate of project failure.

III. Preliminary Literature Review

Despite decades of research into project success and failure, regrettably, the record of high IT project failure rates does not seem significantly reduced. Besides, there is a shortage of research information on this topic in the South East Asia region. Despite many studies concentrating on project performance and project success failure contributory factors, unfortunately, there is still a lack of an effective solution to mitigate some of these identified risks. Several studies have indicated approximately 60% of projects experienced failure, resulting in time and cost overruns or undesired production defects, because the existing models, tools, and techniques are not suitable to mitigate these risks and are incapable of predicting success, especially before initiation (Janssen, 2019; Magaña Martínez & Fernandez-Rodriguez, 2015). Many scholars stress that the current project management strategy focal point has to switch from a "monitoring-based" to a "predictive-based" approach by incorporating computational intelligence, artificial intelligence (AI), or equivalent components, typically to improve forecasting capability in both time and cost dimensions (Bardsiri, 2020; Fasanghari et al., 2015; Fauser et al., 2015). This could enable and enhance the overall project management governance capability. Currently, there is still a lack of research to provide an effective solution to discharge these failure factors or inspire success factors to the next level, therefore leaving the research gap open for further investigation.

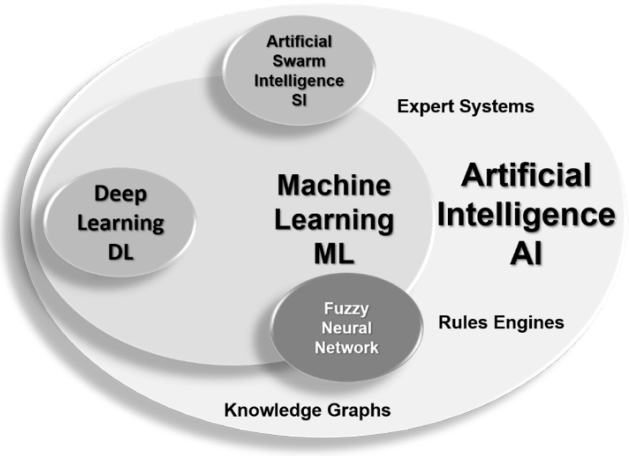

Fig. 1. The Artificial Intelligence Family

There were several studies on using AI in project management. A few examples include: evaluating project features using AI based on math, soft computing, and previous estimation methods (Bardsiri, 2020); proposing an AI method to predict the SPI and CPI of the projects in the earlier state of the projects by computing the Earned Value Management (EVM) indexes (Fasanghari et al., 2015); and developing a new AI-based EVM tool to accurately forecast the DEAC (Sackey et al., 2020). AI is defined as the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. It simulates human intelligence and animal intelligence in programmable machines to think like humans and animals and mimic their actions. Deep Learning (DL) is a subset of machine learning comprising more than one hidden layer with a specific algorithm aiming to provide much higher accuracy, typically in the application of image recognition and natural language processing. Machine Learning (ML) is a subset of AI that possesses the ability to modify itself when exposed to more data without human intervention. AI in a wider dimension includes other components such as the Rules Engine, Fuzzy Neural Network, Knowledge Graph, Expert System, and Artificial Swarm Intelligence (SI). Fig. 1 shows the relationship between the AI family.

IV. Research Methodology

This study begins with content analysis via a narrative review synthesizing insight into three different aspects: (1) project failure contributors, (2) project management techniques, and (3) machine learning models. The research method comprises both quantitative surveys and experimental-based. Fig.2 illustrates the research conceptual framework. Firstly, research gaps are identified via a literature review. Then further literature review is performed on three major aspects: Firstly, an investigation into Project Risk Factors answers **RQ1** "*What are the key contributors to high project failure rates?*". Second, a study on effective project management techniques dealing with **RQ2** "*What are the feasible project management techniques for improving project failure rate?*". Third, a study on various machine learning models, finds out their respective strengths and weaknesses attending to **RQ3** "*What Machine Learning model improve project failure rate?*" Later, a Project Risk Ranking assessment is executed based on collected data from the quantitative survey. A suitable ML model is built to verify its performance in enhancing its prediction in both "cost" and "time" dimensions.

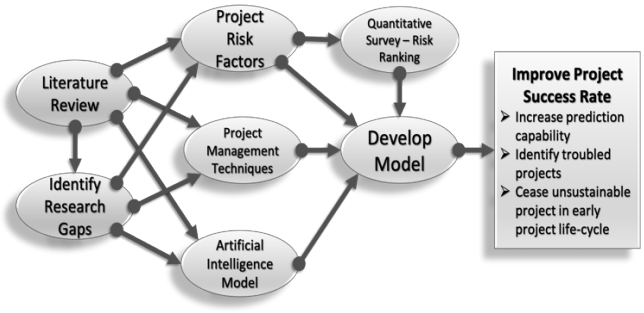

Fig. 2. Conceptual Framework

A. Research Design

The quantitative survey intends to use cross-sectional quantitative structured closed questionnaires to rank project risk contributory factors in both severity impact and frequency of occurrence to determine their risk exposure rating respectively. The experimental-based research leveraging

historical project information pre-processed in a specific format serves as a training and testing dataset for the machine learning model selection in the later stages. Various selected machine learning (ML) models will be evaluated based on their performance metrics *MMRE*, *RMSE*, R^2, *MAE*, *MdMRE*, *RMSLE*, and *Pred* (25). The best ML model will be shortlisted and put forward for live project verification.

B. Population of Study

The quantitative survey will involve a sample of 109 respondents with a target population of 150 project managers and project practitioners located in the Malaysia-Singapore region primarily, irrespective of their organization, gender, or age. The sample size is calculated based on the confidence level of 95% with a 5% margin of error.

C. Data Collection and Analysis

The quantitative survey will collect both primary and secondary data, and the quantitative data generated will be analysed using SPSS, JASP, or equivalent statistical software to perform descriptive and non-parametric statistical testing accordingly. The questions will be specific and detailed, seeking to gather information on identified key project risk factors in both impact and frequency of occurrence. Each key risk factor is then rated by risk exposure rating individually.

D. Experiment Design

In the experiment research, historical project performance data is collected from more than 600 IT projects with more than 8,000 records. Data is codified to maintain its anonymity. The data is filtered and pre-processed with relevant data fields then apply to ML for both the training and testing in the ratio of 70:30 as a guiding principle. It contains both the historical project EVM data and other codified project risk factor data. ML model will be developed using Python, Anaconda, or equivalent integrated development environment software platform with publicly available data/ML scientist API packages.

V. BENEFITS

This concept paper aims to provide an introduction to machine learning to enhance project management techniques in both cost and time prediction. The current shortcomings of project management models, tools, and techniques are not sufficient to mitigate these risks and are incapable of predicting success. The proposed model expects to see an improvement in prediction accuracy. This model is typically used by IT project practitioners and IT project governance bodies to identify troubled projects in the early project life-cycle, then enable proper decisions to be made and appropriate corrective actions to be taken.

From the project sponsored organization perspective, the proposed model can minimize potential wastage and losses by re-allocating precious limited project resources to higher success rate projects; maximizing project benefits and its return of investment (ROI); and indirectly boosting their confidence in approving more projects and dominate better project governance and decision-making capability.

In terms of stakeholders' benefit, they will be more satisfied and accepted of project performance due to the higher success rate. For consumers, the increment of IT projects introduces more innovative digital products and services, thus facilitating a positive contribution to consumer welfare. It improves the flow of timely relevant information such as market prices to any traders, substantially reduces costs in search, transportation, and reproduction, and therefore promotes market efficiency.

REFERENCES

Alexander, M. (2017). *Project management salaries: Talent gap reveals long-term growth*. CIO. https://www.cio.com/article/2399822/careers-staffing-project-management-salaries-show-earnings-growth-career-potential.html

Asay, M. (2017). *85% of big data projects fail, but your developers can help yours succeed*. Techrepublic. https://www.techrepublic.com/article/85-of-big-data-projects-fail-but-your-developers-can-help-yours-succeed/

Bardsiri, A. K. (2020). An intelligent model to predict the development time and budget of software projects. *International Journal of Nonlinear Analysis and Applications*, *11*(2), 85–102. https://doi.org/10.22075/ijnaa.2020.4384

Bloch, M., Blumberg, S., & Laartz, J. (2012). Delivering large-scale IT projects on time, on budget, and on value. In *McKinsey & Company* (Issue October 2012). http://www.qitrmanagement.com/Delivering large-scale IT projects on time on budget and on value.pdf

Comptia.org. (2019). CompTIA IT Industry Outlook 2020. In *comptia.org*. https://www.comptia.org/content/research/it-industry-trends-analysis

CompTIA. (2020). *2020 IT (Information Technology) Industry Trends Analysis | Business of Technology | CompTIA*. Comptia.Org. https://www.comptia.org/content/research/it-industry-trends-analysis

Fasanghari, M., Iranmanesh, S. H., & Amalnick, M. S. (2015). Predicting the success of projects using evolutionary hybrid fuzzy neural network method in early stages. *Journal of Multiple-Valued Logic and Soft Computing*, *25*(2–3), 291–321.

Fauser, J., Schmidthuysen, M., & Scheffold, B. (2015). The Prediction of Success in Project Management–. In *Deloitte*. https://www.bdu.de/media/177649/predictive-project-analytics_artikel_gpm.pdf

Hopping, C. (2017). *UK "wastes billions every year" on failed agile projects*. IT Pro. https://www.itpro.co.uk/strategy/28581/uk-wastes-billions-every-year-on-failed-agile-projects

IDC Corporation. (2020). *IDC - Global ICT Spending - Forecast 2020 – 2023*. Forecast Overview. https://www.idc.com/promo/global-ict-spending/forecast

Idrus, N. A., Ismail, S., & Sanusi, F. A. (2019). Delays in Malaysian Government Projects : Learning From Project. *Jurutera*, *October*. http://dspace.unimap.edu.my/bitstream/handle/123456789/64139/Delays in Malaysian government projects- learning from project management failure.pdf?sequence=1&isAllowed=y

Janssen, N. E. (2019). A Machine Learning Proposal for Predicting the Success Rate of IT-Projects Based on Project Metrics Before Initiation [University of Twente]. In *University of Twente*. http://essay.utwente.nl/78526/

Low, R., & Ling, L. W. (2018). *Singapore businesses remain confident about digital transformation, but worry about progress with digital technology*. Networks Asia. http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip&db=bsu&AN=128295213&site=ehost-live

Magaña Martínez, D., & Fernandez-Rodriguez, J. C. (2015). Artificial Intelligence Applied to Project Success: A Literature Review. *International Journal of Interactive Multimedia and Artificial Intelligence*, *3*(5), 77. https://doi.org/10.9781/ijimai.2015.3510

PMI. (2017). Project Management - Job Growth and Talent Gap 2017-2027. In *Special report*. https://www.pmi.org/-

/media/pmi/documents/public/pdf/learning/job-growth-report.pdf?sc_lang_temp=en

PMI. (2018). *2018 Pulse of the Profession Survey*. PMI. https://www.pmi.org/about/press-media/press-releases/2018-pulse-of-the-profession-survey

Sackey, S., Lee, D. E., & Kim, B. S. (2020). Duration Estimate at Completion: Improving Earned Value Management Forecasting Accuracy. *KSCE Journal of Civil Engineering*, *24*(3), 693–702. https://doi.org/10.1007/s12205-020-0407-5

Taherdoost, H., & Keshavarzsaleh, A. (2015). A Theoretical Review on IT Project Success/Failure Factors and Evaluating the Associated Risks. *14th International Conference on Telecommunications and Informatics*, *August*, 80–88. https://doi.org/10.13140/RG.2.1.3214.9206

The Standish Group. (2015). Chaos Report 2015. *Standish Group - Chaos Report*, *49*, 1–8. http://www.projectsmart.co.uk/docs/chaos-report.pdf