A proposed Project management innovation model for a resilient future.

This paper will propose an innovation, engage with studies of project management, and explore emerging Artificial Intelligence (AI) concepts. The aim is to investigate applications in project scheduling and risk assessment to amalgamate techniques and enhance existing approaches to propose a multi-objective project model. This paper will address Goal 9 of the United Nation’s Sustainable Development Goals (UNSDGs) which aspires to the building of a resilient infrastructure for sustainability and includes the fostering of innovation. The driving force towards changing industry is in recognition of the finite nature of resources and thereby emphasizes the importance of developing new ideas and harnessing technology. The application of AI continues to be contentious, but its potential is undoubtedly significant in our global future and consequently, there are few subjects that have failed to engage with its potentiality. One such subject is the interdisciplinary study of project management, an evolving discipline incorporating more of the challenges of problem solving in each annual iteration of professional guidelines. There has also been a drive to become more agile in approaches taken, incorporating hybrid approaches in recognition of the problematic nature and risky situations revealed in different scenarios like data breaches and chemical spills. There is increasingly unpredictability in global markets too, evidenced by the constant changes in customer demands and expectations, driving advances in technology and leading to more ambitious projects with wider scope and higher expectations. Such challenges inevitably result in some project failures, and leads to more agile approaches emphasizing the importance of flexibility and adaptability in contrast to fixed traditional project management practices. In recognition of this and the volatility and capricious nature of so many impacts upon project management in the world today, scholars began exploring AI methodologies to augment project management capabilities in complex situations and their contributions will be reviewed in this paper. In so doing, examples of relevant tools and techniques will be evaluated for their strengths, weaknesses and applications to lead into the proposed new model. There is clear evidence for example, within project modeling that shows by the power and potential of using Fuzzy Cognitive Mapping (FCM) and Bayesian Networks (BN) for project risk management, scheduling and Earned Value Management (EVM). Another valuable tool to be included in this discussion is the Monte Carlo Simulation (MCS) which is included as an important scheduling forecast tool with capability to estimate the mean duration, start and end times of scheduled tasks. The Bayesian Model (BM) too can calculate consecutive probabilistic events and coupled with MCS, the BM offers an improved statistical tool that can calculate the statistical values of different task combinations to achieve optimized schedule solutions. Using BM in MCS not only widens the application to entire schedule paths, but also identifies and determines potential critical paths, serving as an important functionality in project schedule planning.

Researchers have often combined two of each of the techniques together for dual-functionality and in so doing enhance their individual usage, proving invaluable for an understanding of the techniques’ compatibilities and capabilities. Since complex projects mostly deal with nondeterministic and ambiguous data that cannot be precisely measured such as risks, a way to deal with this issue is by introducing probabilities as a measure or expression of uncertainty. Facilitating the statistical tools of MCS and BM, a stochastic approach to processing uncertainty as statistical ranges and percentages is possible. However, due to the external factors present in complex projects unquantifiable measures are introduced to the problem, therefore, FCM and BN may offer a qualitative alternative, while retaining quantitative properties. These techniques have shown that they have multiple uses in schedule forecasting and risk assessment. Translating these parameters into a range of multi-objective settings it is proposed might yield numerous viable outcomes. There is substantive evidence that Genetic Algorithms have the capacity of managing multi-faceted problems to find optimal or near-optimal solutions and so a Genetic Algorithm optimization technique, capable of handling quantitative as well as fuzzy and qualitative parameters, will be used in the analysis and formulation of a framework. The importance of potential compatibility limitations and gaps in literature will be included to show how these inform the creation of and implementation of said framework with its intention to be used for scheduling and risk assessment applications. Never (as far as is known to the authors) have these techniques been combined altogether for addressing a homogenous objective functionality to such depth. The paper’s investigation therefore proposes the ambitious aim of exploiting the collective benefits of all these AI techniques into a coalescent model for uses in complex projects that tackle uncertainty. Widening the scope of such a project model, however, runs the risk of inflating the number of solutions because of the introduction of multiple facets of a project to one AI model. Therefore, an optimization tool capable of handling multi-faceted cases is needed to mitigate. To provide this solution, genetic algorithms were studied with different techniques to create boundless solutions using subjective and objective preferences, and is therefore, chosen as the optimization tool due to its reasoning capabilities of handling fuzzy and abstract parameters, as well as its compatibility with other techniques. Analyzing all these techniques as standalone functionalities supplemented by evaluating their compatibility, informed the formulation of a wider AI model. The intention being that that AI model would serve as a powerful tool capable of solving multi-objective scheduling and risk assessment cases in a complex project environment. Overall, after reviewing literature and case studies to explain the techniques at a basic level it is hoped that the interpretation may be applied to more complex scenarios. Furthermore, operating the proposed AI tool requires a certain degree of computer literacy and coding skills and so a recommendation is that both education institutions and industry incorporate basic AI technology in project management curriculum and practice. Future researchers would also need to address compatibility limitations, as organizations will not readily adopt AIs with this degree of technicality without a track record of success.

Key words: Artificial intelligence, Project Management, Innovation, UNSDG Goal 9