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Project Strategy and Stakeholder Theory: A System Dynamics Perspective

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Abstract: Research in the area of project strategy has been limited in project management research. In this paper we present the perspectives of project strategy available in literature. Then we present an approach towards an integrated view of project strategy from the viewpoint of stakeholder theory. Most work in this field has been theoretical or conceptual. Furthermore, as large scale projects bring in complexity, it's important to have a dynamic view of project strategy. We therefore use system dynamics to move towards an integrated definition of project strategy. After developing the system dynamics model we validate the definition and analyze the results. This is part of a phd research being undertaken at ICFAI University Jharkhand.

Keywords*: project strategy, stakeholder theory, system dynamics, salience model, sustainability, human factors*

Introduction

Project strategy has appeared in project management literature in various forms. Majority of project management literature is focused around success factors in projects. This is not exactly project strategy but a part or outcome of projects strategy. We may thus say that choosing, organizing and positioning these factors would actually be a part of project strategy. We will therefore have a review of the categories of literature in which project strategy implicitly or explicitly reflects and then put forward our integral view. Our attempt shall be from a systems perspective rather than a deductive method to attempt to capture a holistic view. To do this we will utilize system dynamics modeling. An inherent twin of strategy is risk and this is intertwined in strategy. A lack of addressing risk in project strategy discussion shall only be discussing half of the problem. In fact when authors have discussed success factors or critical success factors they are actually addressing the aspect of risk implicitly. System Dynamics model focus on dynamic complexity and although structural complexity may be handled, we will focus on dynamic complexity in risk through our models. Dynamic complexity is inherent in projects and this is the complexity that arises out of feedbacks in the system i.e occurrence of an event has an impact on a latter stage of project thus bringing complexities. Our definition or integral view shall encompass this type of complexity. We therefore attempt to bring forth the essence of project strategy including risk and complexity.

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Literature survey

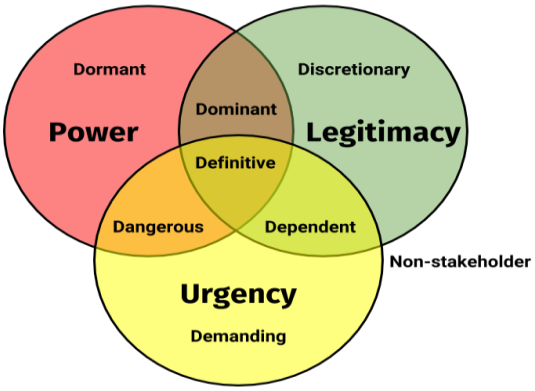
(Ralf Müller, 2012) build on the works done in the field of project success factors and its contributions of Pinto, Slevin, and Prescott.

The article stresses on the strategic view of the factors for long term business view. (Cooke-Davies, 2002) The author brings out the link between project and corporate success and highlights his findings that none of the identified factors are *human factors* though literature is speaking about their impact. (Garbharran, 2013) discuss 4 COMs model comfort, competence, communication and commitment.

Beyond this category comes line of thought of (Cooke-Davies, 2002) the corporate and project strategy link. (Ashely Jamieson, 2007) provide empirical evidence on how people, process and practices bring corporate strategy to project strategy. (AJ Shenhar, 2007) in their article "Project Strategy – The missing Link" provide findings of their exploratory study organizing into three sections: First, the types of risks that emerge over the product lifecycle are identified and summarized. Second, the management approaches taken to deal with such risks are discussed. And third, the management practices for dealing with future risks during the conceptual stages are explored. (Shenhar, 2003) provide a framework to define project strategy which includes Building market share, extending product lines, increasing revenue, satisfying customers, and building for the future are more important, measures of project success. However, all these works concentrate or assume a project within a corporate. (Peerasit Patanakul, 2011) discuss strategic project management beyond time, cost and performance goals encompassing business strategy and sustainability.

(Singh, 2022) put forward the human factors impacting project strategy. The authors have elaborated the strategy view by Rumelt, Mintzberg and others in terms of business and the filtered out human factors impacting project strategy. The authors build on the view put forward by (K. Artto, 2008) on stakeholder view. We take forward the research left out by the authors in this work, where human factors were identified. However, how the stakeholder view impacts project strategy was not analyzed. Our present article focusses on this area. The author has classified stakeholders into Obedient Servants, Innovative Leaders, Strong Leaders and Flexible moderators. (Ronald K. Mitchell, 1997)

Fig 1 Source: The Academic Review



cite Freeman's book "Strategic Management: A Stakeholder Approach and take forward the Stakeholder theory in classifying stakeholders with 3 parameters of Power, Legitimacy and Urgency. The categorization thus made are Latent, Expectant and Definitive Stakeholders. Figure 1 depicts this classification with a further classification into Dormant, Discretionary and Demanding as latent and Dominant, Dangerous and Dependent as expectant stakeholders. This classification is critical to our research. We will use this to take forward K. Artto's approach to project strategy.

Project Strategy as a function of stakeholders

The classification by Artto doesn't refer to any goals (Figure2), cost and timeline which major literature focus on but the environment and the direction which address all these factors and risks associated. However, though this gives a positioning and directional dimension to the definition, the kind/class of stakeholders is not mentioned. In this article we make an attempt to take this forward.

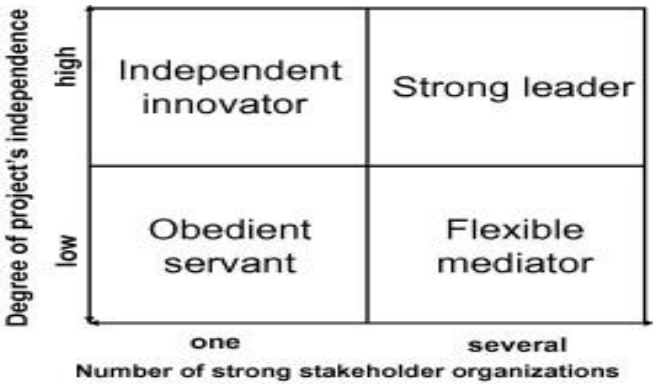


Fig 2: Source : K. Artto, What is Project Strategy?

The System Dynamics Approach:

System Dynamics (SD) is a technique that tackles large-scale, complex engineering problems in a way that goes beyond the traditional domain of systems approach. By combining ideas like stock, flows, feedback, and delays, SD captures the dynamic component of a system and deals with how different aspects interact over time, giving insight into the dynamic behavior of the system. Systems design (SD) is a knowledge subject that logically builds upon systems engineering (SE) and systems analysis (SA).

SD expressly accounts for the system's dynamic behavior as a result of delays and feedback. Jay W. Forrester of MIT/Sloan School, is regarded as the pioneer of this

innovative approach to understanding and solving problems in the business and social sciences. The most notable and contentious use of SD is the creation of world models, World2 and World3, which were published in World Dynamics (1971) and The Limits to Growth (1972), respectively. Although these models based on system dynamics received harsh criticism from a wide range of disciplines, governments, and academia, they were successful in bringing some of the most pressing challenges and issues confronting humanity to the forefront of academic and political thought. System dynamics has been successfully employed in a wide range of business and socioeconomic disciplines to better understand challenges and inform policy actions. We feel that SD is a powerful tool that can be successfully used to a wide range of situations, but its development requires a breakthrough to advance beyond where it is today. It is important that System Dynamics be used properly as a method. (Sterman, 2000)writes, *"system dynamics is a perspective and set of conceptual tools that enable us to understand the structure and dynamics of complex systems. System Dynamics is also a rigorous modeling method that enables us to build formal computer simulations of complex systems and use them to design more effective policies and organizations."* Simply stated, System Dynamics is a method. An approach that allows the analyst to break down a complex social or behavioral system into its constituent components before integrating them into a whole that can be easily viewed and reproduced. The example (slide 1, page 4) on the following page powerfully illustrates this idea. It demonstrates that as People's Express grew its fleet, the number of passengers carried increased, necessitating the hiring of additional rookies. Unfortunately, inexperienced rookies reduced service quality, forcing People's Express to increase marketing costs to maintain client happiness. A well-intentioned policy had unanticipated negative results. This emergent system effect is vividly visualised (slide 4, page 4). Furthermore, the efficacy of its simulation capabilities is proven by the sample graphs that depict the behavior of two crucial system parameters: consumers' perceived quality.

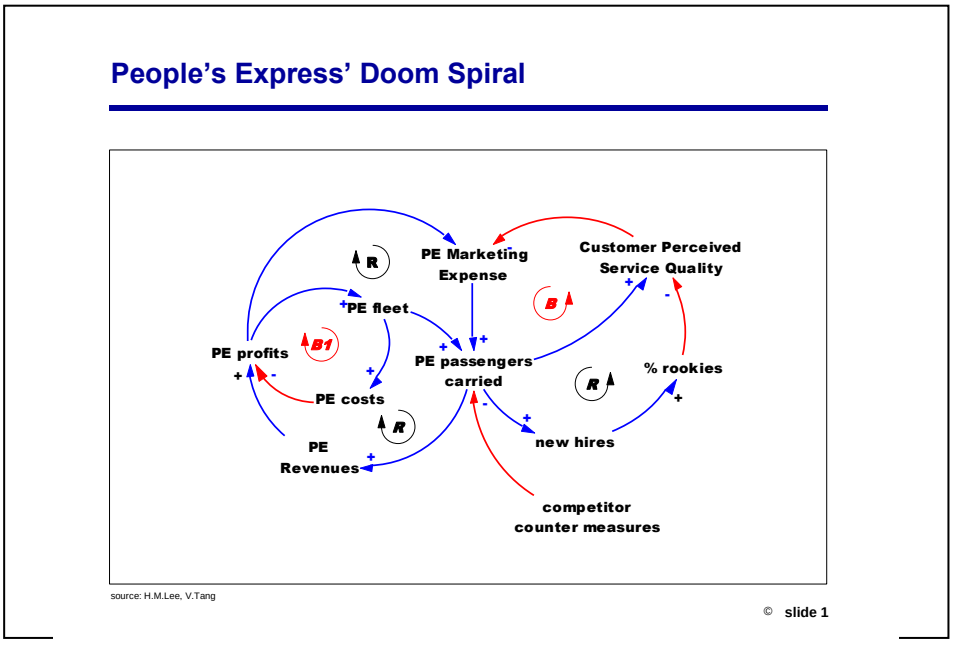


Fig 3: Causal Loop Source: Lecture notes Ed Crawley

Prof. Ed Crawley, heading the Aero/Astro Systems Department, distinguishes three system characteristics: principles, techniques, and tools. To demonstrate the concept, we compare System Dynamics to several other well-known systems (slide 11, page 5).

The principles of system dynamics are based on two main system principles. [1] The first is that supplies, flows, and delays determine the behavior of the system. This is easy to notice in everyday life. Water flows through pipes and collects in tanks, pools and other containers. When you open the hot water tap, the water slowly heats up. Current flows through the wires, the capacitors discharge and their charge decreases exponentially. This required Forrester's ingenuity and imagination to conceptualize analogous behavior in social systems and behavioral systems. [2] Another is limited reason (Simon, 2000). Simon uses the metaphor of scissors, where one blade is "cognitive limits" and the other "environmental structure." The goal of system dynamics is not to deal with all the variables of the problem, but to focus on those that are key to the problem and its context, ie. The "environment" as defined by the analyst. System dynamics does not pretend to optimize, but to satisfy with fast and parsimonious rules that the

analyst can understand when understanding the problem (Gigerenzer, 1999).

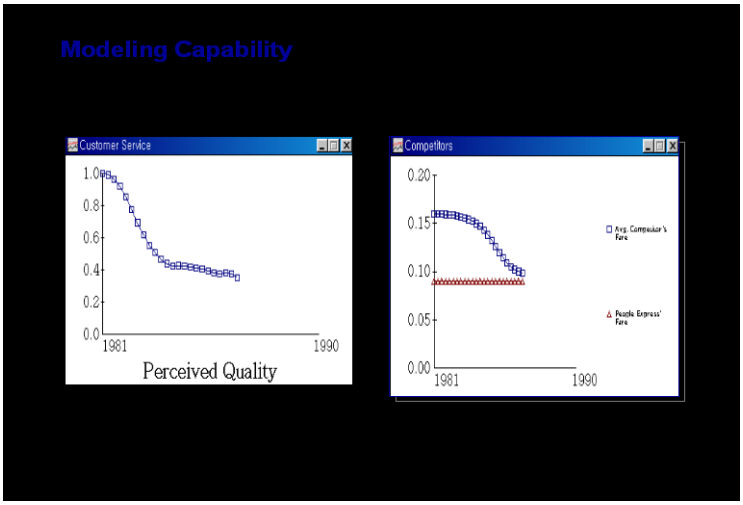


Fig 4: Source : Prof. Ed Crawley Lecturers

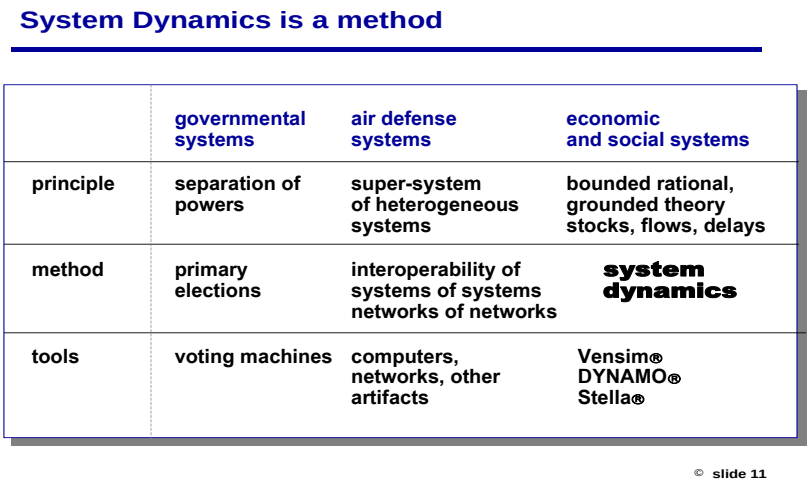


Fig 5: Source : Prof Ed Crawley Lecturers

Modelling & Simulation

Validation of Model: This is done vide the three tests of units check, behavior and structure.

Units Validity : Model is checked for mismatch of units and is found to be ok.

Model behavior test: To evaluate model behavior we can test for the adequacy of the model structure. In this article, behavior prediction and behavior sensitivity testing are used. The future behavior is the focus of behavior prediction test (Forrester, 1980). The changes in parameter values tests behavior-sensitivity (Forrester, 1980). For eg. the sensitivity of the model is examined for 3 values of project manager's independence to check which project strategy it falls in. Consistency of values in the real world is checked with experts, simulation results of all of the variables in the model are checked. In the project strategy for example, negative number of stakeholders makes no sense and hence we ignore these values.

Model structure test: Parameters and structures are directly tested. In this article, extreme condition, parameter verification test and structure verification test are used.

(Sterman, 2000)explains that the extreme condition test tries to check whether each equation makes sense when its inputs take extreme values. Our research shows that the model behaves appropriately in these tests. Structure verification means comparing the structure of the model directly with the structure of the real system that the model represents (Forrester, 1980). In an expert panel, the structure of the model was verified. In the parameter verification test, the purpose is to determine whether the parameters correspond conceptually and numerically to real life or not (Forrester, 1980). The accuracy of the parameters' values was verified by the experts.

Based on the project strategy definition of Artto we develop the following system dynamics model in Vensim.

A. Project Strategy Model:

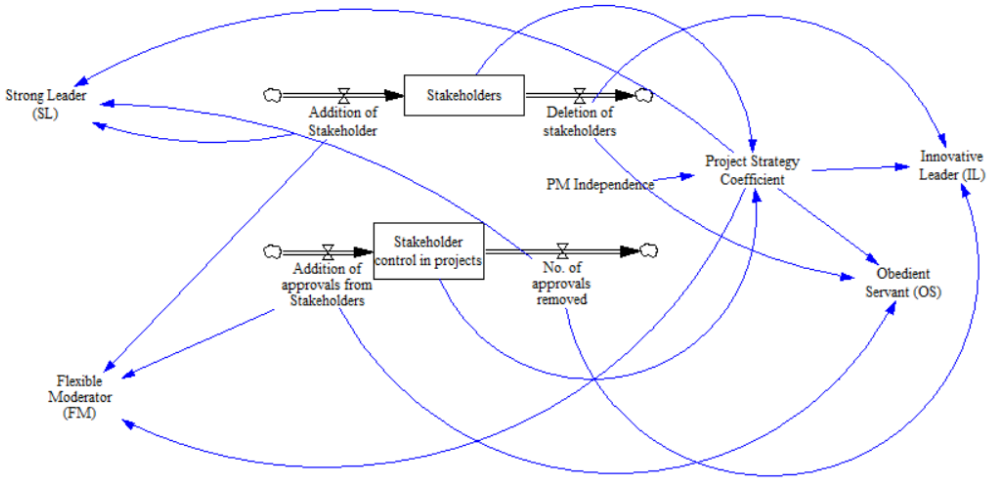


Fig 6 SD Model for Project Strategy

The Stock variables are "stakeholders" and "Stakeholder control in projects" which represents degree of autonomy in Arttos' article. Degree of autonomy is a subjective term and hence to analyze this we make it measurable by making the flow variable as "number of approvals required".

The flow variables are: Addition and deletion of stakeholders, Addition of approvals and deletion of approvals from stakeholders, Strong Leader, Innovative Leader, Obedient Servant and Flexible Moderator. The last four are same as the project strategies illustrated by Artto. They are a combination of the two stock variables i.e. similar to the axes in Artto's 2x2 matrix. We also have another two variables in the system dynamics model viz : Project Manager's Independence and Project Strategy Coefficient. Below is a list of parameters for the model presented.

Row	Parameter name	parameter unit	value in base run
1	Addition of Stakeholders	Person/Year	2
2	Deletion of Stakeholders	Person/Year	2
3	Stakeholders	Person	2
4	Stakeholder control in projects	Taskd	12
5	Addition of approvals from stakeholders	Taskd/Year	12
6	Deletion of approvals from stakeholders	Taskd/Year	2
7	PM Independence	1/TASKSd/Person	0.5
8	Strong Leader	Person*TASKSd/(Year*Year)	48
9	Obedient Servant	Person*TASKSd/(Year*Year)	288
10	Flexible Moderator	Person*TASKSd/(Year*Year)	288
12	Innovative Leader	Person*TASKSd/(Year*Year)	48
13	PM Independence	Dmnl	0.5
14	Project Strategy Coefficient	Dmnl	12

Scenario 1 : Base Run

Scenario 2 : Project Manager's Independence is increased to max i.e 3

A> Addition of stakeholders and deletion increased.

Scenario 3: Project Manager's Independence is decreased to 0

A> Addition of stakeholders and deletion increased.

B. Stakeholder Model

The Stock variables are “latent stakeholders”, “Expectant stakeholder” , “Definitive stakeholders”, “competent stakeholder” and “mentors”.

The other variables are listed below:

Row	Parameter	Unit	Base Value
1	Latent Stakeholder	People	4
2	Expectant Stakeholder	People	5
3	Competent Stakeholder	People	3
4	Definitive Stakeholder	People	1
5	Mentors	People	2
6	Average CS duration	Year	6
7	Average ES duration	Year	3
8	Average time to influence	Year	1
9	CS departure fraction	Dmnl	0.1
10	DS active duration	Year	3
11	DS that accept CS	Dmnl	0.1
12	ES departure fraction	Dmnl	0.1
13	ES departure fraction losing interest	Dmnl	0.1
Row	**Parameter**	**Unit**	**Base Value**
14	Fraction of Non Stakeholder becoming stakeholder	Dmnl	0.5
15	Non Stakeholder becomes Stakeholder	People/Year	2
16	Latent Stakeholder becomes Non-stakeholder	People/Year	2
17	Latent Stakeholder departure rate	People/Year	4
18	Gain Influence	People/Year	2
19	Expectant Stakeholders become Non-stakeholders	People/Year	0.1
20	ES become competent	People/Year	0.75
21	CS leaving	People/Year	0.02
22	CS departure rate	People/Year	0.2
23	ES departure fraction becomes competent	Dmnl	0.75
24	Mentors departure rate	People/Year	0.67
25	Absorption	People/Year	0.018
26	CS becoming Definite	People/Year	0.18
27	ES Leave	People/Year	0.15
28	Expectant Stakeholders becoming Non-Stakeholders	People/Year	0.1

Following is the System Dynamics Model:

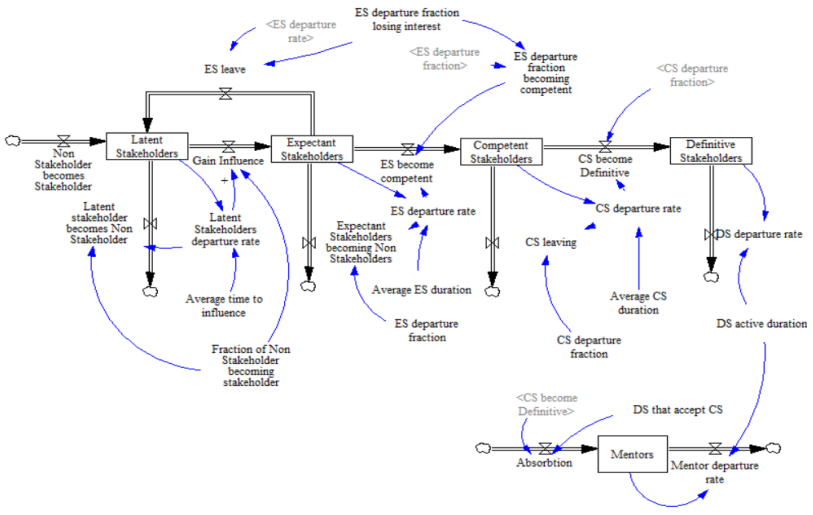


Fig 7: SD Model for Stakeholder Salience

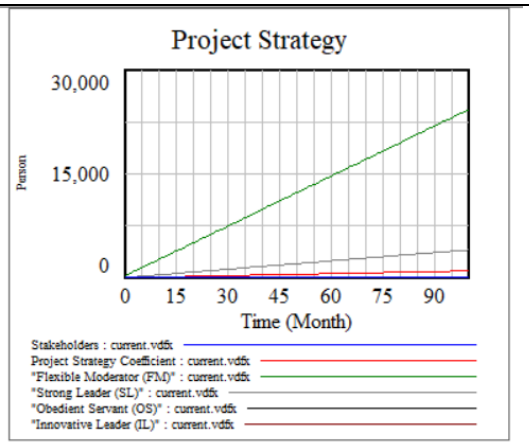
Scenario 1: Base Run

Scenario 2: CS departure fraction decreased to -0.5

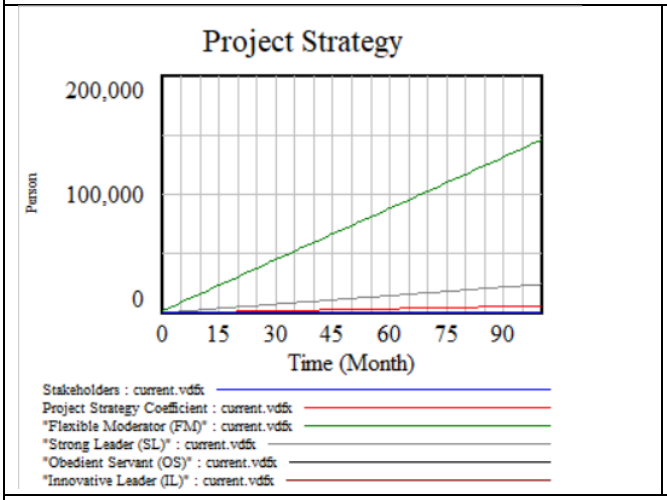
Scenario 3: ES departure fraction decreased to -0.75

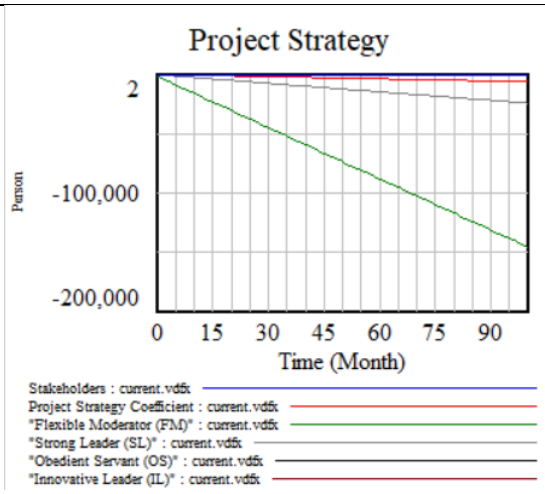
Results

A: Project Strategy Model

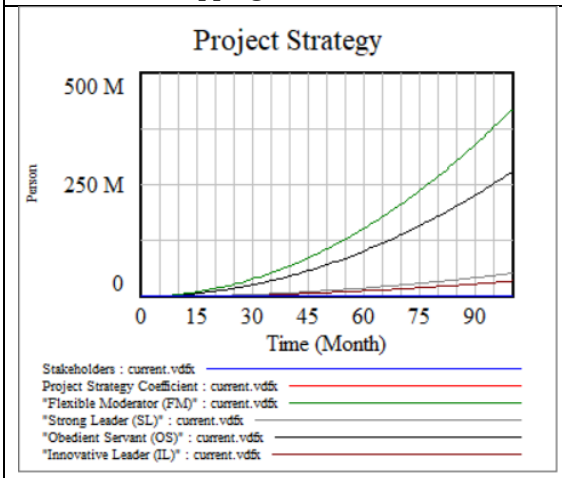


Scenario 1

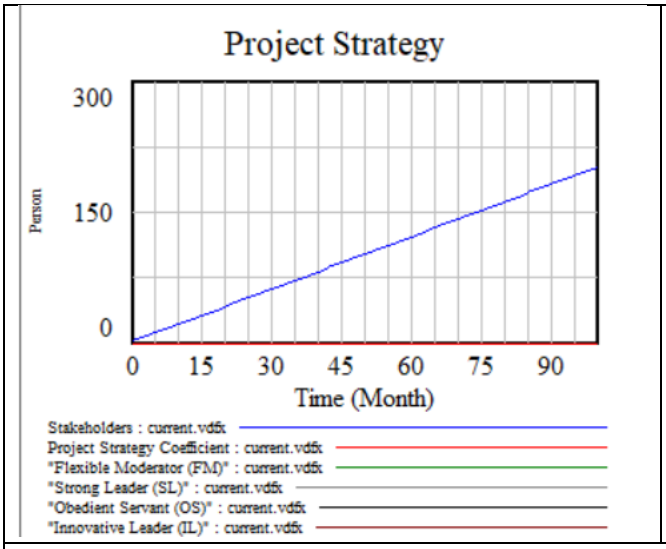




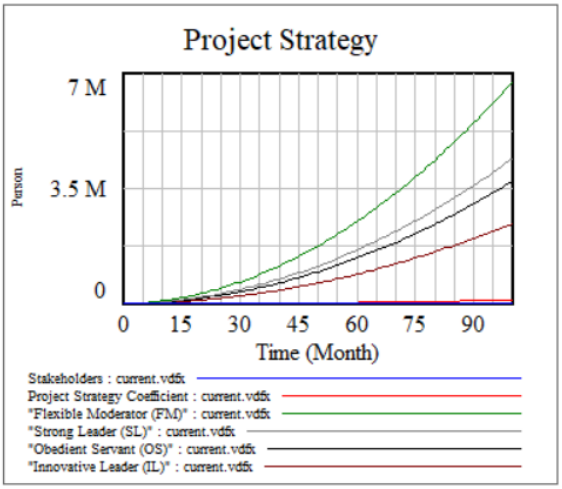
Scenario 2 & Tipping Point



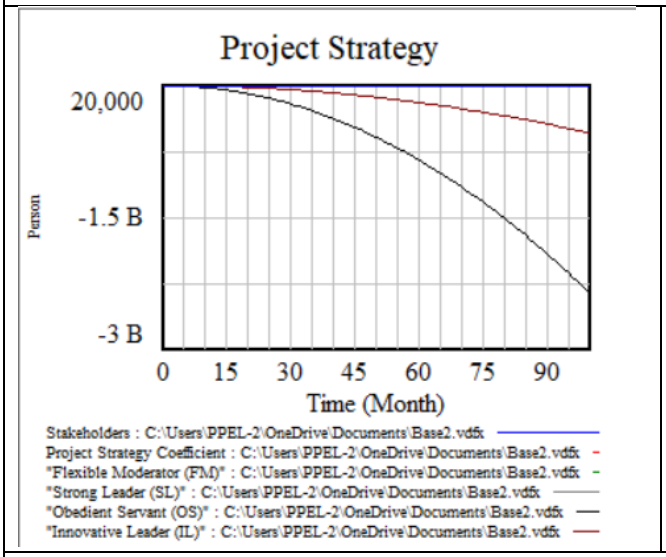
Scenario 2A

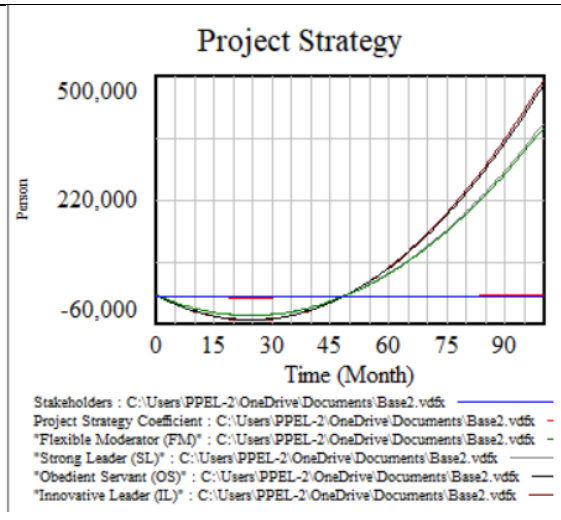


Scenario 3



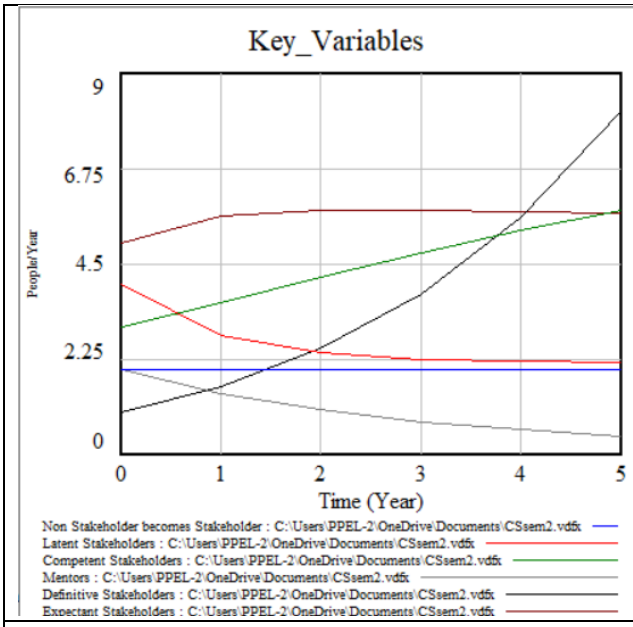
Scenario 3A



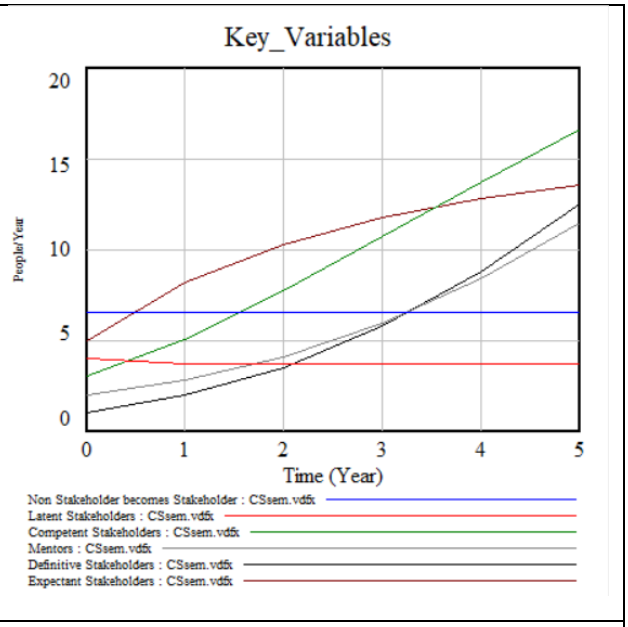


Unstable states

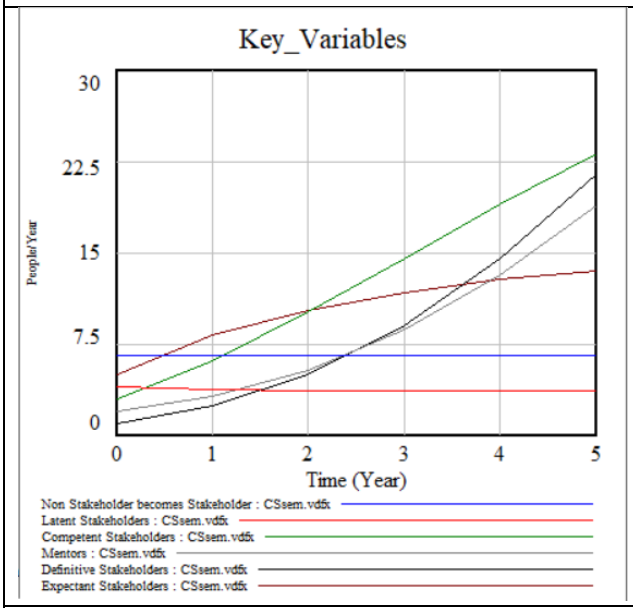
B. Stakeholder Model



Scenario 1



Scenario 2



Scenario 3

Discussion

A. Project Strategy Model

In the base run results, we find the number of tasks as 2000 and time duration of 96 months or 8 years. The flexible moderator is the most prominent strategy and then is strong leader. The number of stakeholders are 2. Hence, we can say this is low. As we know, both strong leader and flexible moderator are for high number of stakeholder strategies. Let us look at the structure of the model. We have designed Strong leader (SL) = Addition of Stakeholder*"No. of approvals removed"*Project Strategy Coefficient.

The above equation comes from K Artto's large number of stakeholder and high autonomy assumption. In our model we assume the differential addition of stakeholder and differential removal of approvals as gradient of this strategy.

The project strategy coefficient = PM Independence * Stakeholders * No. of approvals. This encompasses the autonomy, and total number of stakeholders and no. of approvals into account. In other words Multiplication of the differential change and the overall provides a dynamic equation to the Strong leader strategy.

Flexible Moderator (FM) = Addition of Stakeholder*Addition of approvals from Stakeholders*Project Strategy Coefficient.

Similarly this is the differential increase in stakeholders and increase in approvals. We also observe that PM Independence is a constant here. So we test this for extremes to validate the model's applicability. This is the proxy for autonomy of project manager i.e no. of approvals should be inversely proportional to this constant. Hence the units of this is 1/ (Taskd/Year).

We observe that at 0 the graph tips i.e PM Independence =0 makes the tipping point, however, since number of stakeholders become negative, we ignore these values. Hence we test for 0-3. At 3 we find that for 8 years and 500M tasks, a very complex project, Flexible moderator is still the prominent strategy and obedient servant follows. As we increase stakeholders SL and FM amplify and as we decrease stakeholders IL and OS amplify. We also see the change in criteria for SL and IL however, this falls in zones of -ve value for stakeholders. Hence our model shows that in a dynamic system, only the FM and SL will emerge. The OS and IL are unstable states with increase in stakeholders over time.

B. Stakeholder Model

We run the model for 5 years duration, as complex project usually spans from 3-5 years. In the Stakeholder salience model, we have 3 types of stakeholders, however, we introduce a 4th type. This was done for a realistic assumption. All Expectant stakeholders, i.e with any two of Power, Urgency or Legitimacy may want to become definitive by acquiring the 3rd. However, only if competent they will become definitive. If they are not competent they will make the system unstable. Competency is established by mentors in our model. This may be assumed to be guides or custodians to ensure stability. Hence our model is a sustainable stakeholder model. The incompetent depart either from the Expectant stakeholder stage or the mentor absorption stage.

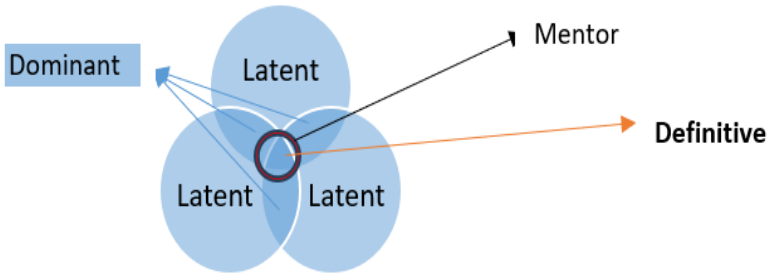


Fig 8: Novel inclusion to Stakeholder salience- sustainable stakeholder salience model

In the base run we see, definitive stakeholders increasing, competent stakeholders increasing while latent decreasing and expectant remaining constant. Mentors decreasing.

In scenario 2 where we decrease the competent stakeholder (CS) departure fraction from 0.1 to -0.5, we observe mentors increasing and competent more prominently increasing than the definitive. This is a natural outcome as more CS are retained. However, what is interesting is that now expectant stakeholders increase rather than plateauing to a constant as in base run. This shows that in our system model, many competent stakeholders are not converting to definitive.

In scenario 3 where we decrease the ES departure fraction from 0.1 to -0.75, we see a similar behavior as scenario 2 but the definitive stakeholders steeply increase including mentors, showing conversion of competent to definite.

Conclusion

In the present article we have developed the system dynamics model for project strategy proposed by (K. Artto, 2008). Then it analyzes the model for a 8 year run and concludes that flexible moderator or strong leader are stable states in project strategy. The second model brings our a new sustainable model of stakeholder salience and analyzes it for 3 scenarios. The results show that definitive stakeholders increase in the system and influence the system overtime. It is important to observe that the expectant stakeholders acquire the missing criteria to become a definitive stakeholder only after approval of mentors. The environment will determine at which stage which stakeholder leaves. The departure fractions are representative of these environmental reasons.

If we reflect on the project strategy model now, the environment actually determines the project strategy and the stakeholder depletion is a reason for this. We can thus say the project strategy will depend on the environment. From the first model we see that the obedient servant and innovative leader are unstable states. However, in real world we do find the obedient servant behavior, which our model suggests could be a result of project manager nature and not the environment. In other words, human factors impact the strategy. We may also conclude that complex

projects with obedient servants are not sustainable. Another point to note that stakeholders variable is assumed continuous, however in reality they will only be in whole numbers. Further, addition of stakeholders will also be in whole numbers. This is however, not a limitation of the model when reflected on with the second model where we have qualified the type of stakeholders. Hence the addition or deletion in fractions of *Persons* denote the power or influence portion of the stakeholder. We also propose a sustainable stakeholder salience model where mentor guard the inclusion of definitive stakeholders.

Limitations and future research

The article moves towards an integral view of project strategy developing on the work on human factors in project strategy (Singh, 2022) and the definition proposed by (K. Artto, 2008). Further, it reflects with the environment impact from a stakeholder perspective. However, the research did not qualify the impact of the stakeholders like latent, expectant or definitive in the project strategy model. That is, the differential increase would be qualified with the type of stakeholder. Further research would throw out a new dimension to the integral definition.

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