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LIFE CYCLE THINKING APPLICATION ON PROJECTS MANAGEMENT IN MINAS GERAIS GOVERNMENT: A CASE STUDY OF POLE OF ENVIRONMENTAL INNOVATION PROJECT

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The Government of Minas Gerais, in its strategic plan 2011-2014 established the sustainable economic development as one of its strategies and in this context born the Pole of Excellence in Environmental Innovation (PEEI). A major challenge in the environmental projects development field is integration and achieving multi-stakeholder consensus for collaborative joint projects to decision making. A critical aspect in the decision making process is to enable stakeholders to not only interpret and make decisions based on politicians judgments, but also to appropriately involve many sector to decision making process. Therefore, scientific analyses in multi-stakeholder contexts can assist responsible decision making in environmental and innovations public projects. As the main goal of this paper is presents an outline of a Life Cycle Thinking to support sustainable decision making in multi-stakeholder contexts to innovation and environmental public projects. The framework is discussed and compared to other common methods used to support environmental decision making in development projects. We argue that the fundamental concept of life cycle thinking can be effectively used to incorporate stakeholders in the research and decision making process, which can lead to more comprehensive, yet achievable assessments in collaboration with stakeholders.

Keywords: *Stakeholders; Life Cycle Thinking; policy making*

APLICACIÓN DEL LIFE CYCLE THINKING EN PROYECTOS DEL GOBIERNO DE MINAS GERAIS: CASO DE ESTUDIO DEL POLO DE INNOVACIÓN AMBIENTAL

El Gobierno de Minas Gerais, en su plan estratégico 2011-2014 establece el desarrollo económico sostenible como una de sus estrategias y en este contexto nace el Polo de Excelencia en Innovación Ambiental (PEIA). Un reto importante es la integración y el logro de un consenso de múltiples stakeholders para proyectos conjuntos en la toma de decisiones. Un aspecto crítico en el proceso de toma de decisiones es permitir a los stakeholders, no sólo interpretar y tomar decisiones basadas en juicios políticos, sino involucrar adecuadamente a muchos sectores. Así, los análisis científicos de múltiples stakeholders pueden ayudar en decisiones responsables en proyectos públicos ambientales y de innovación. El objetivo principal de este trabajo es presentar un esbozo de la utilización del "Life Cycle Thinking" (LCT) para apoyar la toma de decisiones sostenible en contextos de múltiples stakeholders a proyectos públicos ambientales. Se discute el marco y en comparación con otros métodos comunes usados para apoyar la toma de decisiones ambientales en los proyectos de desarrollo. Se argumenta que el LCT se puede utilizar con eficacia para incorporar los stakeholders en el proceso de investigación y toma de decisión, que puede conducir a una evaluación más completa, en colaboración con los stakeholders.

Palabras clave: *Stakeholders; Life Cycle Thinking; Elaboración de Políticas*

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1. Introduction

The Planet is currently confronted with the deterioration of the natural resources, and this is mostly due to human activities and massive manufacturing around the world. This causes great impact on the planet. To confront such environmental and sociological aspects it is necessary not only rethink our production system globally but also the way of design, construction, consumption and governance (Tyl, *et al* 2011).

Taking into account environmental issues in product or service design is a critical step in the direction of a responsible design. Companies traditionally take into account technical and economic criteria first, but sustainability aspects like eco-design, Life Cycle Thinking (LCT), Life Cycle Assessment (LCA) start to be important on decision making (Tyl, *et al* 2011).

The most common environmental assessment methods such as environmental impact assessment (EIA), social impact assessment (SIA), and life cycle assessment (LCA) are generally carried out for one specific stakeholder to assist their decision making to turn their practices more sustainable or greener. In community development, however, sustainable planning requires the commitment of a number of stakeholders in different disciplines. This case can apply to many organizations like a regional (State) government. (Bradley K., Rochlin A., 2000 and ADB 2005).

Life Cycle Thinking (LCT) is about going beyond the traditional focus and production site and manufacturing processes to include environmental, social and economic impacts of a product over its entire life cycle. The main goals of LCT are to reduce a product resource use and emissions to the environment, as well as to improve its socio-economic performance through its life cycle. This may facilitate links between the economic, social and environmental dimensions within an organization and through its entire value chain. (UNEP, 2009)

The basis of the LCT perspective is the Life Cycle Assessment and the norm ISO 14040 (ISO, 2006) defines Life Cycle Assessment (LCA) as a "compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle". In some cases, additional variables must be considered, such as additional positive outputs or how much part of a process impact should be assigned to each one of the products or services. Choosing a relevant allocation method for environmental impacts becomes critical and the social aspects further analysis (Collado-Ruiz *et al, 2010*).

- LCT in stakeholder project: In contemporary sustainable planning and policy, the paradigm is that the community is at the center of the process and the stakeholders, including the community, are empowered to influence and share control over development initiatives, decisions, and the resources affecting them (Allen W. & Kilvington M., 1999). In this context, science is challenged to work with the community and the respective stakeholders to enable them to identify and interpret broad environmental issues interlinked with economic and social aspects, and support decision making for long lasting development solutions within the

community's capabilities (Van MB., Rijkens-Klomp N., 2002). This has led to efforts to propose scientific analyses, e.g., environmental assessment methods in stakeholder contexts of Pole of Environmental Innovation of Secretary of Science, Technology and High Education of Minas Gerais State-Brazil, more transparent, participatory, to provide useful information to assist responsible decision making to government projects (Kasemir B. et al, 1999).

- Challenges in public projects: In stakeholder contexts with different interests, the fundamental concept of life cycle thinking can be effectively used to incorporate stakeholders in the assessment and decision making and policy making process which can lead to more comprehensive, yet simple and fluent assessments together with the stakeholders. Life cycle thinking is a way to examine environmental impacts of activities, but also a way to comprehend and visualize a broader set of upstream and downstream consequences of decisions in development planning and implementation (Lanka T. et al, 2009). In this case, to implement LCT in a governmental project management was followed the perspectives: assess internal and external environment. This perspective was chosen because the knowledge of LCT was very low and would be necessary to mapping the project with a internal and external views. The ability to break down activities in life cycle stages with the flexibility to inventory economic, social, and environmental aspects and evaluation of this aspects to influence in a better public policy making, can be very useful for stakeholders (Akai M., 1999 and UNEP-SETAC, 2006). A life cycle framework including the mapping of stakeholder involvement at each activity in upstream and downstream stages would give stakeholders a holistic view of issues that they otherwise may not have (Figure 01). It could identify their specific roles in relation to the roles of other stakeholders, the resources required from stakeholders for each project, and the costs and benefits of decisions. This perspective is particularly suited for programs and projects that go beyond sector limits like allocation problems in many cases, which is a timely need in the development field and can potentially enable sustainable development by providing a basis for consensus building in joint programs and projects (Innes JE., 1996). In many situations, the consensus and the decision making between public projects and institutions are not effective and efficient and the big part of the projects have no continuous work.

-The Case of Pole of Environmental Innovation: This project from Minas Gerais State in Brazil, whose goal is foment your direct stakeholders like companies and institutions from Minas Gerais State, to integrate a LCT perspective in your management projects to create a culture of life cycle view of the specifically process or product or services and foment the use of new technologies of low carbon (cleantech), where economically viable. This goal would be achieved facilitating the connections between Universities and companies inside and outside of Minas Gerais where help to implement this life cycle vision and connect with different green technologies to improve some process. The application of assess have a regional character, focused on zone interference of the Pole, the Metropolitan Region of Belo Horizonte, Brazil.

When governments design policy, negotiate voluntary agreements with industry, decide where to invest resources, commission new office buildings, or even purchase paper for offices, LCT can be used. Measuring potential life cycle impacts of decisions can help governments to in their efforts to:

• Inform government programs and help priorities these programs, based on life cycle information.

• Make policies more consistent among consumers, producers, suppliers, NGO´s, public and private companies, retailers, and also among different policy instruments (e.g. harmonising regulations, voluntary agreements, taxes, and subsidies).

• Promote pricing products and services to accurately reflect the costs of environmental degradation, health problems, reduction of social welfare, and impacts at other projects and production life cycle stages. Such a policy can provide incentives for consumers and businesses to continuously improve the environmental and social performance of products or services, across each stage of the life cycle.

This paper presents an outline of a management project and life cycle thinking (LCT) approach, that can be used to support sustainable decision making in public institution namely on the project cited above using the strategy of assess internal environmental and assess external environment of the own governmental projects and foment the use of this methods in small regional companies from metropolitan region of Belo Horizonte.

Two environmental assessment methods frequently used in project assessment, namely Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA), are reviewed, the strengths and weaknesses of these methods, including their adoption of participatory approaches, are evaluated relative to the needs in stakeholder contexts. Criteria are used to evaluate the methods' applicability in a stakeholder integrated development planning process. Then, using the same criteria, a life cycle approach called assess internal environment and assess external environment was used to present the manage process of the Pole projects.

2. State of the Art

2.1 Life Cycle Thinking in stakeholders contexts

According with Hajer and Wagenaar (2003), stakeholder means the inclusion of multiple perspectives sharing individual concerns with each other rather than focusing simply on the needs of only one stakeholder. Stakeholder contexts in development involve various actors from national governmental organizations, international organizations, civil society, and the private sector encompassing various disciplines such as urban development, land and natural resource management, mine industry and cleantech sector.

When we talk about application of Life Cycle Thinking and Life Cycle Assessment on government projects, in cross-sectoral integrated planning process, this can be effectively to analyze upstream requirements and downstream consequences and results of strategies while improving collaboration in joint environmental projects.

In an integrated planning process, life cycle thinking could be applied in concert with the stakeholders in multiple stages to, for example, set goals, analyze and assess the current state and the distance to the target goals for the development, assess alternative scenarios, develop and select between alternative implementation strategies, and develop indicators for monitoring and evaluating outcomes. For this, the first step, was created a intelligence bureau (Figure 1), a software platform to connect some projects from govern and approach of the new technology and best practices on the time.

Figure 1: First step of LCT implementation, focusing in Intelligence Bureau. (provided by master document of PIA project)
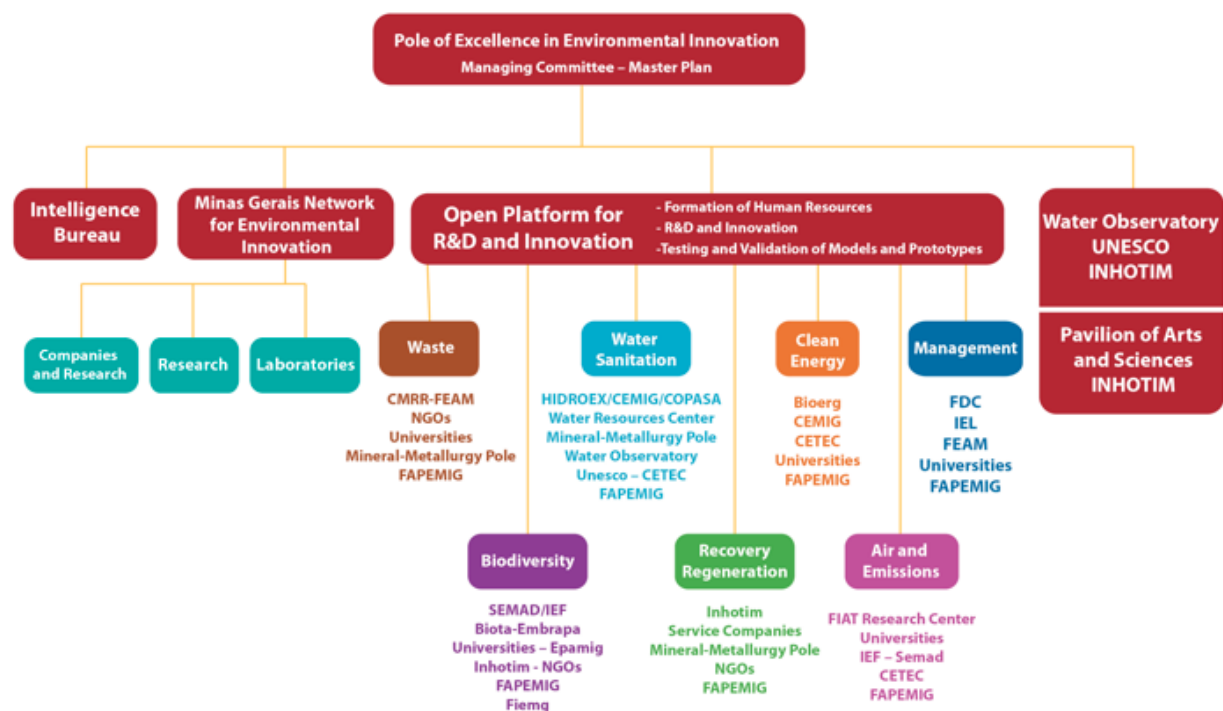
3. Common methods to environmental and social decision making and implementation of life cycle thinking

One of the major challenges on public project is to promote planning common or joint activity programs in manageable scales so that the interlinked interests and sectors can be integrated, reducing the conflicts in implementing projects and achieving the common goal based in three sustainable aspects: economic, social and environmental points applied on regional (state) community. These plans can be based in the two consensual methods of sustainable projects, (1) environmental impact assessment (EIA) (2) and social impact assessment (SIA) (Lanka T. et al, 2009). Each attempt to achieve the objective of ensuring that sustainability aspects are

considered within the entire planning, project and policy-making cycle was used on Pole experience.

To integrating sustainability aspects, making methods useful for stakeholders collaboration and cross-sectoral integration in joint projects is a important aspect in sustainability planning.

3.1 Environmental Impact Assessment

Environmental impact assessment (EIA) is a collection of procedures used to formulate decisions and serves as a guide, which offers an orderly, replicable, and cross-disciplinary assessment of possible bio-physical, cultural, social, and economic impacts of a future activity (INECE, 2013). This assess is accepted as a method that can contribute to richer a conceptual understanding a life cycle thinking and sustainable development. However, many stakeholders understand EIA is performing unsatisfactorily in practice, specially when talk about Government sectors (Sheate WR 2003; Benson JF., 2003).

The ability to incorporate scenario and strategy development in addition to assessment is difficult and not intuitive. Many EIA applications are single-project-based, involving only direct stakeholders (World Bank, 1991). Indirect stakeholders and inter-linkages of activities are harder to represent. Hence, EIA is considered to be a good way to assess a selected project, but not as well suited to reducing uncertainty and transaction costs and achieving the commitment of multiple government stakeholders in joint projects for sustainable development, (UNDP China, 2002).

3.2 Social Impact Assessment

In participatory approaches to Social Impact Assessment (SIA), affected communities observe that their knowledge and experience are appropriately recognised in impact assessments, helping to establish legitimacy and trust among the various parties (Van Scooten 2003).
Yet SIA generally remains a sub-component of environmental impact assessment, and the resources devoted to it are small relative to the biophysical assessment process. In addition, while SIA is considered important by governments, proponents will often seek to meet the minimal requirements of under-resourced and capacity-constrained regulating bodies (Esteves et al, 2012). One of the objectives of an SIA is analyzing how a project may affect people, and how a social change could be better managed (UNEP, 2003). However, other experts have defined SIA as having an initial phase that includes problem analysis and project design, and a main phase that includes scenario and strategy development, assessment of impacts, ranking of strategies, and evaluation (Becker HA 2001). Similar to EIA, it is used for sectoral project-based analysis, and does not necessarily reduce uncertainty and transaction costs, nor does it facilitate achieving the commitment of multiple stakeholders for joint project development.

Further variability may derive from the inconsistency of authorship of SIAs, which may be carried out by the many institutions themselves or by appointed consultants with varying degrees of independence. To this end, some SIAs represent little more than social profiles of

the affected communities, drawing on publicly available data without additional inspection of context or issues that resource development may bring (Esteves et al. 2012).

The evaluation of these two methods indicates that multiple separate assessments, which would typically be project-based, would be required for an integrated sustainability assessment. Using multiple methods has led to increased complexity and dissimilar interpretations by the various stakeholders (Thabrew. L 2009). Inherent limitations in the methodologies, especially for providing a holistic view of the issues and problems, motivated the current research and the development of a technique which can accommodate transparent simple analysis, integrate sustainability aspects, stakeholder knowledge, and stakeholder participation throughout the planning process, and communicate results through easily understood indicators (Table 1).

To contrast the common method to assessment the typical project-base we used to complement this way the methods of: (i) Assess internal environment and (ii) assess external environment. This methods was used to start the process of implementation of Life Cycle Thinking on this specific governmental Project.

(i) Assess internal environment (AIE)

Understanding the internal context is essential to confirm that meets needs of the institution and of its internal stakeholders (EMPG, 2011). It is the environment in which the institution operates to achieve its objectives and which can be influenced by the institution to manage projects, this may include:

· the capabilities, understood in terms of resources and knowledge (e.g., capital, time, people, processes, systems, technologies);
· information systems, information flows and decision making processes;
· internal stakeholders;
· the policies, objectives and strategies in place to achieve them;
· perceptions, values and culture;
· standards and reference models adopted by the institution; and
· structures (e.g., governance, roles and accountabilities).

(ii) Assess external environment (AEE)

Understanding the external context is important to ensure that external stakeholders, their objectives and concerns are considered. The external context is the environment in which the institution seeks to achieve its objectives and may include:

· the cultural, political, legal, regulatory, financial, technological, economic, natural and competitive environment, whether international, national, regional or local;
· key drivers and trends having an impact on the institution's objectives; and
· the perceptions and values of external stakeholders.

Table 1: Comparison of assessment methods in stakeholders using a life cycle thinking perspective

|	Criteria	Method	
		EIA	**SIA**
1	Stakeholder involvement in all stages	No	Yes
2	Assess all dimensions of sustainability	Yes	Yes
3	Assess alternative scenarios	To a moderate extent	Yes
4	Transparent assessment and results	To a limited extent	To a moderate extent
5	Consider holistic view of issues	No	No
6	Adapt to data scarce situation	Yes	Yes
7	Deal with cross-sectoral issues and highlight inter-linkages	To a limited extent	To a limited extent
8	Accommodate strategy building	No	Yes
9	Promote consensus building	To a moderate extent	To a moderate extent
10	Clear and easy communication of results	To a limited extent	To a moderate extent

Scale: No (no applicable of method); Yes (applicable to the method); To a moderate extend (applicable using this criteria, but no for all kinds of projects) and To limited extend (applicable a limited extent using determinate criteria)

5. Overview and partial results of the project

Established national or local standards, recommendations, or regulations can be used to establish a set of metrics, conceptually based on the distance of the current state to targets set by the standards. The Pole of Environmental Innovation, mapped the stakeholders and related activities as well as the resulting economic, social, and environmental impacts will enable the stakeholders to expand their thinking and, therefore, potentially expand their contributions towards the issues that may promote or hinder sustainable development within a local and national sustainable projects (Figure 2).

The impacts are qualitative or quantitative depending on data availability and the nature of the project impact. This in turn is expected to assist stakeholder agreement on the most pressing problems in a market or in a community, and encourage stakeholder commitment and cooperation towards developing joint programs and projects which fit well with community needs and aspirations, available resources, and adoptable LCT view on your managed projects.

Figure 2: Systematic view map of multi-stakeholders of the Pole of Environmental Innovation.
(provided by master document of PIA project)
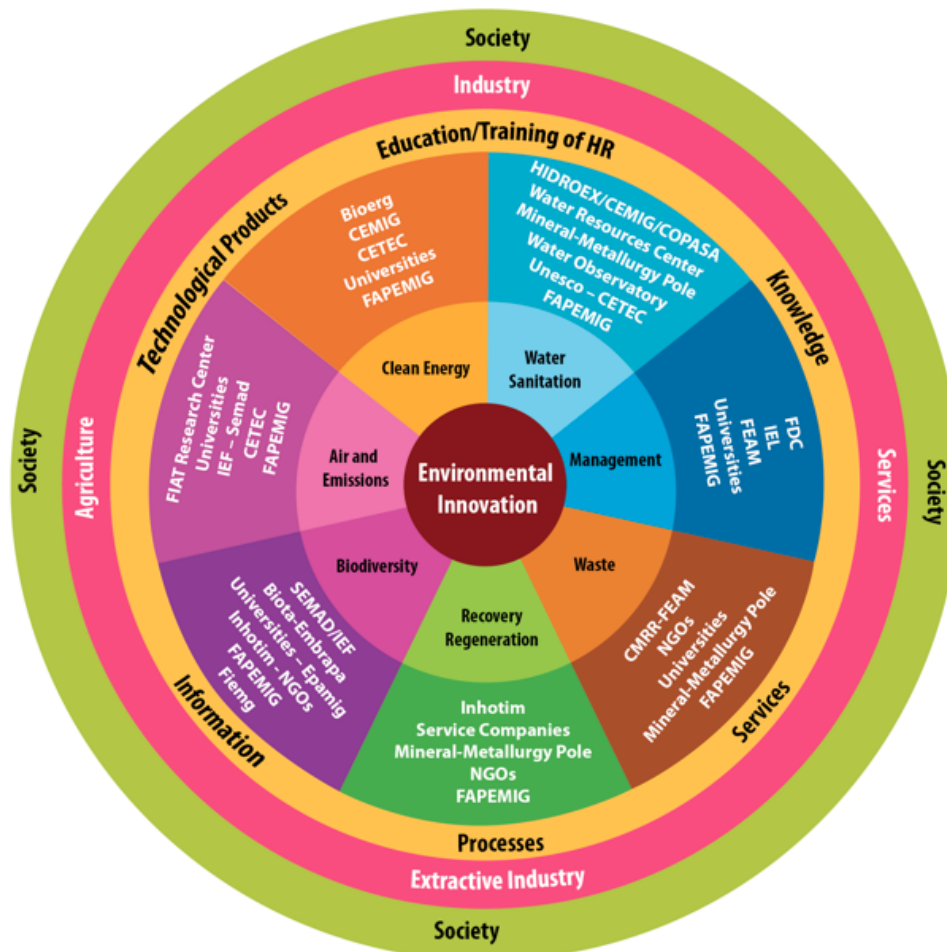
The data and information of the others projects of Pole, in different regions and areas, can be reused in other projects, gradually lessening the data collection required for sustainable decision making. In many cases, this process would be incremental, with the full application of the life cycle framework occurring over time. For this reason, we believe that highlight of Life Cycle Thinking, focus on internal and external assess is a method of evaluating alternative and the close collaboration required among stakeholders in many different sectors in order to address the environmental, social and economic view of the sustainability of the governmental project.

6. Conclusion and outlook

The management in governmental projects has a particular perspective, many small companies show interest in implement in your management project environmental process, but in general did not know the life cycle view of your process and the goals of this project present new ideas and future perspectives for the process management of this companies. For this reason we suggest the use and application of stakeholder management in a context of Life Cycle Thinking. This perspective can give a new view of public projects and benefits own project and others government stakeholders. In this case, the relationship between other public sectors, companies and institutions is clear when will accord a real project and involve spend of time and money. Whenever a problem or challenges relates a several stakeholders, it is likely to have a complexity that cannot to be handled by one actor. In this situation the institution should adapt an issue-objectives stakeholder management using the life cycle perspective to solve the problem by communication and collaboration between the stakeholders of the issue (Mitchell et al., 1997).

However, currently used tools for environmental decision making are limited in their ability to adequately address the needs of the stakeholders in many situations. This leads to challenges in planning and implementing projects, particularly when stakeholder collaboration across traditional planning sectors is required.
Life Cycle Thinking, must be flexible and work with limited as well as rich data sets, have a life cycle perspective while identifying the dependencies between sectors, assess multiple aspects of sustainability and be able to generate alternative scenarios and strategy building for implementation to the management projects of the Pole.

Generating information both quantitative and qualitative together with the stakeholder knowledge contributes significantly to improved understanding and increased transparency. This may lead to reduced uncertainty and transaction costs, and build consensus among stakeholders. Life Cycle Assessment with its underlying concept of Life Cycle Thinking can be both an assessment as well as a consensus building tool in an integrated development planning process in many sectors of public administration, starting from an environmental projects like the Pole of Environmental Innovation.

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