

The Web of Projects: In Search of a Continuous Flow of Sustainable Projects

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Abstract

Nowadays, the traditional approach of Project Management, as described by PMI's (Project Management Institute) PMBoK® (Project Management Body of Knowledge) Guide, divides it into nine knowledge areas: project integration, scope, time, cost, quality, human resource, communications, risk and procurement management. This is the reductionist approach, where a subject is divided into its constituent parts and one tries to understand the whole from its parts. The objective of this paper is to approach the evolution and expand the understanding of Project Management discipline through the eyes of the General Systems Theory, Cybernetics, Deep Ecology and Chaos and Complexity Theory. Thus, it is possible to understand, from the point of view of these traditional theories, how the changes in the world are affecting the concepts and the human side of Project Management and how themes like ecology, network and sustainability should be inserted and connected into the context of Project Management.

Keywords

Project Management; General Systems Theory; Sustainable Projects; Cybernetics; Deep Ecology; Chaos and Complexity Theory

INTRODUCTION

The traditional approach of project management, as described by PMI's (Project Management Institute) PMBoK® (Project Management Body of Knowledge) Guide [1], divides it into nine knowledge areas: project integration, scope, time, cost, quality, human resource, communications, risk and procurement management. This is the reductionist approach, where a subject is divided into its constituent parts and one tries to understand the whole from its parts.

Usually a project is related to change, because each change may be accomplished by a project. But, what is changing? Until the 19th century, the mechanistic approach, i.e., to view the world as a machine and understand the whole from its parts, was dominant. In the 20th century, this view started to change and a paradigm shift took place. From the human side, changes in thoughts and values took place, where the change from self-affirmation to integration is one of the most important [2]. In the organizational structure, the self-affirmation is translated into the organization's

functional and hierarchical structure, where the manager affirms him

self in the position, where power means the dominance on others. The change to integration is translated into more flexible and network structures, like the matrix or "projectized" organization, characterized by intense interaction among multidisciplinary, more empowered and qualified teams, where power means the influence on others, not dominance. This is the context which makes the project management to have more and more demand and acceptance, impacting on organizational culture and on employee's performance, motivation and job satisfaction.

From the system point of view, a project can be defined as a set of interdependent parts and in permanent interaction, constituting this way a synergic whole, with the objective to achieve defined goals, and interdependent also in relation to the environment, being influenced by it and influencing it. This is simply the definition of open system presented in [3] and that is the way the project will be seen in this paper.

The complexity of the world is increasing and affecting how projects and project portfolios should be managed. Thus, the understanding of the project context from some traditional and emerging theories, such as the General Systems Theory, Cybernetics, Deep Ecology and Chaos and Complexity Theory may help the project management community to develop new approaches to deal with the project environment and enhance its contribution to the organizational success.

PROJECT MANAGEMENT AND GENERAL SYSTEMS THEORY

Ludwig von Bertalanffy elaborated concepts of open systems and the General Systems Theory which established the systems thought as a recognized scientific movement.

Bertalanffy defined the General Systems Theory as a general science of the "whole" and dedicated to replace the mechanistic fundamentals of the science by the holistic vision. The newtonian mechanics was a science of forces and trajectories, whereas the evolutionist thought, which leads to concepts of change, growth and development, demanded a new science of complexity [2].

Sadi Carnot established the thermodynamics laws, where the concept of entropy was created to represent a disorder measurement. Any isolated or "closed" physical system

will lead spontaneously towards an ever increasing disorder, in a state of thermal equilibrium. However, live systems evolved from disorder to order, towards ever increasing states of complexity. Then, Bertalanffy called those systems as "open" because they need to be fed by a continuous flow of matter and energy extracted from the environment in order to stay alive [2]. Thus, the concept of "open systems operating distant from its equilibrium, in a 'stationary state' characterized by continuous flow and change" [2] may be transported to the project context as the project may be taken as an open system.

Bertalanffy believed that a general systems theory would offer general concepts to unify various scientific disciplines which became isolated and fragmented. Nowadays, with the complexity of the projects translated into the multidisciplinary, where various specialities are necessary to make the project feasible, those concepts of General Systems Theory may be of great help.

It is the duty of the project manager, for example, to reach an optimum degree of generality: "somewhere between the specific that has no meaning and the general that has no content"[4].

General Systems Theory "is the skeleton of science in the sense that it aims to provide a framework or structure of systems on which to hang the flesh and blood of particular disciplines and particular subject matters in an orderly and coherent corpus of knowledge" [4]. The PMBoK® [1] tries to be such a skeleton, however when the project management is separated into its nine knowledge areas, each area loses the properties of the whole, because the project is in fact composed by the interactions and relationships of those nine areas and more, including the ecological area, for instance.

The General Systems Theory points out the "interdisciplinary movement", with the objective to develop a framework of general theory enabling one specialist to obtain relevant communication from other specialists. The context of project management is, in its majority, multi and interdisciplinary, which makes General Systems Theory very useful to Project Management.

PROJECT MANAGEMENT AND CYBERNETICS

Cybernetics may be defined as the science which studies the communication and control process among machines and of the man-machine complex interactions. Norbert Wiener had already previewed the application of cybernetics in live organisms and social systems. Here, projects, as they are composed by people who manage and execute tasks, are considered social systems.

The Cybernetics concentrates in patterns of communication and control, specially in closed loops and in networks. Its investigations led to the concepts of feedback, self-regulation and self-organization [2].

The concept of feedback is largely known and accepted nowadays, although it is not explored in the PMBoK® [1], for example, when describing the project management process interactions. The feedback forms a closed loop

where each effect feeds the following event until the last feeds the first. This closed loop has the consequence of self-regulating all the system, as the initial effect is modified each time it travels throughout the cycle. According to Norbert Wiener, the feedback is the control of a machine based on its effective performance, not on its planned one. The same way, in the project context, the control consists in basically compare the effective and planned performance and feedback it based on the differences between both.

Wiener and his colleagues also recognized the feedback as the essential mechanism of homeostasis, the self-regulation which allows the live organisms to maintain itself in a state of dynamic equilibrium [2]. It can be said that this dynamic equilibrium is the objective of project management. The equilibrium line is the planning. The actions and decisions are taken in order to maintain the project in equilibrium, or according to its planning.

The project, as it is composed by people, may also be faced as a live system. The neurologist Ross Ashby recognized clearly that live systems are energetically open, although they are organizationally closed. This concept may also be applied to project management, where the people interact with the environment (energetically open), however it has its own way to organize itself, trying to keep stable along the project, in spite of the exchange of energy with the environment (organizationally closed) [2].

The feedback may be advantageous or not, depending on the conditions. Wiener describes in [5] that a feedback which is too brusque, under certain conditions of delay, will make the rudder overshoot. This will be followed by a feedback in the other direction which makes the rudder overshoot still more, leading to a wild oscillation until the complete break down of the system. Of course, this situation may happen to a project or to a project portfolio, when wrong decisions based on the feedback of effective performance are taken.

Using the language of Cybernetics, it may be said that the objective of project management is to create systems in the form of projects, which are self-regulated and self-organized, using exhaustively feedback loops in its processes.

In summary, Cybernetics offers a set of concepts which constitutes an adequate approach in order to help to describe and understand project management.

PROJECT MANAGEMENT AND DEEP ECOLOGY

The term "ecology" is used here in a deeper meaning than the usual one. The deep ecology recognizes the fundamental interdependence on all phenomena and the fact that individuals and societies are inserted into and dependent on the cyclic processes of the nature [2].

Comparing the terms "holistic" and "ecological", they differ a little in the sense that, for example, when the holistic vision of a project is considered, it means to observe the project as a whole and understand the interdependencies of its parts (taking into account the PMBoK®, the parts would be the nine knowledge areas). The ecological vision of the

project includes that, but adds the perception of how the project is inserted into its natural and social environment, if it affects the environment and the community which is being benefited by the project.

The deep ecology does not separate the human beings, or anything else, from the natural environment. It sees the world not as a collection of isolated objects, but as a network of phenomena which are fundamentally interconnected and are interdependent. And it is not anthropocentric [2]. The same way, the project cannot be seen as isolated objects, but inserted and interacting with its "natural" environment, which is the organizations environment, with its culture and particular conflicts, including the nature itself. Also, if the technology dimension is pointed out here, it is important to say that the migration from technique to technology is not an issue of gradual internal development in the field of the techniques, but it refers to, in the first place, the socioeconomic condition in which the technology is inserted. Thus, the importance of ecology for technology projects.

The deep ecology bears the concepts of network and community. Ultimately, it brings into discussion the concept of sustainability and ethics in the project management context. The General Systems Theory and Cybernetics points out the systems view of project management and the Deep Ecology adds the environment in which the projects are inserted and upon which they are dependent. It will be used here the term "web of projects" to express the set of projects which an organization maintains and manages in order to be sustainable over time, operating in a world made of networks and relationships, interacting with human beings, in a natural environment. It is interesting to point out here that the human being is not the center of the project (anthropocentric), but he or she is a particular node in the web of projects.

PROJECT MANAGEMENT AND CHAOS AND COMPLEXITY THEORY

In the last years, the globalization and the increasing velocity of change transformed the world into a more complex environment. Of course, this also affected the project management context and created more complex projects and project environment. According to IPMA (International Project Management Association) Competence Baseline [6], a complex project contains all of the following characteristics:

- Many interrelated **subsystems/subprojects** and **elements** should be taken into account within the structures of a complex project and the **relations** to its context.
- Several **involved companies** and / or different **organizational units** are managed in a complex project.
- Several different **disciplines** are working for a complex project.

- The management of a complex project is operated during several different **phases** with a minimum **duration**.
- Many of the **project management methods, techniques and tools** known (more than about sixty to eighty percent) are necessary and applied in the management of a complex project.

In this world of complex projects, it shows up what is being called the "mathematics of complexity", which is a mathematics of relations and patterns. It is more qualitative than quantitative and incorporates the change to the systems thought, from objects to relations, from quantity to quality, from substance to pattern. Thus, with the development of high speed computers, it was possible to solve complex equations, which came up when the scientists tried to model the non-linear interrelationships which characterizes the current networks. Then, it was found out new qualitative patterns of behavior of those complex systems and a new level of order within the apparent chaos [2].

Thus, the chaos and complexity theory shows up, as a branch of the dynamic systems theory, in order to describe and understand the chaos and find out that it is possible to find order within the chaos, which is the situation projects may experience.

As a complex system, the project is subject to non-linear phenomena, and is highly sensible to its initial conditions. Edward Lorenz, in 1962, made the eminent metaphor: the fact of a butterfly flapping the wings in Brazil may produce a tornado in Texas [3]. The same way, in a complex project, where many non-linear phenomena may occur, even insignificant changes in its initial conditions may produce over time different effects, which can be positive or disastrous to the project.

The chaos transcends the notion of unpredictability, here associated with our ignorance, which would be solved in the future by the acquisition of a better knowledge. Here it has an intrinsic meaning, i.e., the unpredictability simply cannot be solved [3]. This is an important notion in projects and it can be said that the risk management exists to deal with this unpredictability, seen as an intrinsic existence within complex projects.

Another contribution of chaos theory is the concept of chaos frontier (by S. Kauffman), which is the critical state of dynamic systems of distinct nature, in the limit of becoming completely unpredictable [3]. This may be useful to the project context in formally characterizing the limit from which the project becomes out of control and unpredictable.

In summary, the study of chaos may help us in understanding the phenomena which escape the strict deterministic comprehension. This is the case of project and project management.

FINAL CONSIDERATIONS

Dr. Harold Kerzner says that organizations of recognized excellence in Project Management create an environment

where there is a 'continuous' flow of projects managed with success, where success is measured either by the achievement of performance in points of interest for the company as a whole or by the conclusion of a specific project [7]. A sustainable society, according to Lester Brown, of WorldWatch Institute, "is that one which satisfies its necessities without decreasing the perspectives of the future generations" [2]. So, in order to be excellent in project management, a company should have a continuous flow of sustainable projects managed with success, keeping in mind that the world is made of networks and relationships, forming a web of projects, technological or not, interacting with human beings, in a natural environment. This is the systems view that General Systems Theory, Cybernetics, Deep Ecology and Chaos and Complexity Theory make the contemporary project management context more understandable.

This paper tries to set new approaches to project management, not discussion the more operational world (S Curve, Gant diagram, nine knowledge areas of PMBoK®, PERT/CPM, etc.) found in the traditional literature and inserting project management into the context of the traditional and emerging theories, like the General Systems Theory, Cybernetics, Deep Ecology and Chaos and Complexity Theory, with the hope to motivate new researches considering these theories within project management. These approaches should be studied more profoundly in order to create new and more effective ways of teaching and deploying project management.

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