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PROJECT STAKEHOLDERS' POWER DISTRIBUTION A SYSTEM'S APPROACH TO UNCERTAINTY MANAGEMENT

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Abstract. The impact of Stakeholders' behaviour and policy on a project is complex as their interests in the project, positive or negative define their policy and subsequent behaviour toward the project with respective impact on its successful completion. Project Management must assess the influence of all direct stakeholders before or during the project initiation stage in order to develop appropriate response strategy plans and influence strategies to avoid, transfer or mitigate negative risk and enhance opportunity. Knowledge maps and influence diagrams can prove a useful tool in identifying the key stakeholders, their objectives and their potential influence on the various parts of the project life-cycle, as well as their influence on other stakeholders, as power distribution within the project-stakeholder network has been found to be of paramount importance. In principal, each stakeholder' s position stems from his/her perception of utility before, during or after project execution. The paper presents the development of a conceptual framework incorporating the above ideas to analyse the influence of client and partner behaviour on project performance. The application of the described framework is illustrated on a complex interest project.

1. INTRODUCTION

The internal and external environments of projects are dynamic and relatively unstable. Whether in the construction, software or service sector the management of risks, or rather uncertainties as it has been debated, has become a major concern of project management [1,2]. The Project Management Book of Knowledge (PMBOK) [3] considers six risk management processes: planning, identification, qualitative analysis, quantitative analysis, response planning, monitoring and control. A recent paper by Green [4] is concerned with the fact that established risk management techniques pay too little attention to uncertainty associated with stakeholder interactions, proposing the use of Friend and Hickling's [5] "Strategic Choice" approach to project uncertainty, which seeks to aid decision making processes by conceptualizing three types of uncertainty related to the working environment, guiding values, and related decisions. To the effect of evaluating uncertainties about fundamental relationships, project stakeholders' being such, Chapman and Ward [6] proposed the six Ws framework. However, very few have attempted to model the "cause" in the actual project system studied [7]. The present paper adds to the investigation of stakeholder influence on project performance combined with adopting appropriate strategic risk management response planning and proposes a conceptual framework to this end. One of the basic features introduced in this conceptual framework is the influence of the power distribution within the project stakeholder network. The idea is based on the concept of the ABCs of power [8, 9] described by Salancik *et al.*, followed by the theory [10], that knowledge of pairwise dependency relationships can be used to analyze the distribution of power for an entire network of actors within a field of inter-organizational relations or the distribution of power among subunits or persons within a single organization. A conceptual framework, initially, proposed by Roumboutsos *et al* [11] is discussed further and is illustrated through the case study presented. The concept has not been tested widely, and thus, is offered to stimulate debate and empirical testing.

2. CONCEPTUAL FRAMEWORK

The PMBOK [3] defines stakeholders *as individuals and organizations that are actively involved in the project, or whose interests may be positively or negatively affected as a result of project execution or project completion; they may also exert influence over the project and its results*. When considering development projects or mega-projects, which is the current trend, the number of individuals or organizations actively involved or influenced by the project becomes inevitably large. This is not an absolute drawback as in most cases they can be grouped by relevance of interests. Logically, each stakeholder will develop a strategy towards the project based on the particular stakeholder's perceived utility of the project objectives during or after project execution as an estimate of compliance with its own overall strategy. The impact of each stakeholder's strategy on the project would depend on the "power" the particular stakeholder has within the project stakeholder network. Strategic project management should identify all possible stakeholders, consider their perceived utility of the project objectives, appreciate possible trade-offs between project cost to completion, time to completion and quality, map the power distribution within the project stakeholder network, in order to establish project management policies that would maximize overall positive acceptance of the project. In practice, project management would be seeking a "threshold" of positive behaviour towards the project for each stakeholder.

Power Distribution within the Project – Stakeholder Network

Three of the six Ws of the Chapman and Ward [6] six Ws framework (i.e. (1) Who are the parties ultimately involved? (2) What do the parties want to achieve? (3) What is it that each party is interested in?) are relevant in terms of the ABCs of power transformed to (1) who are the stakeholders? (2) what are their desires? (3) Who/what fulfills them? Taking this inquisition further stakeholders who are dependent on the project and moreover on particular outcomes or activities and those, whom the project is dependent upon and moreover which outcomes and activities are dependent upon particular stakeholders, may be identified. The agents formulating these dependencies are none other than contractual agreements,

legislations, regulations, organizational structures etc. as well as the political environment linking the stakeholders. In this context, the relations between stakeholders and the project may be viewed as a distribution of power within the project – stakeholders network.

The identification of these dependencies and regulatory agents constitute the first step and one, which in most cases, is carried out by project managers to lesser or greater extent, formally or informally. The second step, and most probably a more diligent one, is the identification of the "Alternative agents" and the "Alternative targets", as well as the regulatory agents bounding these relationships. The mapping of these dependencies depicts the first degree of the project – stakeholder network power distribution.

The second degree mapping aims to identify the dependencies between stakeholders. Though these dependencies are more difficult to track, they may, in practice, prevail for the dependent stakeholders as target alternatives, or may even subside positive or negative influence on project performance as the dependent stakeholder will follow its target's position towards the project.

In practice this simplifies matters, as stakeholders are either dependent on other stakeholders or not. In the first case their strategy will follow/enhance that of the *dominant* stakeholder, while in the latter they will formulate strategies based on their perceived dependencies.

The identification of power distribution within the project stakeholders network, is the product of observation and subjective analysis on behalf of the project manager (or/and project management team) and, thus, is subject to respective bias. In depth interviews with interest groups and/or the application of the Delphi technique may lead to interesting results and alleviate the inherent bias. However, monitoring of stakeholders' behaviour during the initial stage of the project can be used to adjust initial estimates. This monitoring should be carried out through out the project as regulatory agents, as they are described above, are vulnerable to change, and thus, so is the individual stakeholder's power position.

Concluding, a stakeholder, k, will be dependent on a project if its purposes are best fulfilled through it then through any other existing alternative:

$$U_k(\text{project}) \geq U_{k,i}(\text{alternatives}), \text{ for all other alternatives } i,\ i = 1, \ldots\ldots, n$$

Though these utility functions may take on many forms, it is convenient, at a conceptual level, to view them as step-wise functions. This approach is preferable when seeking behavioural thresholds, as in this case.

Thus, the dependency of a stakeholder (dominant or independent) on a project may be described as the relation of the perceived dependence on other alternatives and the perceived dependence on the project, multiplied by a factor for dominant stakeholders i.e.:

$$U_{k,D}(SH_k) = m * f(U_{k,n}(alternative_n),\ U_k\ (project)),\ where\ SH_k\ is\ the\ k^{th}\ Stakeholder$$

As this forms a conceptual relation, f is expressed as:

$$f = \begin{cases} = +1, \text{ for positive values, i.e. dependence on the project} \\ = -1, \text{ for negative values, i.e. the project is dependent on the stakeholder} \end{cases}$$

while m takes values:

$$m = \begin{cases} = 1, \text{ for independent stakeholders} \\ > 1, \text{ for dominant stakeholders, with the value m expressing the number or relative "power" of the dependent stakeholders.} \end{cases}$$

It should be made clear that this is a dynamic situation, as a change in regulatory conditions or stakeholder alternatives may reverse the influence output. Additionally, new stakeholders, such as providers, might be introduced during the project life cycle, which may alter or enhance the existing power distribution.

Project Utility Values

It should be noted that power distribution and dependency on the project, for some stakeholders, may be independent of the perceived utility of the actual project objectives during or after execution expressed as their respective compatibility with the project implementation plan (project trade-offs) as well as other not identified factors. In other words, in some cases power dependency may prevail, while in others power dependency may be offset by negatively perceived utilities of the course of action taken during project implementation. The described project utility for the k^{th} stakeholder, in general, may be described by:

$$U_k(SH_k) = f(U_{k,TD} \text{ (project trade-offs)}, U_k(\text{other factors}))$$

The perceived utility of the basic three project attributes quality (Q), time to completion (T) and cost to completion (C) has been modeled [12]. The need for trade-offs, which is likely to arise during the project life cycle, is expressed as pairwise preferentially independent attributes for each stakeholder, i.e.:

$$U_{SH_k}(q,t,c) = U_{Q_{SH_k}}(q) - U_{T_{SH_k}}(t) - U_{C_{SH_k}}(c)$$

where, U_Q, U_T and U_C are single – attribute value functions and SH_k is the k^{th} Stakeholder

Ultimately though, each stakeholder based on the above mentioned value function would have a positive or negative response depending on the course of action (project implementation plan) taken by project management team. The issue being whether the trade-offs made by project management ($u_{PM}(q,t,c)$) coincide with the stakeholder's preferences or not. Again, this relation, for conceptual purposes may take the following values:

$$U_{k,TD}(SH_k) = \begin{cases} = 1, \text{ for compatible trade-off preferences} \\ = 0, \text{ for neutral perception} \\ = -1, \text{ for incompatible trade-off preferences.} \end{cases}$$

Strategic Risk Response Planning

Based on the above, the overall behaviour of the k^{th} stakeholder towards a certain project implementation plan (M) is described by a function of the type:

$$U_M(SH_k) = f\{U_{k,D}(SH_k), f(U_{k,TD}(SH_k), U_{kother}(SH_k))\}$$

This relation would take positive or negative values, describing positive or negative overall behaviour towards the project implementation plan and presenting project management with opportunities and downside risks respectively. Thus, the ultimate project strategy (UPS) would be such that would maximize the positive effect of the stakeholders on the project and simultaneously achieve positive behaviour of all stakeholders, i.e.:

$$UPS = \max \sum_{k=1}^{n} U_{UPS}(SH_k) \qquad \text{and } U_{UPS}(SH_k) \geq 0, \text{ for all } k = 1,....n$$

As, the second term would be, in most situations, difficult to achieve, project management would seek a compromise in project strategy such that would, on the one hand maximize the overall stakeholder utility and, thus, behaviour and, on the other, accept negative behaviour from some stakeholders, depending on the trade-offs project management is prepared to make.

System Dynamics

As the number of stakeholders in a project increases, the project system becomes extremely complex, consisting of multiple interdependent components, which are highly dynamic. The project system involves multiple feedback processes, nonlinear relationships, as well as "hard" and "soft" data. The attempt to solve the problem with mental models is subject to the famous "principle of bounded rationality" [13]. Though, the outline of an SD application

exerts the objective of the present document, it is important to note that major SD applications refer to supporting dispute resolution [14,15,16,17], where the applications were used to identify and quantify the full impacts of disturbances introduced by one of the parties involved (stakeholders) in the project. Thus, the evaluation of total stakeholders' impact on the project, for various project implementation plans through the application of system dynamics would be a logical step and one based on existing applications.

Knowledge maps and influence diagrams are useful at this point in illustrating the effect negative and positive stakeholder behaviour exerts on the various parts of the project life cycle, as well as any other interdependencies that may prevail.

3. A CASE STUDY

In June 1998, the University of the Aegean was assigned the project "IALYSOS", a turn key contract to develop 40 school libraries on 17 islands in the Aegean Archipelagos by the Greek Ministry of Education within the framework of the European Structural Funds (ESF) 1994 – 99. The project involved identifying schools that could accommodate libraries, construction work, procurement of furniture, computers, other tutorial equipment, 6.000 book titles per library, library services, training etc. The project budget was approximately 7.5 million € and the project duration was 2 years. Considering the geographical dispersion, it was a complex project on its own.

Conventional project risk management would imply planning, identification, qualitative analysis, quantitative analysis, response planning, monitoring and control. The project management team, using the brainstorming technique, identified the following major project risks:

1. On-site project progress reporting and quality control
2. Authorization to access and intervene in school property, as school buildings are owned by the respective Municipality, which receives school funding by the respective Prefecture and whose technical services are responsible for any interventions in school buildings.

3. Authority over school staff and moreover the school principle and teacher responsible for the library, as they belonged to a totally different hierarchy, which composed of the school principle, the secondary school prefecture director, the Ministry of Education Secondary School Directory. The latter is responsible for teachers' placements and the application of the respective employment regulatory framework.
4. Ownership of materials, equipment etc. and liability of misusing facilities before the project transfer phase.

Considering the facts, usual risk response planning would include the employment of people on site and seeking formal approval to initiate the project and consequently a string of "approvals" for every project task provided by various departments, sectors etc. of Municipalities, Prefectures or the various Directorates at the Ministry of Education. This would put the entire project at risk, as it would result in project cost increase and unpredictable time delays.

The project management team attempted a different approach by applying the conceptual framework discussed above. The original Stakeholder groups, as depicted in table 1, and the Regulatory Agents, as noted in table 2, were identified through the brainstorming technique.

1. Teachers Responsible for Library (TS) - users	11. Construction Sub-Contractors (CSC)
2. School Principles (SP) - users	12. Equipment Contract Suppliers (ECS) Contractors (C)
3. Secondary School Prefecture Directors (SSPD)	13. Book Contract Suppliers (BCS)
4. Students and Parents (SUP) – Users	14. National Documentation Center (NDC) – assigned library software provider
5. Local Communities (LC)– other users	15. The University as the Contractor Organization (UCO)
6. The Municipalities the School belonged to (MS) – operators	16. The University Research Unit (URU) – contract administrator
7. The Ministry of Education ESF	17. The University Library Service (USC)

Directorate (MEESFD) – client (funding agent)	
8. The Ministry of Education Secondary School Directorate (MESSD)	18. The University Technical Service (UTS)
9. The Prefecture Technical Services (PTS) – building operators	19. The Project Management Team (PMT)
10. Book Editors (BE)	20. The Project Operation Teams (ROT)

Table 1: The Stakeholder Groups

1. ESF Regulations	5. The organizational (reporting) structure of the Ministry of Education
2. National and European legislation concerning public tenders.	6. The organizational (reporting) structure of the ESF Ministry of Education
3. National Legislation regarding public construction works.	7. The organizational structure of the University
4. Regulations concerning Library performance.	

Table 2: Regulatory Agencies

The Delphi technique was, then, used by the project management team to assign values to the power dependency and map the power distribution within the project – stakeholder network. While applying the technique, it became evident that stakeholder power values varied throughout the project. Thus values had to be estimated per project phase. These values by stakeholder and project phase are shown in table 3.

Stakeholder	**SSP**	**PDPP**	**PIP**	**PTP**
The Ministry of Education ESF Directorate (MEESFD) – client (funding agent)	1	1	-1	1
Teachers Responsible for Library (TS) - users	-1		-1	-1
School Principles (SP) - users	-1		-1	-1

Secondary School Prefecture Directors (SSPD)	-1		-1	-1
Students and Parents (SUP) – Users	-		1	1
Local Communities (LC)– other users	-		1	1
The Municipalities the School belonged to (MS) – operators	-1	-1	-1	-1
The Ministry of Education Secondary School Directorate (MESSD)	-1	-1	-1	-1
The Prefecture Technical Services (PTS) – building operators	-1	-1	-1	-1
The University as the Contractor Organization (UCO)	-1	-1	-1	-1
The University Research Unit (URU) – contract administrator	1	1	-1	-1
The University Library Service (USC)		-1	-1	
The University Technical Service (UTS)	1	-1	-1	
Contractors (C)			-1	-1
Book Editors (BE)		1	-1	
National Documentation Center (NDC) – assigned library software provider			-1	

SSP : School Selectio Phase, PDPP: Project Development & Planning Phase, PIP: Project Implementation Phase, PTP: Project Transfer Phase

Table 3: Stakeholder Power Distribution by project phase for initial project planning

The findings in Table 3 correspond to the first degree estimation of the power distribution between the project and the stakeholders. The power relationships, however, were far more complex and described by the second degree mapping. This was carried out by applying the brainstorming technique. The results are presented in Figure 1.

When studying the Power Dependency Map for the School Selection Phase, it became evident that the entire power system depended on two Stakeholders; the Local Community and the Ministry of Education Secondary School Directorate (MESSD). Thus, their power value was

not (–1), as shown in Table 1, but a multiple, as a number of other stakeholders were influenced and dependent upon them.

Additionally, the "teachers responsible for the school library" (TS) and the "school principles" (SP) were identified as the two most interesting stakeholder groups. These groups were important to the project as they would be the only financially feasible individuals that could provide on site support to project management and day-to-day progress reports. Simultaneously, they were linked to the Ministry of Education Secondary School Directorate and the Prefecture Technical Services. The power dependency involving these two stakeholder groups for the initial project plan is mapped in figure 1.

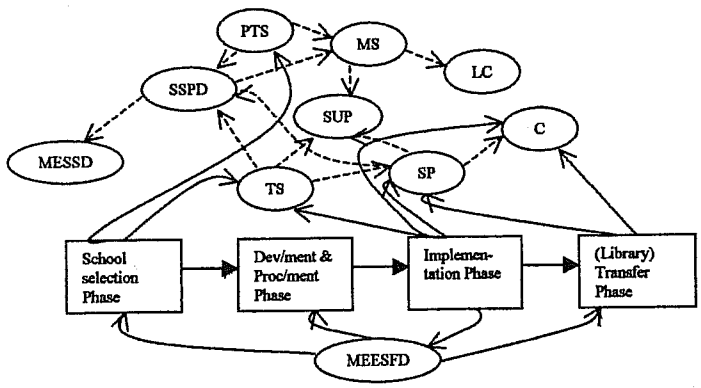

Figure 1: Power dependency for initial plan

The project management team focused interest in this direction. By investigating the two dominant groups of the School Selection Phase, the project management team was able to identify, the major "desires" these stakeholders would need to fulfill. An interview with the MESSD verified the fact that they required information on the project as there was no link to the Ministry Directorate funding the project (MEESFD). Moreover, in the MESSD's perception, they were deprived of their entitled hierarchical power by the MEESFD's fund control power.

The project management team had to position itself and the project in a power position towards these two stakeholders. Thus, a reporting task was inserted in the project plan, constituting the MESSD dependant on the project. The LC was addressed through a campaigning task promoting the project as a "scarce commodity" and a unique opportunity to improve school standards. Local communities bought into the project objective and became dependant on the project management team to deliver the project to their communities. However, this strategy had a drawback as shown in Figure 2, as this would lead to their direct involvement in the project.

The principle source of possible inconvenience caused by the involvement of the MESSD would stem from the perceived compatibility concerning project planning trade-offs, as this group had little respect for budget or time constrains. In order to offset undesirable influence, the role of the MEESFD (funding agent) was enhanced concerning decisions on time and cost, while always retaining their dependency on the project.

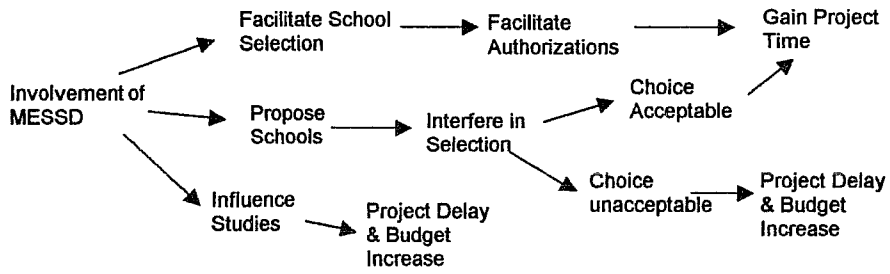

Figure 2. The anticipated effects of the MESSD involvement in the project

Similar activities were undertaken to identify strategies to offset negative trade-off values for the TS and PS groups during the selection stage, as well as identifying other factors influencing their power dependence. The latter were found to be independence and relief of teaching obligations and professional credit for the TS and PS groups respectively. The power dependency through this strategy was mapped as shown in Figure 3.

By applying the proposed strategy, project risks concerning access to schools without prior authorization, authority over school staff and on-site progress reporting was offset.

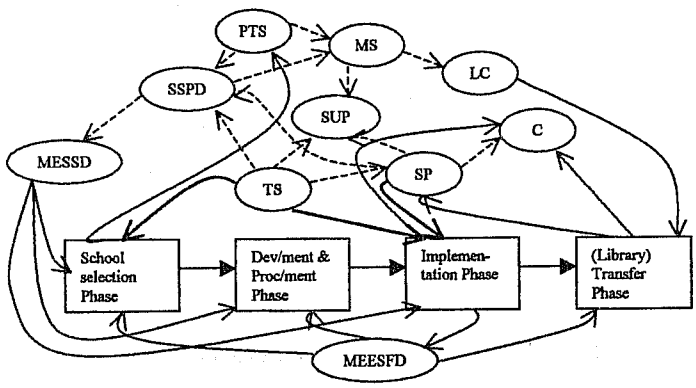

Figure 3: Power dependency for the first

In order to reduce the remaining risks the project management team considered the introduction of regulatory agents in the form of terms of reference in tenders and contracts binding TS and PS groups to the project and contractor stakeholder groups. The regulatory agents depicted the schools as procurers and responsible for quality control of delivered services and materials. Thus, contractors were dependent on TS and PS groups, who in turn were dependent on the project, while there was an immediate transfer of ownership offsetting the remaining project risks. Figure 4, maps the dependencies accomplished by the application of the final strategy plan. Table 3 shows the shift in utility function values for the MESSD, LC, TS and PS groups through the application of the devised strategy.

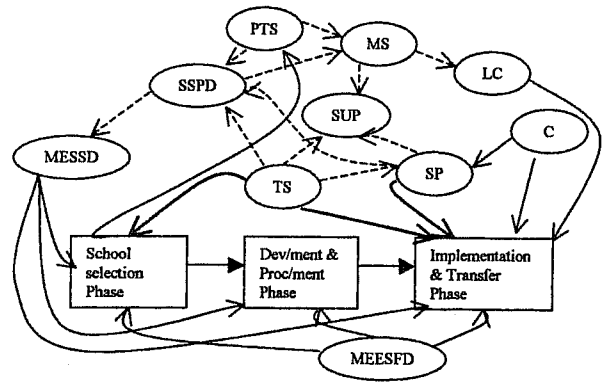

Figure 4: Power dependency in the applied

	School Selection Phase				Implementation Phase			
	Initial		Applied Strategy		Initial		Applied Strategy	
Stake-holder	U_D	U_{TD}	U_D	U_{TD}	U_D	U_{TD}	U_D	U_{TD}
MESSD	-m	-	m	-	-m	-m	m	m
LC	-	-	m	-	m	-	m	-
TS	-1	1	1	1	1	1	0	1
SP	-1	1	1	1	1	1	0	1

Table 3: The shift in utility function values for the MESSD, MEESFD, TS and PS groups

4. CONCLUSIONS

A conceptual model is developed to assist in risk response strategic planning. The model addresses risks by evaluating and mapping the power dependency amongst project stakeholders and their perceived utility of the project trade-offs between project cost to completion, time to completion and quality. Strategic risk response planning consists in influencing factors that define stakeholder utility thresholds, and thus, behaviour. In the presented case study, stakeholders and their respective utilities were identified and assigned through the brainstorming and Delphi techniques. The successful completion of the described project is promising for the conceptual model illustrated herewith. However, further work is required to test and establish the proposed model.

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