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Analysis of Stakeholder Influence: A Perception of Software Engineering Projectsin Nigeria

Adanma Cecilia Eberendu[a],*; Edem Okon Peter Akpan[b]; Emmanuel C. Ubani[c]; Kelvin A. Okorocha[c]

[a]Department of Computer Science, Madonna University, Nigeria.
[b]Faculty of Engineering, Akwa Ibom State University, Ikot-Akpaden, Nigeria.
[c]Department of Project Management Technology, Federal University of Technology Owerri, Nigeria.
*Corresponding author.

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Abstract
Software Engineering Project (SEP) failure has been an issue of concern to software engineers and one of the warning signals is non-involvement of stakeholders. For a project to succeed it is essential to know how a stakeholder can take action, get involved, and the level of stakeholder's involvement in the project. This study investigated the level of influence stakeholders have on software engineering projects in Nigeria and prioritized the stakeholders based on their level of influence. This involved analyzing 130 questionnaires collected from three different sectors namely tertiary institutions, government ministries and government agencies. The respondents rated the stakeholders involved in the selected projects according to stakeholder attributes: Attitude, Vested Interest, Power, Proximity, Legitimacy, Urgency, and Knowledge. The result showed that project sponsors and project team have more influence on the project than any other stakeholder. This revealed that project sponsors and project teams control software engineering projects in Nigeria.

Key words: Software engineering project; Stakeholder influence; Stakeholders' management; Level of influence; Project organization

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INTRODUCTION
Software engineering projects (SEP) comprise series of activities or tasks carried out by different people or groups who might have diverse interest or involvement in the project (Tarawneh, 2011). The projects are usually unique due to the stages involved and many parties interacting with one another. The projects are also limited by time and other resources like manpower, material and money, which are needed to deliver the projects (Bourne, 2006; Olander & Landin, 2005). Although the stages of SEP are complex, the projects involve collaboration and negotiations among many people such as customers, end-users, analysts, designers, developers, suppliers, government, and the society (Baida, 2001; Boonstra, 2010). Each of these stakeholders has contribution that can move the project forward hence their influence in the success or failure of the project matters. Influence is the level of involvement a stakeholder has on a project (Frooman & Murrell, 2005) or the extent to which a stakeholder compel others into following certain course of action (Nguyen, Skitmore, & Wong, 2009).

Project stakeholders have influence on the decisions of the project based on the role they play during the development process. For example, owners/sponsors have the ability to set the project schedule and decide on the deadlines, customer can influence a project by deciding to withdraw from the project; the project manager runs the daily decisions of the project such as implementing the decision of the steering committee, what to produce, and who will work on which task. The project team can influence the project by their actions towards activities of the project or their job in general. Suppliers might decide to delay supplies until all resources are paid for and statutory organization can influence the project by introducing new regulations or policies. For each of these stakeholders to carry out their work effectively, the developed software should meet their requirements, thus they are interested in the outcome, activity, and decision of the project.

Stakeholder management means that stakeholders in software engineering projects are identified and analyzed in order to take appropriate actions to support the project. Some studies had been carried out on stakeholder identification and categorization, though not specific to software engineering projects. Vos and Achterkamp (2006) concentrated on identification of stakeholders while Mitchell, Agle, and Wood (1997) assessed their relative influence in a project.

The objective of this research is to identify the level of influence of software engineering project stakeholders and prioritize the impact of these stakeholders based on their level of influence.

1. RELATED LITERATURE

Assudani and Kloppenborg (2010) stated that stakeholders have different levels of influence and interests in projects in which they are involved. Determining the influence and interest of a stakeholder affects the effectiveness of a project. Influence can be important in terms of supporting as well as constraining a project. Interest means how significant the stakeholder values project while influence is the authority that the stakeholder has to change the course of the project. For a project to succeed it is essential to know how a stakeholder can take action, get involved, and the capacity to contribute (Carroll & Buchholtz, 2008; Clarkson, 1995; Freeman, 1984; Mitchell et al., 1997). Organization may not have the resources to implement all stakeholders' requirements, therefore prioritizing stakeholders according to their respective influence is crucial (Cleland & Ireland, 2002). A common approach is to map the stakeholders' interest and influence on a quadrant, (Chandra, Indarto, Wiguna, & Kaming, 2012). Ackermann and Eden (2011) described this technique as a two-dimensional matrix with stakeholders' interest ranging from low to high on the vertical axis and influence to affect the project ranging from low to high on the horizontal axis. The British Office of Government Commerce (OGC, 2007) suggested three columns and rows with Interest/Influence as High, Medium or Low. The interest/influence grid drives communications strategy which ensures that the stakeholders receive the correct level of information at the right time to aid their understanding of the project and its benefits. Stakeholders with high interest and influence are given high priority and listed first before those with lower interest and influence. The influence/interest grid is used to determine if stakeholders have strong influence/ negative interest, weak influence/positive interest, strong influence/negative interest, or weak influence/negative interest. According to Assudani and Kloppenborg (2010), a stakeholder is evaluated with interest and influence to determine their potential level of impact on the project. Olander and Landin (2005) translated influence/ interest into the impact/probability matrix. There is need to identify stakeholders and map their influence and interest in order to understand their potential impact on projects, and then formulate and enact suitable strategies to maximize their positive influence and minimize their negative influence.

Smith (2000) and Bryson (2004) used participation matrix to map the varying levels of influence and interest that the stakeholders have a project and analyze how they are involved. It also highlights assumptions and risks and prompts project managers to respond to different stakeholders according to their skills/expertise. Different stakeholders may participate at different phases of the project as such their roles need clarification and at what level they have to participate (Yang, Shen, Ho, Drew, & Chan, 2009). The levels of participation range from informing stakeholders to control. Chinyio and Akintoye (2008) categorized them into four levels as collaborate, involve, inform, and consult in order to manage project stakeholders.

Stakeholder's impact might be negative or positive thus establishing the opponents and supporters of the project objectives is vital. Susser (2012) used stakeholders' attitude to determine whether the stakeholder supports or opposes the project. She classified attitudes as active opposition, passive opposition, no commitment, passive support, and active support but Mitchell et al. (1997) categorized stakeholders' attributes as power, legitimacy and urgency. Brourne and Walker (2006) described stakeholders with power attributes as those that can make permanent change or stop the project. Stakeholders with legitimacy attributes are those that the project manager can account for their actions or claims, due to their possible effects upon normative stakeholders. The stakeholder legitimacy reflects that contractual, legal, and moral relationships exist between stakeholders and the project (Nguyen et al., 2009). The stakeholder urgency attributes (time-sensitive and critical) is used to exert pressure on a project manager during emergency action.

Bourne and Walker (2006) proposed proximity as a standard for rating stakeholders and it shows how involved a stakeholder is in the project. The rating ranges from 1 to 4; these are remote, far, near, and direct as shown in Figure 1.

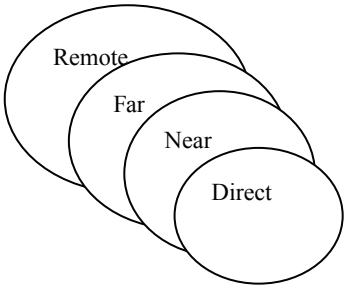

Figure 1
Stakeholders' Proximity Rating (Conceived From the Literature)

The potential impact of some stakeholders may be underestimated despite the position on proximity rating (Bourne & Walker, 2006). The more knowledgeable a stakeholder is about the project, the more impact a stakeholder has on that project. Lim et al. (2005) consider knowledge as a catalyst for influencing projects.

2. METHODOLOGY

This research used questionnaire method of data collection because it is widely used for conducting surveys of this type. Questionnaire was disseminated to different public organizations involved in software engineering projects, that is, tertiary institutions, government agencies and government ministries. The total number of projects selected using simple random sampling was 30; 10 from tertiary institutions, 10 from government agencies and 10 from government ministries. Six respondents were selected from each project given a total of 180 respondents out of which 130 returned the questionnaire. The level of stakeholder impact was derived using Nguyen et al. (2009) formula:

$$I = P + L + U + K + D \,. \quad (1)$$

Where I = Impact level;
P = Power level;
L = Legitimacy level;
U = Urgency level;
K = Knowledge level;
D = Degree of proximity.

Bourne and Walker (2006) mentioned a measuring scale for stakeholder vested interest (V) as 1 -very low, 2-low, 3-medium, 4-high, and 5-very high. Nguyen et al. (2009) also concluded that the influence can be represented by the impact index of a stakeholder which is used for prioritizing the project stakeholders. They calculated the impact index by using this formula:

$$SII = ViII * Pos \,. \quad (2)$$

Where: SII = Stakeholder Impact Index;
ViII = Vested interest Impact Index;
Pos = Attitude position value.

Olander and Landin (2005) used numerical values to represent attitude position value (*Pos*): active opposition (*Pos* =1), passive opposition (*Pos*= 0.5), not committed (*Pos*= 0), passive support (*Pos*= - 0.5), and active support (*Pos*= -1). Bourne and Walker, (2006) affirmed that the stakeholder impact index may be derived from vested interest impact index (ViII) which is calculated by using this formula:

$$ViII = \sqrt{\frac{v * I}{25}} \,. \quad (3)$$

Where ViII = Vested interest Impact Index;
I = Stakeholder Impact level;
v = Stakeholder Vested interest.

3. FINDINGS AND DISCUSSIONS

3.1 Stakeholders' Assessment

This section discusses the results of stakeholders' assessment of the selected sample of SEP stakeholders in Nigeria, which consist of project sponsor, owner/ customer, end-user, functional department, project team, supplier, government, and society.

Table 1
Stakeholders' Attitude

Stakeholder		Sponsor	Customer	End-user	Functional department	Project team	Supplier	Government	Society
Attitude	Mean	3.36	2.91	2.63	2.53	3.43	2.03	2.74	1.83
	Rank	2	3	5	6	1	7	4	8

In Table 1, most respondents believe that Sponsors and Project team show active support in terms of their attitude towards the software projects. This can be justified by the fact that the sponsors have financial commitment to the projects and its success would make them believe that their investment was not in vein. The project team defines the goals of the project and ensures that they are achieved by estimating the time, resources, and procedures needed. The project teams also have to exhibit a positive attitude towards the project due to the fact that its success improves their occupational competence. Also it is obvious that society and supplier show inert attitude towards the projects as depicted by the results. The customer, Government, End-User and Functional Department show passive attitude towards SEP.

The stakeholders are characterized as having a "stake" in SEP; therefore their influence compliments individual interests. Respondents endorsed that the sponsors, project team, customer, and government show higher interest in SEP, ranking 1, 2, 3, and 4 in Table 2. These are the key players in the projects and they try to influence the implementation and decisions of the project. The government might also be interested in seeing that the project design and implementation meet established standards and regulations. End-user and functional departments have moderate interest, while suppliers and society have subdued interest.

Table 2
Stakeholders' Vested-Interest

Stakeholder		Sponsor	Customer	End-user	Functional department	Project team	Supplier	Government	Society
Vested Interest	Mean	4.64	4.08	3.14	3.13	4.41	2.55	3.91	1.9
	Rank	1	3	5	6	2	7	4	8

Table 3
Stakeholders' Power

Stakeholder		Sponsor	Customer	End-user	Functional department	Project team	Supplier	Government	Society
Power	Mean	4.63	3.83	2.78	2.79	4.39	1.9	4.03	1.78
	Rank	1	4	6	5	2	7	3	8

The result in Table 3 shows the calculated value of the power exhibited for each of the stakeholders. All respondents share the view that project sponsors have the utmost power. This is as a result of their investment in the projects. In these projects, the Sponsors not only have the power of providing fund, but have also held the political power in the management to approve and decide whether the project is to be implemented or changed. The respondents pointed out to the power level of project team (Rank = 2) and Government (Rank = 3) as moderate. This is not surprising because the project team has the power to develop and supervise the activities of the project, deal with technical issues and assist top management in making decisions related to projects. Project team and Governmental have no power to decide either financial issues or make changes, Government's social and political matters are of great importance in managing the other stakeholders' needs and expectations. Respondents also think that the Customers (Rank = 4), Functional Department (Rank = 5), and End-user (Rank = 6) have some capacity to stop or jeopardize the project. Furthermore, respondents agreed that the power level of Supplier (Rank = 7), and Society (Rank =8) in SEP is low, since both of them are external stakeholders and their attitude towards the project based mainly on the reaction to the implemented product.

Table 4
Stakeholders' Proximity

Stakeholder		Sponsor	Customer	End-user	Functional department	Project team	Supplier	Government	Society
Proximity	Mean	4.39	3.9	3.11	3.08	4.45	2.44	3.93	2.04
	Rank	2	4	5	6	1	7	3	8

All the respondents believed that Project Team (Rank = 1) and sponsor (Rank= 2) interact directly with the project activities from the inception of the closure of the projects. The sponsors follow up the project from preliminary design up to the deployment stage while the project teams analyze, design, develop, and implements all the project activities including preparation of project documents. Customer and government stakeholders have directly participated in software projects on a part-time basis because they might also engage in other projects simultaneously; customer (Rank = 4) might participate mainly in the implementation phase (Table 4).

End-users (Rank = 5), Functional Department (Rank= 6) are involved on a routine basis in the projects. On the other hand, Suppliers (Rank = 7), and Society (Rank = 8) are detached from the project but they have regular contact with various project process.

Respondents believed that the Sponsor and the Project team have high degree of legitimacy, because they are internal stakeholders and they have been integrated into the software projects. The reason is due to their valid relationships with the projects which are specified in the terms of reference, and this gave the following results

Table 5
Stakeholders' Legitimacy

Stakeholder		Sponsor	Customer	End-user	Functional department	Project team	Supplier	Government	Society
Legitimacy	Mean	4.44	3.7	2.99	2.8	4.35	2.11	3.86	1.81
	Rank	1	4	5	6	2	7	3	8

in Table 5); Sponsor (Rank = 1) while project team (Rank = 2). The next group (Government – 3, customer – 4, End-user – 5, and functional department – 6) has moderate legitimacy because there are legal requirements that should be considered in the project towards these stakeholders. It is not surprising that respondents think that legitimacy for both supplier (Rank = 7) and society (Rank = 8) is low, because the legal requirements towards these two stakeholders are not significant from the viewpoint of the respondents.

Table 6
Stakeholders' Urgency

Stakeholder		Sponsor	Customer	End-user	Functional department	Project team	Supplier	Government	Society
Urgency	Mean	4.5	3.85	3.11	2.91	4.4	2.39	3.93	1.71
	Rank	1	4	5	6	2	7	3	8

In general, Sponsors and Project teams tend to respond to the demands of all stakeholders (Table 6). Specifically, sponsors provide funds needed to implement the activities of the project which project teams will use to provide immediately reply to the claims of other stakeholders. The Project team should reply urgently to the needs of Sponsors (Rank = 1), Government (Rank = 3), Customer (Rank = 4), End-users (Rank = 5), and Functional Department (Rank = 6) within short time frame, while the claims of Supplier (Rank = 7) and Society (Rank =8) are attended to within the planned period.

Table 7
Stakeholders' Knowledge

Stakeholder		Sponsor	Customer	End-user	Functional department	Project team	Supplier	Government	Society
Knowledge	Mean	3.41	3.19	2.5	2.84	4.73	2.05	3.43	1.7
	Rank	3	4	6	5	1	7	2	8

All respondents agree that the project teams are fully aware of project activities because they take full responsibility of implementing other stakeholders' requirements, resolve technical issues and problems, oversee the deployment of the system, and attending meetings throughout the project lifecycle. The results also show that Government (Rank = 2), Sponsors (Rank = 3), Customers (Rank = 4), and Functional Departments (Rank = 5) have a considerable knowledge of the project activities, compare to End-users (Rank= 6), Supplier (Rank = 7) and Society (Rank =8) that have the least knowledge of the project as depicted in Table 7.

3.2 Stakeholders' Prioritization

In order to prioritize the SEP stakeholders, Nguyen et al. (2009) method was adopted to explore the software stakeholders' influence on software projects. All the attributes considered important factors that affect the stakeholder management process from the perspective of the respondents. Olander (2007) and Nguyen et al. (2009) had used this method to determine the level of influence of project stakeholders in their research. The results are presented according to the following factors, stakeholders' impact level, stakeholders' vested interest-impact index and stakeholder influence index (Table 8). The ranks show the stakeholder priority in order of the influence index, ranging from the highest (Rank = 1) to lowest (Rank = 8), which reflects the most influential stakeholder in SEP.

Table 8
Summary of Stakeholder Influence Index

Stakeholder	Sponsor	Customer	End-user	Functional department	Project team	Supplier	Government	Society
Attitude	3.36	2.91	2.63	2.53	3.43	2.03	2.74	1.83
Vested interest	4.64	4.08	3.14	3.13	4.41	2.55	3.91	1.9
Power	4.63	3.83	2.78	2.79	4.39	1.9	4.03	1.78
Proximity	4.39	3.9	3.11	3.08	4.45	2.44	3.93	2.04
Legitimacy	4.44	3.7	2.99	2.8	4.35	2.11	3.86	1.81
Urgency	4.5	3.85	3.11	2.91	4.4	2.39	3.93	1.71
Knowledge	3.41	3.19	2.5	2.84	4.73	2.05	3.43	1.7
Impact Level	21.37	18.47	14.49	14.42	22.32	10.89	19.18	9.04
Impact Index	0.398	0.347	0.270	0.269	0.397	0.211	0.346	0.166
Influence Index	1.338	1.011	0.7096	0.6799	1.3612	0.4279	0.9491	0.3034
Rank	2	3	5	6	1	7	4	8

Note. Impact Level = Power + Proximity + Legitimacy + Urgency + Knowledge

$$\text{Impact Index} = \sqrt{\frac{(\text{Vested Interest} * \text{Impact Level})}{25}}$$

Influence Index = Impact Index * Attitude

The project team (Rank= 1), sponsor (Rank = 2) and customer (Rank =3) are on the top of the list showing that these stakeholders have the highest influence on SEP and therefore the project manager should give them more attention. The project manager has to determine and implement the exact needs of the stakeholders and have ability to adapt various procedures in software development as well as form close relationship with the nominated representatives to ensure that the key issues of cost, time, quality, and end-user satisfaction can be realized. Similarly, the project manager has to beware of the sponsors requirements because of their financial commitments in the project and without which it will be difficult to initiate the project. The project team has to work in line with the sponsors requirements (e.g. progress report, payment procedures, transparency in selection of the qualified team members, etc.). The government (Rank = 4), end-user (Rank = 5), and functional department (Rank = 6) despite the lower rank shown in Table 8, these stakeholders have a high level of influence on SEP in Nigeria. The high rank of government in the analysis is not surprising due to the political matters and policies. The End-user's rank might as a result of their role in the use of the system, and the functional departments have requirements that should be meant to enable them to be part of the system. Suppliers and Society ranked lower than others but the project manager should be aware of them. They might play an active role in making contributions concerning the project.

3.3 Stakeholders' Categorization

The prerequisite steps for categorizing the stakeholders are assessing the attributes of the stakeholders and prioritizing stakeholders. The categorization is based on the impact / probability matrix developed by Olander and Landin (2005). The impact level and the probability of impact are calculated from the analysis of the questionnaires using the formulae developed by Nguyen et al. (2009) and Bourne and Walker (2005), and the results are shown in the Table 9.

Table 9
Categorization of Stakeholders

Stakeholder	Sponsor	Customer	End-user	Functional department	Project team	Supplier	Government	Society
Probability of impact	4.64	4.08	3.14	3.13	4.41	2.55	3.91	1.9
Impact Level	21.37	18.47	14.49	14.42	22.32	10.89	19.18	9.04

Note. Impact Level = Power + Proximity + Legitimacy + Urgency + Knowledge. (Nguyen et al., 2009)
Probability of impact = Vested interest (Bourne & Walker, 2005)

The importance of selected stakeholders in this research is placed on the impact/probability matrix, and then categorized as shown in Figure 2 as follows:

- Key player: Sponsors, Project Teams, Customers, and Government
- Keep satisfied: End-Users and Functional Department.
- Minimal effort: Suppliers and Society

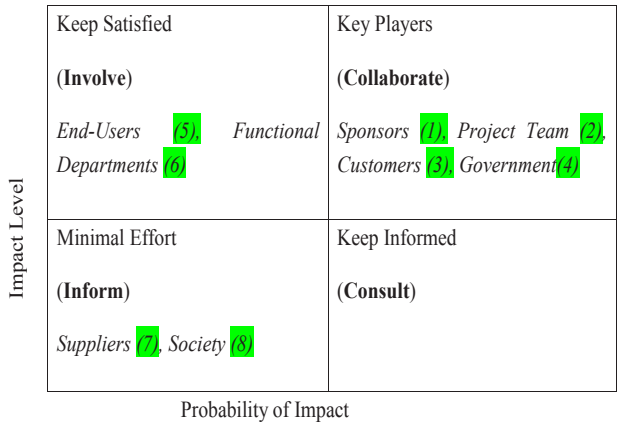

Figure 2
Categorization of Level of Influence

The following results were obtained from stakeholder categorization in Figure 2 in accordance with Chinyio and Akintoye (2008), which said that stakeholders could be managed at any of these four levels (collaboration, involve, inform, and consult). The collaborators (sponsors, project teams, customers, and government) have a high probability of impact and level of influence to the project success. This corresponds to the opinion of stakeholder management researchers (Yang et al., 2011; Nguyen et al., 2009; Bourne & Walker, 2009). All the actors of keeping satisfying group are not involved directly in the exection of the project, but they have some influence effect in the key player group. End-user imposes their influence through the customer by representing their needs and expectations. Functional departments enforce their influence through the requirements and expectations. External stakeholders (suppliers and society) with a lower probability of impact and lower level of impact need to be kept informed of decisions taken that may affect them directly. The Sponsor is the financial party who paid for this software product, Project teams design and implement the activities of the project and supervise the deployment of the product, the customers need the software product, while the government is a senior partner and has the sole power to change the law governing the industry.

CONCLUSION

This paper studied how stakeholder influence is identified in software engineering projects. The following was used to establish the level of stakeholders' influence in SEP assessing the stakeholders' attributes, prioritizing stakeholders, categorizing the stakeholders, and select their level of influence. The respondents were asked to rate the stakeholders according to selected attributes which are: Attitude, Vested Interest, Power, Proximity, Legitimacy, Urgency, and Knowledge. The value of each attribute is used to prioritize and classify the stakeholders and then select their level of influence in SEP. This therefore achieves the objective of this study. The management of the project should work directly with these stakeholders to ensure that their concerns are consistently understood, considered, and reflected in the developed system. This study revealed to the project managers the level of influence stakeholders have on their project. The research also highlighted that the society and supplier may not enact any influence on the project but they might jeopardize the implementation of any decision taken without their knowledge.

Further research can be conducted to analyze stakeholders' influence in private software engineering organizations, since this sector is growing rapidly.

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