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TELOS Feasibility Analysis for Application Development Project using System Dynamics Approach

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ABSTRACT

Organization X reported that 75% of its application development projects from 2020 to 2023 were overscheduled, with the ABC application project being the most delayed. Field observations attributed these failures to inadequate planning and the absence of structured feasibility evaluations. This study addresses the gap by designing a dynamic feasibility model for the ABC project using a System Dynamics (SD) approach grounded in the TELOS criteria—Technical, Economic, Legal, Operational, and Scheduling. Unlike traditional static methods, the SD model captures feedback loops and interdependencies between project variables, enabling dynamic scenario simulations. Applied research methods were used to develop causal loop and stock flow diagrams, which were verified and validated via the Vensim tool. Baseline simulations yielded an average feasibility score of 7.26, exceeding the viability threshold. Among four tested scenarios, a combined intervention—adding a 30%-time reserve, increasing team size, and enhancing quality control—produced the highest score of 7.35. Singular adjustments to time, cost, or quality were less effective than the integrated approach. This study demonstrates the novelty and effectiveness of applying SD to TELOS-based feasibility analysis, offering a predictive and adaptive tool for strategic project planning. The model enables proactive identification of critical phases and supports more informed decision-making, improving alignment with organizational objectives and overall project success.

Keywords: *Project Feasibility, TELOS, Dynamic Systems, Decision Making, Project Management*

Introduction

A project can be considered successful if it achieves its goals within the specified time, budget, and quality constraints, while also meeting the needs and expectations of stakeholders [1]. However, obstacles often arise during implementation. According to an evaluation of projects carried out by Organization X, 75% of projects conducted between 2020 and 2023, which were primarily application development projects, were overscheduled. Through field observations, the main causes of overscheduling and overbudgeting were the failure to meet quality standards for project deliverables. Consequently, the progress made was not recognized. This issue stemmed from insufficiently defined scope boundaries and acceptance criteria. These findings align with a survey conducted by the Project Management Institute in 2017, where 37% of executive leaders cited a lack of clear goals and baselines for measuring progress as the primary cause of project failure. [2]. Inadequate and unclear feasibility planning is a significant factor contributing to project failures.

Project feasibility studies are essential for project management and decision-making. They involve assessing a project's feasibility and potential success to prepare for and control potential risks. By conducting feasibility studies, stakeholders can make informed decisions by identifying potential challenges during project implementation. These studies consider various criteria, commonly referred to as TELOS: Technical, Economic, Legal, Operational, and Scheduling. [3]. Given the need to evaluate project feasibility, this research aims to design a model that assesses project feasibility based on TELOS criteria. Using a dynamic systems approach, the model identifies project feasibility variables related to TELOS criteria and explores their interconnections. Additionally, the research aims to create alternative scenarios and determine the best scenario to support decision-making regarding project acceptance and organizational preparedness regarding financing, scheduling, technical capabilities, legal compliance, and organizational objectives.

Project feasibility evaluation is a crucial initial step before allocating resources, time, and effort to a project. The TELOS criteria classify project feasibility into five aspects:

- Technical (Technological): This aspect assesses complexity levels and technological readiness indicators.
- Economic: Economic indicators include project performance metrics derived from the Earned Value Method (EVM), such as the Cost Performance Index (CPI) and Schedule Performance Index. Financial stability indicators like Net Present Value (NPV), payback period, and benefit-cost analysis contribute to economic feasibility.
- Legal: Legal feasibility considers compliance with regulations and data security [4].
- Operational: Operational feasibility focuses on productivity indicators [5] And the quality of outcomes.
- Scheduling: Scheduling feasibility analyzes performance indicators such as the Schedule Performance Index (SPI) [6] The Duration Performance Index (DPI) is measured using the Earned Duration Management (EDM) method.

Using a dynamic systems approach, these feasibility analysis indicators are interconnected with relevant project variables. The dynamic system approach is used to understand, analyse, and model behaviour in dynamic and complex projects. In project management or business, dynamic systems can model and analyze the complex dynamics of decision-making, strategic planning, and resource management. These models can facilitate stakeholders' understanding of the impact of their decisions on the overall system and help formulate more effective strategies in response to continuous changes. In the context of project management, dynamic systems are a modelling and simulation technique that can assist project managers in comprehending the complex dynamics during project execution and the interdependencies within the project system. This approach enables project managers to forecast project performance, identify potential risks and improvements, and ultimately make more informed decisions and implement effective strategies to enhance project success [7].

Dynamic Systems is a concept that involves studying complex systems and their behaviour over time. This methodology combines elements from mathematics, computer science, ecology, and other disciplines to understand the dynamic behaviour of systems. [8]. The theory of dynamic systems emphasizes interconnections and feedback within a system, recognizing that changes in one part of the system can ripple effects throughout the entire system. Dynamic systems are a modeling and simulation approach that focuses on feedback loops and interactions within a system, aiming to capture its dynamic behavior and component interactions. [9]. Dynamic systems is a method to enhance learning within complex systems. In part, it serves as a method for creating a management flight simulator or computer simulation model. Its purpose is to assist us in studying dynamic complexity, understanding the sources of policy resistance, and designing more effective policies. Dynamic system simulations have been utilized in various projects, including construction projects and software or application development projects. Dynamic systems can be employed to design simulations that aid project managers in planning software development projects. [10]. Simulation models designed with dynamic systems can enhance system thinking within organizations, making it easier for all project team members to understand the relationships between factors that influence the quality of project or software outputs. The dynamic systems approach is also used to evaluate the relationships in the integration process that occurs between workflows, project personnel factors, and rework in application development projects [11] The dynamics or behavior of a system are defined by its structure and the interactions among its components. In project management, assessing feasibility is paramount before undertaking any initiative. Traditionally, feasibility studies have been conducted using static methods, providing a snapshot of the project's viability at a specific time. However, projects exist within dynamic and ever-changing environments, where factors such as market conditions, technological advancements, and regulatory landscapes continuously evolve. [11]. The use of dynamic systems is chosen to produce a model that can illustrate the relationships between variables influencing project feasibility, covering economic, technical, operational, scheduling, and legal aspects, which are dynamic. This dynamic feasibility model can later be used for similar projects undertaken by the organization in the study. The dynamic systems approach for simulating problems, especially project delay constraints and optimizing project planning, has been selected in previous studies because project implementation involves various variables such as team personnel, budget, cost, and scope within a complex organizational structure. This complexity necessitates clarity in the roles and relationships of each variable.

These variables interact with each other over time, creating feedback loops and non-linear relationships that can significantly impact the project's feasibility. Developing a dynamic model that captures the relationships between key variables and their evolution over time is at the core of the dynamic system approach. This model, often built using system dynamics principles, allows stakeholders to simulate different scenarios and understand how changes in one variable propagate throughout the system. The dynamic system approach in project feasibility assessment involves analysing the viability of a project over time by considering various interconnected factors and their evolution. Unlike traditional static methods, which often overlook the temporal aspect of project dynamics, a dynamic system approach acknowledges the changing nature of the project environment and incorporates it into the analysis.

The application development project undertaken by Organization X also has a large scope and involves many stakeholder roles in its implementation. Therefore, clarity in the relationships between each variable affecting cost performance and team scheduling is crucial, while aiming to meet the agreed-upon output expectations of stakeholders and comply with the legal regulations stipulated in the work contract. Besides the complexity in project execution structure, dynamic systems can simulate variables in real-time, providing more accurate and dynamic results that are less biased compared to other simulation approaches like AHP or discrete methods. [12]. Using a dynamic systems approach to analyze project feasibility based on TELOS criteria offers a holistic view of a project by linking technical, economic, legal, operational, and scheduling elements. This helps identify potential delays and avoid unwanted consequences. Therefore, Organization X needs to review its standard project execution processes to incorporate a dynamic project feasibility study process, which provides an estimated potential achievement and success probability for future projects.

The expected output of this research is to create a feasibility model for implementing dynamic application development projects. This model can serve as a tool to assist decision-makers in determining whether an organization should accept a project request and what needs to be anticipated or prepared if the project is accepted, thus accommodating potential changes during the execution phase.

This study aims to develop a dynamic system model for analyzing project feasibility based on the TELOS criteria. The study builds upon the feasibility analysis measurement using TELOS criteria conducted in Uzoka et al.'s research, employing a simple weighting method [4]. Additionally, it extends this analysis method into a feasibility model using dynamic systems, similar to the approach taken by Jo et al. [12]. The outcome of this research is a conceptual model capable of assessing project feasibility by considering indicators for each TELOS criterion. This model provides valuable insights for decision-makers regarding whether a project is viable for execution. However, there are limitations in this study. Notably, it does not discuss the relationship between profitability analysis and return on investment (ROI) variables within the economic feasibility model. Furthermore, the scheduling feasibility criteria do not explore the connection between PERT (Program Evaluation and Review Technique) or CPM (Critical Path Method), which are methods for accelerating complex projects. This research combines a dynamic system approach with TELOS-based project feasibility analysis to address these limitations. The proposed model focuses on improving application development projects by considering TELOS indicators, where each criterion influences the others.

The novelty of this study lies in several aspects, such as:

- Intellectual Property Rights (IPR): The study incorporates IPR as a parameter indicator for Regulation Compliance in legal feasibility assessment.
- Legal Tools and Economic Criteria: It explores the relationship between Legal Tools and Cash In variables in measuring economic feasibility.
- Duration Performance Index: This index serves as an indicator in the scheduling feasibility model.
- Scenario Alternatives: The feasibility model generates alternative scenarios to assist decision-making during project acceptance and organizational preparation.

This research contributes to project feasibility assessment by integrating dynamic system modeling and TELOS criteria. It provides a comprehensive view of project viability, considering legal, economic, and scheduling aspects. Future research could expand this model by incorporating profitability analysis, such as Return on Investment (ROI), to enhance the economic feasibility assessment. Additionally, integrating project scheduling techniques like PERT and CPM into the scheduling feasibility criteria may improve the model’s ability to handle complex project timelines. Further studies could also explore the application of this dynamic model in various project domains beyond application development to validate its adaptability and scalability.

Research Method

This research is motivated by the phenomenon observed in application development projects, where scheduling targets are unmet, resulting in compromised expected quality. Consequently, project bottlenecks occur during the billing process, adversely affecting project cash flow. The study originates from the software development project lifecycle phase framework proposed by Lemke [20]. Within the initiation and planning phases, the development of a system concept is essential, involving activities such as defining the scope of work and project feasibility analysis.

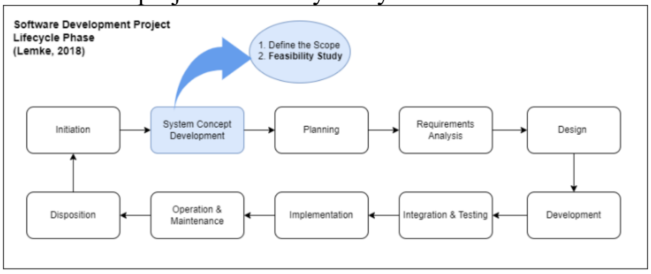

Figure 1. Framework Software Development Project Lifecycle Phase

As identified by Mukherjee & Roy and McLeod, project feasibility analysis can be assessed using the TELOS criteria, which encompass technical, economic, legal, operational (or organizational), and scheduling aspects 1. However, variations exist in the choice of indicators used for measuring and analyzing feasibility across previous research studies. In this study, we focus on the indicators that serve as fundamental variables in designing a dynamic simulation model for assessing the feasibility of application development projects within Organization X.

Simulation model design

A dynamic system is a method used to understand complex systems and focuses on interrelationships and feedback loops in a system, which aims to capture the dynamic behavior and interaction of its components [13]. In building a dynamic system simulation model, researchers previously designed a conceptual model of the dynamic system by the research objectives to be achieved, to understand and get an overall picture of the system to be designed. In the conceptual model, researchers also determine the boundaries of the system scope and the relationship dynamics between the variables involved. Further simulation model development was conducted by designing a Causal Loop Diagram (CLD) and a Stock & Flow Diagram (SFD).

A Causal Loop Diagram (CLD) is a diagram that can illustrate the cause-and-effect relationship between the variables in the implementation system of this application development project. CLD serves to explore and understand the complexity of the relationship between variables. This study illustrates the relationship between technical, economic, legal, operational, and project scheduling feasibility variables, which are influenced by the indicators previously identified in Figure 2. SFD consists of stock (level), flow (rate), auxiliary, and constant components, each with a value, unit of measure, information flow, and mathematical operations between its components, which can be simulated to mimic the actual system's performance. The SFD describes the rate for each feasibility criterion derived from the TELOS-based project feasibility indicators. This SFD serves to understand the behavior of complex systems, so that it can help in analysis, planning, and decision making, which in this case is to determine the feasibility of a project.

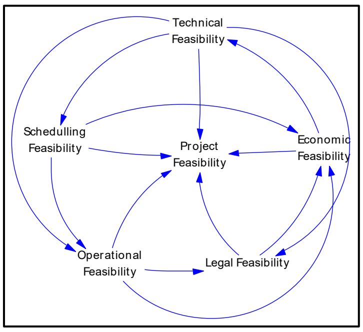

Figure 2. Project Feasibility: Basic Causal Loop Diagram

- Technical feasibility: This aspect assesses whether the project can be implemented technically. It considers factors such as the availability of technology, the expertise of the project team, and the feasibility of the proposed solution.
- Scheduling feasibility: This aspect evaluates whether the project can be completed within the planned timeframe. It considers factors such as the project's complexity, the availability of resources, and potential delays.

- Operational feasibility: This aspect assesses whether the project can be successfully operated and maintained once it is completed. It considers factors such as the ongoing operation costs, the availability of support personnel, and the potential for operational challenges.
- Legal feasibility: This aspect evaluates whether the project complies with all applicable laws and regulations. It considers intellectual property rights, environmental regulations, and data privacy laws.
- Economic feasibility: This aspect assesses whether the project is financially viable. It considers factors such as the project's costs, the potential benefits, and the expected return on investment.

Analysis of the dynamic system simulation model

After developing a simulation model for project feasibility analysis, the model must be verified and validated. Model verification can be done by checking the model's or simulation's technical or mathematical accuracy. This model verification can be done by performing model checking, unit checking, and reality checking on the dynamic simulation model design application tools, one of which is the Ventana System (Vensim) application. If no errors are found from the checking results, then the model needs to be validated to evaluate the extent to which the model or simulation can represent the system by the actual behavior of the system [14]. This validation test involves comparing the results or output of the model with empirical data from the real world, starting from the model structure test to find out and see if it is in accordance or has similarities with the real conditions that occur, the model behavior test to test the suitability between model behavior and behavior in the real system, and the performance validity test (output) to see if the performance or output of the model resembles the performance of the existing or real system by comparing the same empirical data with the model.

After the simulation model has been designed and tested, the determination of alternative scenarios for conducting dynamic system simulations is used to generate a reference so that the impact caused by the scenario can be known when applied to the model that has been made. Determination of the simulation scenario is done by determining what variables most affect the system and can provide important information about the behavior of the system, including stock, flow, or external factors that affect the system. The determination of this simulation scenario serves to obtain information about how the system reacts to certain changes or certain conditions, so that it can help in making better decisions in managing or planning the system. [15].

By determining several alternative scenarios, further research is carried out by analyzing and interpreting the results of dynamic model simulations of several predetermined scenarios. This analysis aims to determine the impact of each scenario tested on system behavior. The simulation results are reviewed to examine what scenarios need to be done on the system to achieve the goals and have an effect in making decisions on the implementation of application development projects.

Results and Discussion

Based on the TELOS project feasibility framework [16], which consists of technical, scheduling, operational, legal, and economic feasibility aspects, the relationship between these feasibility aspects can be depicted in the diagram as follows:

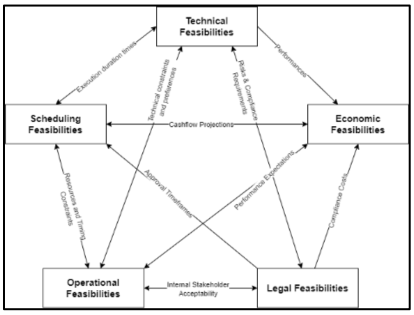

Figure 3. Relationship between TELOS feasibility aspects

A Causal Loop Diagram (CLD) visually represents a system's causal relationships. It can be used to identify reinforcing and balancing loops, which are important for understanding the dynamics of a system. The diagram above illustrates the relationships of each aspect of the TELOS framework for project feasibility; each aspect is further detailed into variables that align with the existing business processes and can serve as measurement components for project performance. Moreover, the CLD illustrates the decline in the variables that serve as indicators for each feasibility aspect. In the context of the TELOS project, a CLD could be used to map out the relationships between the different feasibility aspects. For example, a reinforcing loop between technical and economic feasibility could be identified. This means that if the project is technically feasible, it will likely be economically feasible. Conversely, if the project is not technically feasible, it is less likely to be economically feasible.

By understanding the relationships between the different feasibility aspects, project managers can make more informed decisions about project planning and execution. CLDs can be valuable for identifying potential risks and opportunities and developing strategies to mitigate risks and maximize opportunities. The CLD representation, tailored to the specific conditions of the application development project, is depicted as follows:

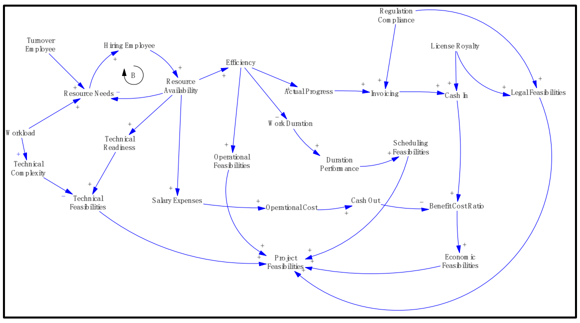

Figure 4. Causal Loop Diagram (CLD) of Application Development Project

The causal loop diagram has one balancing loop involving the relationship between Resource Availability, Resource Needs, and Hiring Employees. The diagram explains that an increased project workload leads to a greater need for the project team or human resources, resulting in a higher recruitment frequency to handle the additional workload. As the resources increase, the project's progress improves, allowing invoicing or billing to be carried out. However, this also leads to increased expenses that need to be accounted for, specifically the salary expenses for the additional recruited resources. Therefore, the diagram highlights the dilemma between increasing the number of resources (Hiring Employees) to handle the rising workload and the additional costs (Salary Expenses) that come with hiring more resources.

Table 1. Correlations between Variables in the Causal Loop Diagram

No	Impacting Variable	Impacted Variable	Polarity
1	Actual Progress	Invoicing	Positive (+)
2	Benefit Cost Ratio	Economic Feasibilities	Positive (+)
3	Cash In	Benefit Cost Ratio	Positive (+)
4	Cash Out	Benefit Cost Ratio	Negative (-)
5	Duration Performance	Scheduling Feasibilities	Positive (+)
6	Economic Feasibilities	Project Feasibilities	Positive (+)
		Work Duration	Negative (-)
7	Efficiency	Actual Progress	Positive (+)
		Operational Feasibilities	Positive (+)
8	Hiring Employee	Resource Availability	Positive (+)
9	Invoicing	Cash In	Positive (+)
10	Legal Feasibilities	Project Feasibilities	Positive (+)
11	License Royalty	Cash In	Positive (+)
		Legal Feasibilities	Positive (+)
12	Operational Cost	Cash Out	Positive (+)
13	Operational Feasibilities	Project Feasibilities	Positive (+)
14	Regulation Compliance	Invoicing	Positive (+)
		Efficiency	Positive (+)
15	Resource Availability	Resource Needs	Negative (-)
		Salary Expenses	Positive (+)
16	Resource Needs	Hiring Employee	Positive (+)

No	Impacting Variable	Impacted Variable	Polarity
17	Salary Expenses	Operational Cost	Positive (+)
18	Scheduling Feasibilities	Project Feasibilities	Positive (+)
19	Technical Complexity	Technical Feasibilities	Negative (-)
20	Technical Feasibilities	Project Feasibilities	Positive (+)
21	Technical Readiness	Technical Feasibilities	Positive (+)
22	Turnover Employee	Resource Needs	Positive (+)
23	Work Duration	Duration Performance	Positive (+)
24	Workload	Resource Needs	Positive (+)
		Technical Complexity	Positive (+)

The dynamic model design involved developing the CLD into a Stock and Flow Diagram (SFD) based on each aspect of project feasibility. This study focuses on creating a feasibility evaluation model for economic, operational, and scheduling aspects. The economic aspect includes four variables as evaluation indicators: Net Present Value (NPV), Benefit Cost Ratio (BCR), Return on Investment (ROI), and Cost Performance Index (CPI) [17], [18].

The economic aspect depiction features numerous influencing components, beginning with cash flow. Outgoing cash flow primarily comprises operational and maintenance costs. Operational costs cover team salaries and technical expenses such as server costs and licensed tools fees. In contrast, maintenance costs arise after the application development phase, including helpdesk personnel expenses and technical costs for the application server post-go-live. Incoming cash flow includes project billing, valuation, and application license royalties.

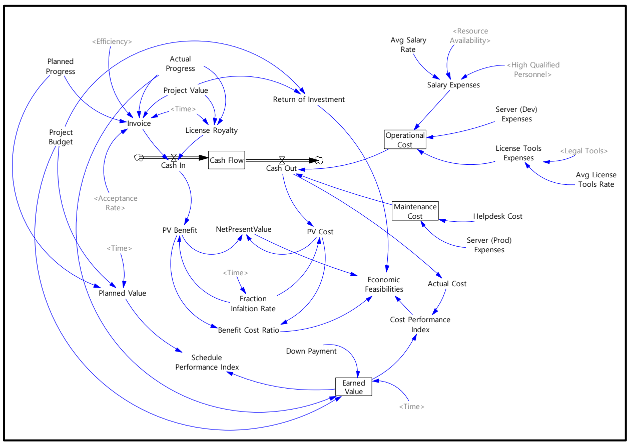

Figure 5. Stock & Flow Diagram of Economic Feasibility Study

The model for project feasibility in the operational aspect is based on the PIECES framework (Performance, Information, Economy, Control, Efficiency, and Service). The PIECES framework is commonly used to evaluate information systems. By adopting this approach, the feasibility evaluation of the project can be conducted comprehensively, considering various important operational aspects. [19].

Each component perspective in the PIECES framework consists of interrelated variables. For example, from a performance perspective, variables such as throughput and response time can be used to measure how well the system performs under certain conditions. From an economic perspective, operational costs and cost savings are crucial for assessing the project's economic efficiency.

One crucial variable is quality control, an indicator from the information perspective. This variable not only functions as a tool to ensure the quality of information produced by the system but also acts as an input in measuring the acceptance rate of deliverables (Acceptance Rate). Thus, the relationship between Quality Control and Acceptance Rate highlights the importance of maintaining high quality to increase the acceptance of work deliverables by end-users.

For the scheduling aspect, the measurement consists of two main performance indexes: the Schedule Performance Index (SPI) and the Duration Performance Index (DPI). The Schedule Performance Index is widely known as one of the performance indexes calculated using the Earned Value Management (EVM) method. This index measures a project's time efficiency by comparing the value of the completed work with the planned schedule.

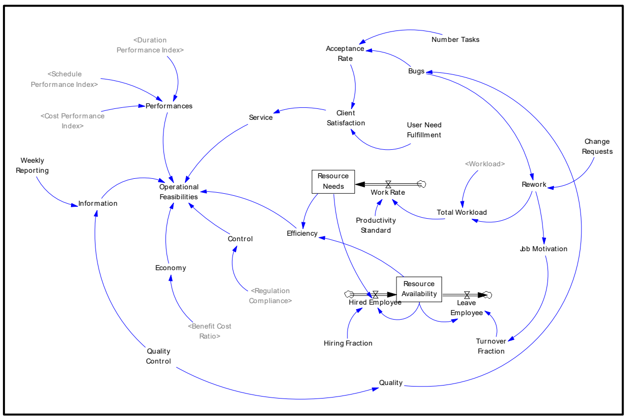

Figure 6. Stock & Flow Diagram of Operational Feasibility Study

On the other hand, the Duration Performance Index uses the Earned Duration Management (EDM) method, which focuses more on calculating work duration performance in time units. Unlike EVM, which emphasises financial value, EDM emphasizes how well the duration of work execution aligns with the scheduled plan. This provides a more detailed perspective on project scheduling performance, allowing project managers to effectively identify and address delays. [20].

By combining these two indexes, the scheduling model provides an overview of how well the project is progressing according to schedule in terms of work value and the duration of time utilized. This is crucial to ensure that the project can be completed on time without compromising the quality of work. This approach enables a more comprehensive and accurate project feasibility evaluation in the scheduling aspect.

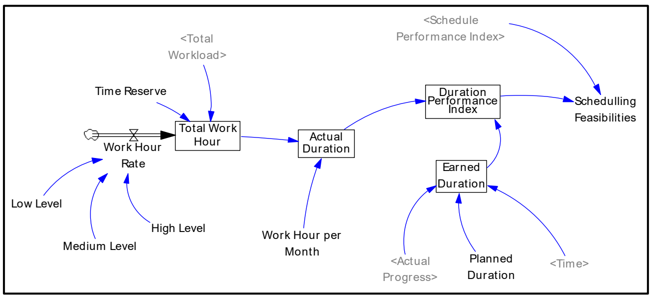

Figure 7. Stock & Flow Diagram of Scheduling Feasibility Study

Model Verification & Validation

A comprehensive verification and validation process was conducted to ensure the robustness, credibility, and accuracy of the proposed dynamic system model for project feasibility assessment based on the TELOS criteria. This process is critical in system dynamics modelling to demonstrate that the model behaves consistently with real-world project conditions and theoretical expectations.

Model verification evaluates the model's structure, equations, and unit consistency to ensure that it operates as intended without logical or computational errors. This study employed Vensim as the modelling platform, which provides tools for structural verification through model checking and unit checking features.

- Model Checking: This procedure verified whether the model's internal logic conformed to the designed conceptual framework and flow structure. The model passed the built-in diagnostics, returning the “Model is OK” status, indicating no logical flaws in the causal loop or stock-and-flow configurations.
- Unit Checking: The Vensim unit checking feature was employed to confirm dimensional consistency. All variable relationships and equations complied with the expected units of measurement, resulting in the status “Units are OK,” affirming the correctness of unit associations across the model components.

These results confirm that the developed model is free from structural and dimensional inconsistencies, satisfying the initial verification requirements.

Structural validation assesses how the model accurately represents the system's structure, variables, and interrelationships. Two primary approaches were employed:

- Empirical Validation through Expert Elicitation: The model structure, including its causal relationships and variable configurations, was reviewed against actual operational practices through interviews and field observations involving 15 stakeholders. These stakeholders included Project Managers, Account Managers, Team Leaders, software developers, legal and administrative personnel, and business support teams from the relevant organizational unit (Direktorat X). The insights gathered were instrumental in refining the model to reflect actual decision-making processes, operational constraints, and project dynamics.

- Tool-Assisted Structural Consistency: Structural validation was reinforced through simulation-based diagnostics in Vensim, ensuring that inter-variable connections and feedback loops accurately modeled the empirical system without deviations from real-world project structures.

The combination of empirical and software-assisted validation confirms the model's structural validity as a representation of project feasibility assessment mechanisms.

Behavioural validation tests whether the dynamic behaviour of the model over time aligns with actual data from the modelled system. This study utilized historical project data to compare the model's simulation output against actual performance using two standard quantitative metrics, that is Mean Comparison (E1) to Measures the difference between the average simulated values and the average actual data and Percentage Error Variance (E2) to Compares the variance of the simulation results to the variance in the actual data. Validation was conducted for three key output variables: Cost Performance Index (CPI), Schedule Performance Index (SPI), and Employee Metrics, including Hired and Leave employee data.

- Cost Performance Index (CPI)
  Mean Error (E1): 1.01%
  Error Variance (E2): 9.08%

These results indicate that the model's simulation of cost efficiency is highly accurate and within acceptable tolerance levels (E1 < 0.1 and E2 < 0.3).

- Schedule Performance Index (SPI)
  Mean Error (E1): 12.59%
  Error Variance (E2): 21.93%

Although slightly higher than CPI, these results are still considered acceptable for dynamic simulations of project schedules and reflect the model's ability to capture variations in real-world project timelines with reasonable accuracy.

- Hired and Leave Employee Metrics
  Hired Employee: E1 = 2.18%, E2 = 9.92%
  Leave Employee: E1 = 3.56%, E2 = 26.63%

The simulation results for the human resources variable also demonstrate high fidelity, especially for hired employees. While the variance in leave data is higher, it remains within acceptable validation thresholds, possibly reflecting variability in project turnover that is inherently more difficult to model precisely.

Scenario Model Simulation

Several scenarios were designed after the dynamic model underwent structural, parameter, and behavioural tests and was declared valid. The aim was to observe the outcomes of the existing conditions when changes or adjustments are made to the variables that serve as indicators of project feasibility across various criteria. Three scenarios were simulated in these dynamic feasibility models, namely:

- Scenario 1: Adjust the variable affecting Resource Availability by increasing the hiring fraction.
- Scenario 2: Enhancing the Client Satisfaction standard by increasing the quantity of Quality Control in the work.
- Scenario 3: Adding time reserve for the Work Hour Rate variable.
- Scenario 4 (All Combined): Adjusting the hiring fraction, increasing the frequency of Quality Control, and adding time reserve.

The scenarios for this simulation are determined based on optimizing project feasibility by considering the success factors of the project's triple constraint: Cost, Time, and Quality. Scenario 1 involves increasing the hiring fraction variable to meet the rising resource needs due to rework caused by change requests or bugs. As illustrated in the dynamic model's CLD, there is an inherent dilemma in project execution: increasing the number of hired workers to promptly address the added workload. On the other hand, this increase in workforce leads to a surge in operational costs. Decision-making related to this variable needs to be aligned with the project's urgency; therefore, Scenario 1 should be analyzed carefully before being implemented in other projects.

Scenario 2 focuses on increasing the frequency of Quality Control activities, effectively reducing the number of bugs in the application. By repeatedly checking the application before demonstrating it to users or clients, the number of bugs can be minimized, thereby reducing the potential increase in project resource needs. Furthermore, improving quality through stricter quality control enhances client satisfaction and boosts the reputation and trust of the development team.

Scenario 3 centers on adding a time reserve for the Work Hour Rate variable. By incorporating time reserves, the project gains more flexibility to handle unexpected changes and ensure deadlines are met despite any obstacles. This flexibility also aids in maintaining the quality of work, as the team has sufficient time to address every project detail thoroughly. Scenario 4 combines all three aspects—adjusting the hiring fraction, increasing the frequency of Quality Control, and adding time reserves—to create a more comprehensive approach to improving project feasibility.

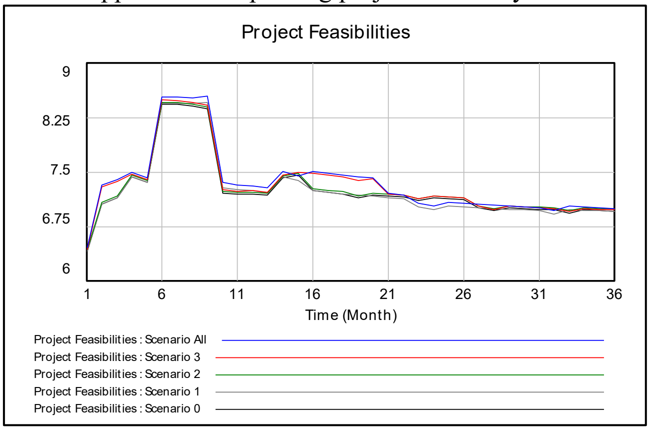

Figure 8. The simulation results of the dynamic model (Scenario 0 represents the existing condition, Scenario 3 is the All Scenario)

The simulation results of various alternative scenarios show that Scenario 3 yielded the most optimal outcome, where an additional 30% reserve time is allocated for tasks. This is evidenced by a higher project feasibility score compared to other scenarios. While Scenario 3 can be considered the most optimal in enhancing project feasibility, the changes or gaps experienced by each scenario were not significantly different. Therefore, another simulation scenario was conducted where all three conditions—increased hiring fraction, enhanced Quality Control, and added Time Reserve—were simultaneously adjusted. Comparing the results with Scenario 0 (existing condition) and Scenario 3 (best-performing scenario), the Combined Scenario or Scenario 4 simulation yielded better outcomes than other scenarios.

The technical and legal feasibility values did not change in all four simulation scenarios and remained stable. This stability stems from the initial completeness of legal and technical feasibility aspects at the project's inception, with no issues regarding the adequacy of the project's legal documentation requirements.

Table 2. Simulation Result of Dynamic Models

Aspects	**Scenario 0**	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4 (All)**
Project Feasibility	7.257394722	7.250780556	7.284060556	7.327618611	7.347672778
Economic Feasibility	5.667704444	5.770508056	5.770508056	5.667704444	5.770508056
Operational Feasibility	6.940855278	6.737786667	6.842632778	6.779035	6.709299167
Scheduling Feasibility	6.7010975	6.7010975	6.378459722	6.378459722	6.378459722

Therefore, the simulation results of these scenarios suggest that implementing the academic information system development project would benefit from increasing the recruited team size, enhancing monthly QC activities during project planning, and adding potential time reserves in scheduling to make project execution more manageable.

The simulation graph of these scenarios highlights three control variables: hiring fraction, quality control, and time reserve. Each variable is designated as a control variable representing the success factors of the triple constraint of project management: time, cost, and quality. The hiring fraction variable controls the cost factor, where an increase in hiring fraction escalates expenditure, thus making hiring resources more efficient and cost-effective for project operations. However, addressing additional workload due to rework necessitates resource augmentation. Introducing the time reserve variable under the time constraint provides a buffer period to anticipate delays, ensuring project planning includes contingency time for unforeseen events in the field. Meanwhile, Quality Control as a controlling variable optimizes quality factors, as increased quality control activities can minimize the number of bugs found during application demos or user testing, thereby reducing the need for rework and saving additional recruitment expenses.

Considering these control variables in the project implementation scenarios for similar application development projects at Organisation X, the feasibility level can be optimised, covering workforce planning, project duration, work breakdown structure details, and agreed-upon work constraints to mitigate excessive change requests.

Through this dynamic simulation, decision-makers gain insights into critical periods during project execution, allowing proactive measures to be taken during those months. For instance, a drastic downturn depicted in the tenth month due to project progress setbacks can be analyzed to optimize by temporarily adding team resources specifically for those months or by conducting meetings with users to negotiate incoming change requests, thus avoiding undue workload burdens.

Conclusion

This study investigates the feasibility assessment of application development projects in Organization X using a dynamic system (SD) modeling approach. The authors identify and design a process flow for application development projects, highlighting the lack of feasibility evaluation in the existing process. They propose incorporating a feasibility study into the project execution flow. The SD model optimizes project execution by controlling variables related to the project's triple constraint: time (adding time reserve), cost (adding hiring team fractions), and quality (increasing quality control frequency). Optimizing individual variables yielded insignificant feasibility scores. However, combining all triple constraint aspects resulted in a more optimal feasibility score, enhancing decision-making regarding project viability. Simulations reveal that optimizing human resources, quality control activities, and time reserve enhances project feasibility, particularly for operational, economic, and scheduling aspects. The SD model can be employed for feasibility evaluation by incorporating components affecting the triple constraint factors. However, optimizing human resources in this model involves adding personnel to handle rework and bugs, without optimizing worker efficiency.

For similar application development projects, the SD model implementation should focus on time reserve and quality control reinforcement. Project costs tend to be fixed and difficult to adjust. Anticipatory analysis of change requests can be conducted to address resource spikes without overburdening the original workload.

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