JOURNAL OF SYSTEMS AND INDUSTRIAL PROJECT ENGINEERING
JSIPE

Vol. 2, N° 1, July 2016
pp. 59-67
ISSN: 2411-7226

Determination of Critical Success Factor of Development Projects by Theory of Constraints-Thinking Process

Herisoa RAKOTOARIMINO, François A. RAVALISON
University of Antananarivo, 101 Antananarivo-Madagascar

ABSTRACT
This study aims to show the critical success factor relative to a development project. A development project is a project whose goal is to improve targeted people's everyday life. But the problem is that when the funding comes to an end, the impacts of the project results also stop. This research tries to resolve this question which is often seen in some developing countries. The Theory of Constraints-Thinking Processes (TOC TP) was the engineering method used. It was used to highlight the critical success factors of a project. Two of them which are the organizational factor and the human factor were found to be the ones affecting the success of a project.
It can be concluded that the use of the Theory of Constraints-Thinking Process tools to improve management is one of its possible applications. In addition, this method helps to lead and manage change by providing practical guidance on situation assessment and conflict resolution.

Keywords: *Development project, sustainability, critical success factors, theory of constraints*

1. INTRODUCTION

Development projects are currently one of the processes used by the rich countries and donors to contribute to the development of developing countries. Projects can be controlled by a non-government or government agency. But in all cases, they have a goal and a clear purpose: that is to meet the expectations of the population targeted by the project and assure sustainability.
But the common problem is that in general, those development projects are not sustainable in some countries. It is the case of Madagascar. Indeed, the projects supposed to bring pro-poor socio-economic growth have not produced the expected results in terms of quality. Moreover, the life cycle of a project ends with the withdrawal of the donors.
The sustainability problem manifests itself in several facets, for instance in the transfer of jurisdiction from the technicians to the beneficiaries. Concerning the quality of the expected results, the Skinner settings (time-cost-quality-flexibility) were poorly defined and did not allow beneficiaries to directly see the impacts of the project in their daily lives. This has not favoured a participatory and inclusive approach among beneficiaries.
But what are the factors that affect the sustainability of a project in Madagascar?
Murray (Murray 2001), Thite (Thite 1999) and Warne (Warne 1996) state that human and organizational factors impact the success of a project.

2. LITTERATURE REVIEW

Current theories according to Pedrito and Marie Louise (Pedrito et Marie-Louise 2008), tell that success is a broad concept that encompasses different meanings. The success or failure of a project is subjective and, as such, is perceived in different ways, depending on the objectives. In addition, Smith-Doerr

(Smith-Doerr 2004) reinforces that projects can fail in terms of delay, performance and budget, but can still be considered a success in terms of value of the project or customer satisfaction (beneficiary). Therefore, according to the same author, the success of the project depends on the criteria used, and on the fact that the final product will satisfy the customer, to the point of acceptance. Moreover, success depends on the type of project.

There are several factors that affect the success of a project, known as the critical success factors (CSF). These factors may vary during the life cycle of a project. Many authors, including Belassi (Belassi 1996), Belout (Belout 2004), Fortune (Fortune 2006) agree that the following are critical factors in an entire project lifecycle: project mission, management support, project schedule, plans, client consultation, personnel, selection and appointment of competent teams, technical, client acceptance, monitoring and feedback, communication, troubleshooting, the characteristics of the project team, power and politics, environmental effects and urgency.

Pedrito and Marie-Louise (Pedrito et Marie-Louise 2008) say that the success of the project management is not synonymous with project success. It has been argued by Baccarini (Baccarini 1999), Jha (Jha 2006), Lehtonen (Lethonen 2007), Zwikael (Zwikael 2006) and other authors that successful project management can influence the success of the project but it is unlikely to prevent project failure. Also according to these authors, project management is essentially intended to achieve three objectives; complete the project within the budget, within the deadlines and within the specifications. Moreover, Cookies-Davies (Cookies-Davies 2002) and Baccarini (Baccarini 1999) add that the success of a project depends on the effect of final deliverables.

In addition, according to Pedrito and Marie-Louise (Pedrito et Marie-Louise 2008), the theory claims that the project is a success if it achieves organizational goals, satisfies customers/users, satisfies internal and external stakeholders and meets the technical specifications.

3. METHODOLOGY

The theory of constraints (TOC), originally developed by Goldratt, is a management philosophy focusing on continuous improvement process. The central idea of TOC lies in the identification and exploitation of the system constraint in improving a system. TOC is based on the assumption that the performance of a system is determined by the system constraints, which are anything that blocks the system from accomplishing its stated goal, or in achieving a higher level of performance with respect to this goal.

As the first step in improving a system, managers need to determine what prevent the system from reaching its goal. Constraints can be physical or non physical. When the constraints are physical, such as resources, raw materials, or supplies, they can be relatively easily identified by undertaking a capacity analysis. However, if constraints are non physical, such as policies, behaviours, or measures, they are harder to identify.

Theory Of Constraints-Thinking Process was developed as a set of logical tools that enables people to tackle non physical constraints. TOC TP consists of a set of six logical tools which are Current Reality Tree (CRT), Evaporating Cloud (EC)1, Future Reality Tree (FRT), Negative Branch Reservation (NBR),

Prerequisite Tree (PT), and Transition Tree (TT). Each of these six can be used as stand-alone tools (Goldratt 1994) or they can be used together.

- **Principle**

HOW THEORY OF CONSTRAINTS LEADS TO IMPROVEMENT

The improvement process focuses on three questions: *What to change? What to change to? How to cause change?* These three questions must be answered in sequence to make the improvement process effective.

a. What to Change?—Identify the Weakest Link

The first step in the improvement process is to determine what to change. Current Reality Tree (CRT) is used to identify the core problem by revealing causal relationships among the undesirable symptoms that an organization exhibits. Building a current reality tree begins with constructing a list of 'UnDesirable Effects' (UDEs) that are dysfunctional symptoms or behaviours. Once UDEs are identified, the second step is to seek causal relationships between these UDEs and possible causes. Which UDE is the cause of which other UDE? To identify, refine and audit the causal relationships, a set of rules, called the Categories of Legitimate Reservation (CLR) is used to find out if the logic presented makes sense.

b. What to Change to?—Design a Stronger Link

The next step in the improvement process is to determine what to change to.

The Evaporating Cloud (EC) is a tool that helps the decision makers search for a solution by challenging the assumptions underlying the conflict.

The construction of the EC starts with a desired objective (A), such as the opposite of the core problem identified in the current reality tree (CRT). Next is a determination of requirements (B & C) and prerequisites (D & D'). Requirements are the necessary conditions to achieve the objective, while prerequisites are the necessary conditions for requirements. The necessary conditions are verified using the 'IN ORDER TO…WE MUST HAVE…' logic. In order to have the objective A, we must have the requirements B and C. In order to have the requirement B, we must have the prerequisite D. But in order to have the requirement C, we also must have the prerequisite D'. As the two prerequisites D and D' are in conflict, the objective A appears to be unobtainable. The resolution of the conflict requires the hidden assumptions of the necessary conditions to be surfaced and challenged. A solution that invalidates any of the assumptions is called an 'injection'.

EC helps determine the initial thrust or primary injection needed to create a future system that produces the desired effects. However, this primary injection is just the first step. To build a robust solution that actually work, other injections need to be added to ensure that the primary injection achieves the desired results while not creating new, undesirable problems.

c. How to Cause Change?- Operationalize this Stronger Link into the Chain

The last step in the TOC improvement process is the implementation of the solution. Its success depends on the degree of understanding of the participants in the improvement process and on what they might think about the implementation of the change. Participants might have doubts because they may perceive some critical obstacles that prevent the change from being implemented.

The Prerequisite Tree (PT) is a tool used to identify these obstacles and to establish a series of intermediate objectives to overcome

them. The last step in planning is a detailed action plan, embedded in the Transition Tree (TT).

The TOC TP tools are clearly useful in identifying root causes and the primary injection for change. They are also useful as communication tools to facilitate cooperation, collaboration and co-ownership of participants in the improvement process. As a team works together in employing these tools for the purpose of organizational problem-solving and continuous improvement, the team develops strong process skills and mutual trust in the process. Team members learn a common vocabulary and reflective process for communicating about organizational design, conflict management, action planning and organizational learning. (Schon 1983).

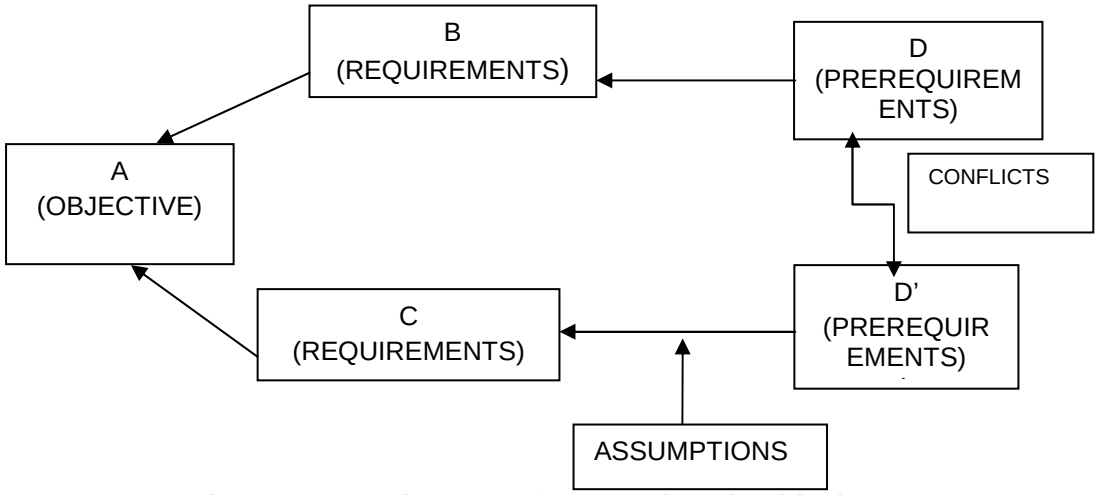

Figure 1: General Format of Evaporating Cloud (EC)

4. RESULTS

4.1. CRT of the organizational factor

All constraints or undesirable effects have been tested and arranged as multiple clusters. A first group of these clusters has produced the following CRT:

The main constraint is at the bottom of the Figure 2 It is the lack of consensus with stakeholders, i-e donors and recipients, during the development of the project. The main constraint has two direct effects: unmotivated beneficiaries and unbalanced spending, respectively first branch and second branch.

For the first branch, if beneficiaries are not motivated, there is no feeling of belonging to the project process, thus no beneficiary satisfaction. For the second branch, starting from the main constraint, if operating costs are too high, there is a conflict of interest between beneficiaries and technicians. This conflict involves the ineffectiveness of transfer of jurisdiction between these two stakeholders involved.

Firstly beneficiaries are dissatisfied by the first branch. Secondly, the transfer of authority is not effective according to the second branch. These two effects at each branch involve unsustainable project after the withdrawal of donors.

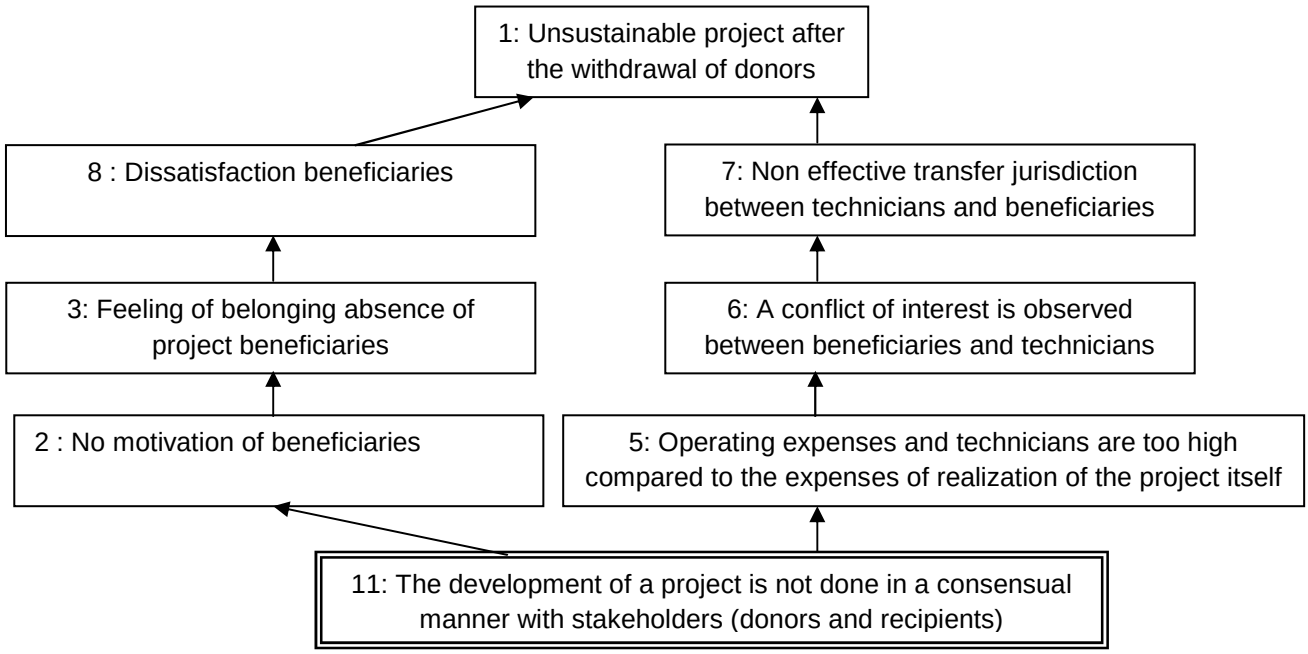

Figure 2 : Current Reality Tree of organizational factor [Source: Author]

4.2. Evaporating Cloud of organizational factor

The main constraint above has been positive and allowed to have a main objective "the project is made with consensus". It is the starting point of the EC on the organizational factor presented by the following figure 3:

Two requirements are necessary for this main objective: donors agree to finance the project on the one hand, and on the other hand, stakeholders composed by the beneficiaries and local authorities adopt a participatory approach. But achieving each of these needs is conditioned by two opposing preconditions: "no consensus approach" to donors and "consensual approach" for beneficiaries and local authorities. These two preconditions, although contradictory, must be satisfied simultaneously.

To solve this problem, the injection of a hypothesis is necessary. The conduct of a quality approach using the Six Sigma process is alleged to remove the contradiction and therefore achieve the main goal.

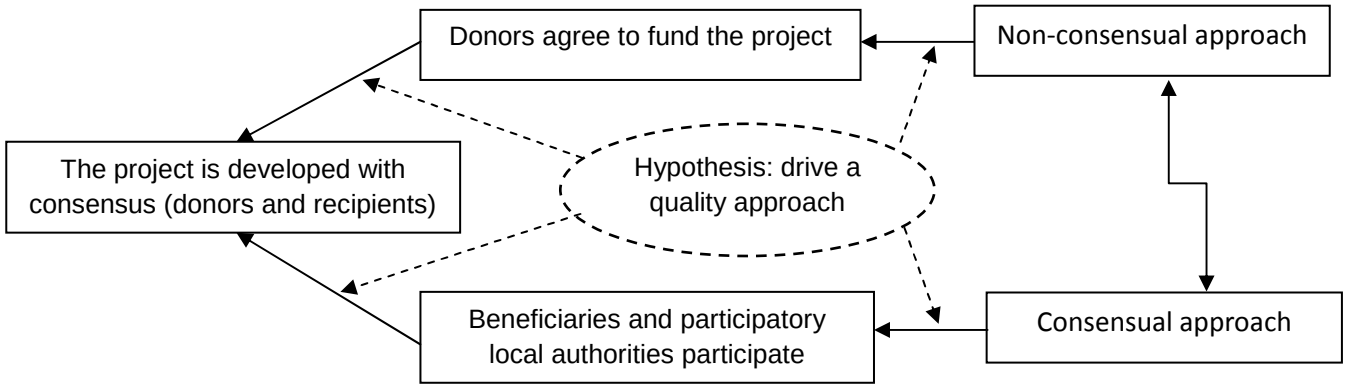

Figure 3: Evaporating Cloud of organizational factor [Source: Author]

4.3. CRT of the human factor

A second group of clusters of undesirable effects or constraints yielded the CRT on the human factor as follows:

In the case of the human factor, the main constraint is "unconsciousness on the usefulness of the beneficiaries of the project in their daily life" .This main constraint generates two effects: "the mentality of the beneficiaries does not evolve following the expected change" and "beneficiaries have no feeling of ownership of the project."

First, if the mentality of recipients does not change following the expected change, then the transfer of skills between technicians and beneficiaries will not be effective and the assistantship feeling persists among beneficiaries. These two constraints have the effect of "the incompetence of the beneficiaries."

On the other hand, the beneficiaries have no sense of belonging to the project so, they are not motivated. Then, if they are not motivated, then they are not satisfied.

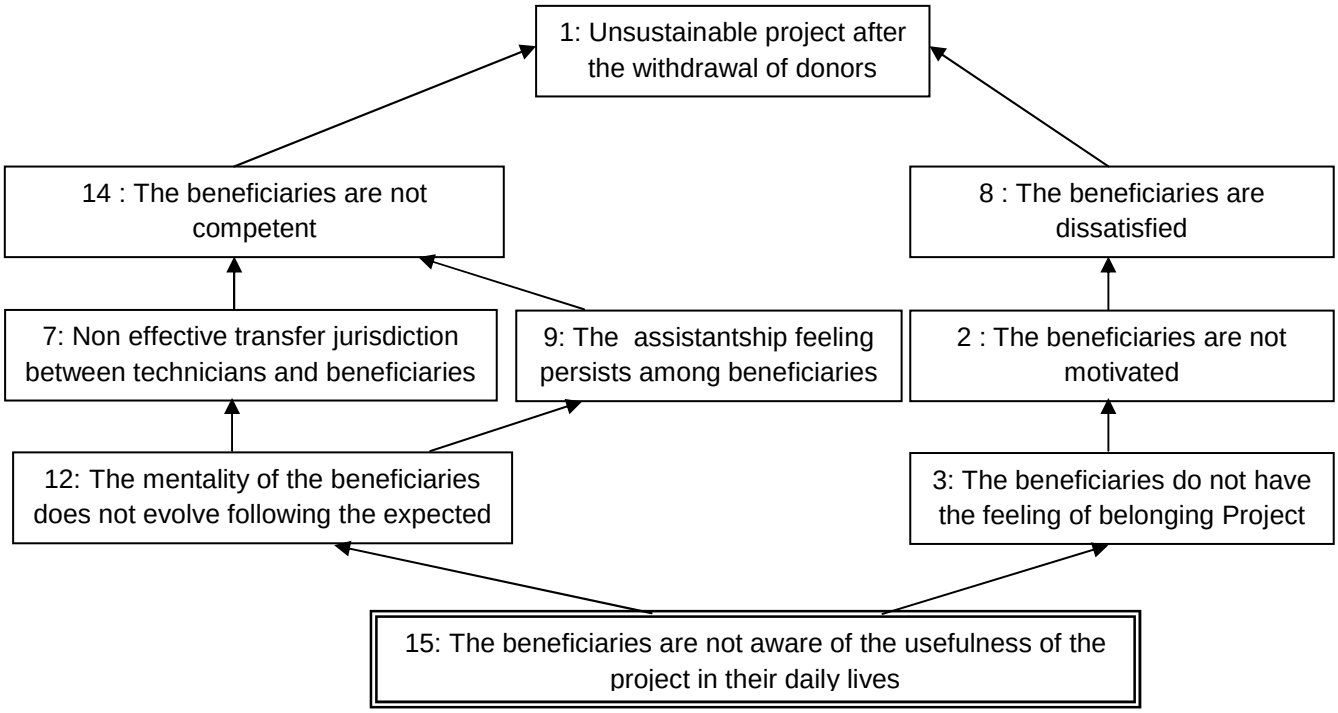

Figure 4: Current Reality Tree of Human factor [Source: Author]

4.4. Evaporating cloud of human factor

The main constraint in the CRT was positive with "beneficiaries understand the usefulness of the project". The EC corresponding human factor is shown in the following figure 5.

To achieve the main objective "beneficiaries understand the usefulness of the project", two requirements are necessary: "the quality of transfer of jurisdiction of the executing agency to beneficiaries is not effective" and "recipients are motivated". But achieving these needs requires two preconditions that are contradictory and must be met simultaneously. They are "focused high operating expenses" and "expenses focused activities".

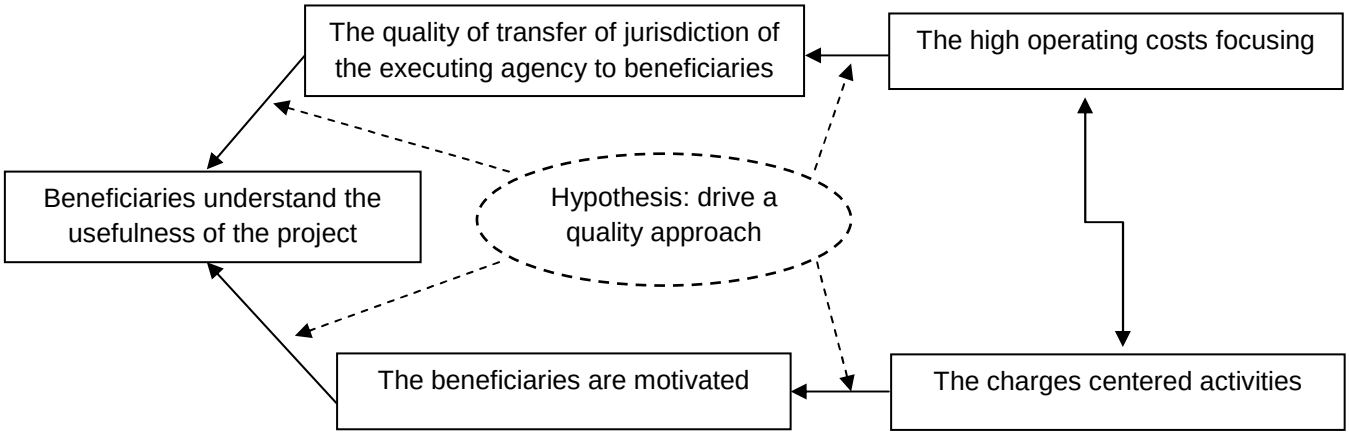

Figure 5: Evaporating cloud of human factor [Source: author]

To achieve the main objective "beneficiaries understand the usefulness of the project", two requirements are necessary: "the quality of transfer of jurisdiction of the executing agency to beneficiaries is not effective" and "recipients are motivated". But achieving these needs requires two preconditions that are contradictory and must be met simultaneously. They are "focused high operating expenses" and "expenses focused activities."

To resolve the issue while raising these contradictions, the injection of a hypothesis based on Six Sigma process is proposed.

5. DISCUSSION

The above results revealed that the organizational and human factors significantly impact the sustainability of a development project. These two factors are the major constraints to the success of a project. And a quality approach using the Six Sigma process achieves quality results, while lifting the constraints involved.

The result shown in Figure 4 demonstrates the involvement of organizational factor in the perpetuation of a development project. This factor has encompassed 50% of the involved constraints. This partly confirms the first hypothesis. This result compared to that was found by Choe and Herman (Choe et Herman 2013) shows a relatively low precision. Choe and Herman (Choe et Herman 2013) were able to develop their CRT organizational factor on the basis of 51% of the identified adverse effects, which is a ratio obtained in the same case as our results. However compared to the literature, Mabin (Mabin 2013) showed that this ratio is 70% that is to say 70% of a principal stress constraint.

In the case of the human factor, 56% of constraints have determined the main constraint according to Figure 5. This result compared to the organizational factor recorded 5 more points, and 3 more points compared to what was found by Choe and Herman (Choe et Herman 2013). The latter, in the case of a business plan, arrived to encompass 54% of the identified constraints. The main constraint-based leadership Choe and Herman (Choe et Herman 2013) is likened to the human factor in our case. But compared to what was confirmed above by Mabin (Mabin 2013), the result found is much lower. These two initial observations show two critical success factors resulting in

the identification of key constraints, organizational and human factor for the sustainability of a development project.

The success of a project depends on the initiative and behaviour of any member of the project team to work together. But it also depends on the relationship of the team with other factors such as the structure, availability of resources, leadership style.

Kerzner (Kerzner 1989) states that "the major factor for the successful implementation of project management is the project manager and the team, so human factors become the focal point of the integration responsibility".

The achievement of a project requires inclusive participation of a variety of groups, including the recipient who is the end user, the project team, the funder. Each party has a role in the definition and determination of success. They all have specific tasks and responsibilities they must fulfil to achieve and sustain success (Kumar 1989). According to Kumar (Kumar 1989) the beneficiary is the main stakeholder involved in the success of long-term project.

Furthermore, the project comes from a requirement to meet initial needs of the recipient. This initial requirement should be kept in the minds of all those involved in the project. And Pinto and Prescott (Pinto and Prescott 1988) say that the critical success factor of a project varies depending on the life cycle of the project. They also conclude that there is not enough connection between the organizational context and the success of a project. However, the communication and consultation of beneficiaries are the organizational factors that impact the success of a project according to Hyväri (Hyväri 2006).

6. CONCLUSION

A project is often set up to change the daily life of beneficiaries. But the problem we raised during our research is the negative finding that often, the withdrawal of donors marks the end of the project and its impact on the beneficiaries.

We can say that the project is a success or a failure according to what the beneficiaries feel. It is judged a success if its effects last, even after the termination of the funding.

Our study revealed that the organizational and human factors are the two factors that impact the development project.

Initially, organizational factor (techniques and methods) has been shown to impact on project success. Indeed, projects financed by donors are often made of top-down manner i-e donors dictate the use of project funds (imposed by the different budget lines). In our case, we were able to prove that if the project is not done by consensus with stakeholders and donors then it will not be sustainable. We mean that the beneficiaries are the ones who really know what the benefeciaries need, not a third party Collaboration should be implemented to improve the outcome of the financial aid provided by donors.

Furthermore the human factor including the project team, beneficiaries and local authorities, also impacts on the sustainability of the project; the beneficiaries do not understand the usefulness of the project in their daily life. The fact is that sometimes, the operating expenses of project staff, including those of technicians, are higher than those allocated to the activities. So there is a conflict of interest between the two parties, the beneficiaries do not feel their belonging to the project because it has no direct impacts on their everyday life.

7. REFERENCES

Atkinson, R. "Project Management Cost, Time and Quality.Two Best Guesses and a Phenomenon, it's time to accept other success criteria." *International Journal of Project Management*, 1999: 337-342.

Baccarini, D. "The Logical Framework Method for Defining Project Success." *Project Management Journal*, 1999: 25-32.

Cookies-Davies, T. "The Real Success Factors on Projects." *International Journal of Project Management*, 2002: 185-190.

Diallo, A. "The Success Dimensions of International Development projects: the Perceptions of African Project Coordinators." *International Journal of Project Management*, 2004: 19-31.

Herman, Steyn. *A Framework for Managing Quality on System Development Projects.* Pretoria, South Africa, 2008.

Hyväri, I. "Success of Projects in Different Organizational Conditions ." *Project Management Journal*, 2006: 31-41.

Hyväri, Irja. "Success of Projects in Different Organizational Conditions." *Project Management Journal*, September 2006.

Jha, K and Iyer K. C. "Commitment, Coordination, Competence and The Iron Triangle." *International Journal of Project Management*, 2006.

Kerzner, H. *Project Management, a systems approach to planning, scheduling, and controlling.* New York: Van Nostrand Reinhold, 1989.

Larson, E. W. and D. H. Gobeli. "Significance of Project Management Structure on Development Success." *IEEE Transactions on Engineering Management*, 1989: 119-125.

Lethonen, P. and M. Martinsuo. "Three ways to fail in Project Management. Role and Improvement needs of a Project Management Methodology." *Retrieved 11/06/07 World Wide Web,.* juin 11, 2007. http://www.asb.dk.

Lewis, M.A. "Success, Failure and Organisational Competence: a Case of the New Product Development Process." *Journal of Technology Management*, 2001: 185-206.

Lim, C.S and M. Z. Mohamed. "Criteria of Project Success: an Exploratory Re-examination." *International Journal of Project Management*, 1999: 243-248.

Mabin, Victoria. 2004. http://www.systemdynamics.org/.../para104 (accessed Février 7, 2013).

Mahaney, R. C. and A. I. Lederer. "The Effect of Intrinsic and Extrinsic Reward for Developers on Information Systems Project Success." *Project Management Journal*, 2006: 42-54.

Meredith, J. K. and S. J. Mantel. *Project Management - A Managerial Approach.* Willey & Sons, 2003.

Munns, A. K, and B. F. Bjeirmi. "The Role of Project Management in Achieving Project Success." *International Journal of Project Management* XIV, no. 2 (1996): 81-87.

Pinto, J. K., and J. E. Prescott. "Variations in Critical Success Factors Over the Stages in the Project Life." *Cycle Journal of Management* XIV, no. 1 (1988): 5-18.

Pinto, J. K.and Prescott J.E. "Planning and Tactical Factors in the Project Implementation Process." *Journal of Management Studies*, 1990: 305-527.

Schon, D. *The Reflective Practitioner, How Professionals Think in Action.* New York, NY: Basic Books, 1983.

Senhar, A.J., A. Tishler, D. Dvir, S. Lipovetsky, and T. Lechler. "Refining the Search for Project Success Factors: a multivariate, typological approach." *R & D Management*, 2002: 111-126.

Smith-Doerr, L., I. M. Manev, and P. Rivoza. "The Meaning of Success: Network Position and the Social Construction Outcomes in an R & D lab." *Journal of Engineering Technology Management*, 2004: 51-81.

Van der Westhuizen, D. and E. P. Fitzgerald. *Defining and Measuring Project Success. .* Juin 13, 2007. http://0-eprint.usg.edu.

Wit, de A. "Measurement of Project Success." *Project Management*, 1988: 164-170.

Yu, A. G., P. D. Flett and J. A. Bowers. "Developing a Value-centred proposal for Assessing Project Success." *International Journal of Project Management*, 2005: 428-436.

Zwikael, O. and Globerson S. "From Critical Success Factors to Critical Success Process." *International Journal of Production Research*, 2006: 3433-3449.