

Quality Features-Based Model of Interactions of Engineers and Meaningful Social Agents for Contributing to the Construction of Social Peace

German Urrego-Giraldo

Engineering Faculty - University of
Antioquia
Medellin, Colombia
gaurrego@udea.edu.co

Gloria-Lucia Giraldo-G.

Mines Faculty – National University of
Colombia
Medellín, Colombia
glgiraldog@unal.edu.co

Abstract— The education of engineers as constructors of peace considers the introduction of peace-oriented curricula, the understanding of social, human, economic, environmental and cultural factors that determine peace; as well as, the characteristics of meaningful agents who must interact to attain and conserve peace. World peace is a major human goal considering the challenge of overcoming human injustice, social inequity, states unsustainability; govern illegitimacy, uncontrolled resource waste, etc. Educates engineers for the construction and conservation of world peace constitutes a meaningful challenge. There are difficulties in the elaboration of curricula oriented to the solution of big and complex social problems, and in the construction and management of processes to accomplish collective solutions. This research proposes a method for contributing to the peace construction, involving the actions and interactions of social agents, including engineers. The implementation of agents' actions and interactions lay on quality features of a society living in peace. The context of agents' actions and interactions introduced in this paper orients the realization of goals for a peaceful society. These goals are formulated from a set of particular categories of quality characteristics that must be achieved in each of the general processes of a peaceful society. With the categories of quality features, a set of social interacting agents, and a set of processes realized by a peaceful society, recognized in this research, we formulate problems and goals in the direction to social peace. From these elements, we work on the construction of curricula for peace engineering. Our research shows that it is not enough to describe peace solutions; but rather the formulation and execution of processes for the achievement of the peace.

Keywords- *context; curriculum; process; social peace construction; peace engineering, quality attributes; peaceful society goals.*

I. INTRODUCTION

For engineers education different pedagogical approaches and many curricula models have been used. Some models may be founded on problems and oriented to competences. In this type of model, the consideration of particular aspects, as the social peace construction, requires identifying the subjacent causes of social conflicts as problems that society must overcome and curricula may contribute to finding a solution. This contribution must be expressed in educational purposes of curricula, which need the definition of knowledge areas and

curricular activities aiming at developing engineers' capacities, usually named competences.

The scope definition and the measurement way of competences attained by engineers is not an easy task. Regarding the integral education of engineers, from [1] we adopt four competency categories: to be, to know, to do, and to behave. In social research like other research champs, the characterization of social agents is fundamental; social agents are those, who determine the phenomena appreciated in the study of realities. For the comprehension of problems and the creation of a solution, we construct the concept of context, as a space of agents' actions and interactions. The context concept is treated in [2], [3], [4], [5], and [6]. One way for characterizing the social agents, including the engineers and education institutions, the society, the organizations, etc., through their evolution is the achievement of capacities or competences for intervening in a correct sense in social processes. In this research, competences are expressed as quality attributes achieved by the society and their interacting agents. Quality attributes are essential properties of an entity that allows us to judge its value, as explained in [7], and they cover social, human, economic, environmental, legal, political, and in general, cultural aspects. These aspects enclose the factors that determine particular social states; for example, the peace. For expressing this state in a society, the competences concept may be extended for considering the categories of quality features of a peaceful society as its competences for living in peace. We identify a set of quality features corresponding to a peaceful society, and sub-set of this one, to be absolutely required in each one of the identified general social processes. The identification of these groups of quality features consider the aspects of ethics, equity, justice, sustainability, etc. treated in [8], [9], [10], [11], [12], [13], and [14].

Our research identified general social processes and it established the particular processes for reaching each one of the corresponding quality features of a peaceful society in every social process. General social processes and particular processes for achieving a specific quality feature in a general social process are expressed in operative contexts, in terms of social agents' actions and interactions. These social agents' intervention contexts determined by social agents' actions and interactions, constitute the space where engineers and in general

professional curricula may be implemented in order to educate peace engineers and other professionals cooperating to attain peace societies.

The consideration of social aspects, in relation to the environment, natural, economy, and cultures, is supported on known specialized reports for UNESCO and elaboration on social pedagogy, referred in [15], [16], [17], and [18].

Engineering curricula are not oriented to the solution of big and complex social problems and in many cases, the study and the sensitization on social, human, and in general, cultural aspects are minimized against the consideration of technical aspects. In the present article, for the sake of space, curricula elaboration is not included.

The absence of peace constitutes a truly social, human, and environmental tragedy risen from human injustice, social inequity and states unsustainability; illegitimacy of governments, inequity, and voracity of economic models, uncontrolled resource waste, etc. Human mentality and the world spread a culture of injustice and own benefits, as well as, the lack of solidarity barrier the possibility of the implementation of models leading to the peace. This culture tolerated by the education models are supported by the communication media subjected to the dominant economic agents.

Overcoming conflicts and causes of negative factors that prevent the attainment of peace require the construction of a peace culture, change of economic models, commitment with a rational care and use of natural resources; an improvement of social organization and their governing systems, and the transformation of human beings. These aspects demand innovative ways to impact society and individuals and to involve them in own and social transformations. In this sense, we develop the concept of co-innovation to assume cooperative and creative innovation. Considering social projects, we work in the field of social co-innovation, related to our research project on processes modelling in the lifecycle of solutions in diverse fields of knowledge. Education is the engine that may impulse the required transformations. Engineers education gather scientific, technical, social and cultural elements in order to develop tangible and intangible solutions involving social, natural, and economic resources. Engineers are asked by other social agents to intervene in processes for the construction and implementation of social solutions, which need massive and collective learning, teaching and knowledge management. Contributions of social pedagogy are necessary to aid engineers and multiple social agents for the construction and adoption of social solutions, as well as, the transformation of individuals, and society. This way conduces to the construction of a culture, in which these solutions will be consolidated and permanently completed and improved. These social processes stimulate the creation and use of mechanisms for making social decisions, as may be the social consensus and the social agreement.

In this paper, we introduce a method for contributing to the peace construction, involving education institution, including the engineering and engineers and other concerned social

agents. Here, the basis for the involvement of engineers and other professionals in social processes for peace construction is established.

After the Introduction, Section 2 describes the levels of contexts and processes for accomplishing results. Section 3 presents an approach to envision social peace construction. The Conclusion and Future Work are introduced in Section 4. Section 5 contains the Bibliography.

II. CONTEXTS FOR ACCOMPLISHING RESULTS

The classification of Knowledge as Context Knowledge and Domain Knowledge allows the study of a reality in function of involved agents. An agent is an object responsible for an intervention: an action or interaction. An action is a basic operation (atomic task) under the responsibility of an autonomous agent. An interaction involves multiple agents for realizing an activity, process or service. These two types of interventions determine the concept of context. In [2] we define a *context* as *the space determined by a set of agents, their goals, decision, interventions, and tangible and intangible support resources; influenced by internal and external events, and circumstances related to mentioned elements; where intervened tangible and intangible objects of one or more domains and their associated knowledge acquire meaning and value*. An agent's intervention may be a causative action, activity, process, or service, as well as a description of agents' actions, interactions, or situations. A *domain* is defined in [2] as *a real or imaginary activity field integrated by products, services, objects, and relationships among them, containing the knowledge on which agents from different contexts intervene aiming to satisfy specific objectives*. Context is a space where the domain knowledge acquires meaning and value.

A process is currently defined as a set of agents' interventions (actions or interactions) aiming at a result, working on tangible or intangible objects belonging to a domain, progressing from initial or delayed inputs in a collective way. This agent-centred concept allows to define a process, in terms of context and domain, as a *Set of interventions (actions or interactions) of the agents of a context on tangible or immaterial objects carrying knowledge of a domain, progressing from the initial entries, or provided at any time, aiming to obtain results that respond to the individual and /or collective objectives of the agents*. In this sense, the process is an operational context. It is a context applied to a domain giving specific results.

A process highlights the operative capacity of the context concept and the richness, meaningful, and value of domain knowledge. Thus, a process incorporates knowledge of tangible and intangible domain objects, and the context knowledge related to interacting agents, agents' actions and interaction, means, methods, all types of resources, events and circumstances associated with the mentioned processes elements. In this way, the functioning and results of the society, communities, and organizations as a whole, as well as natural, social and economic systems may be expressed as a big process, which is in turn decomposed in many specific processes.

Every object is considered in some context as an interacting agent, namely, it intervenes in a process in which this context is applied on a domain. Equally, each object belongs to some domain and it is treated in some context. Moreover, every object has an internal process or may be an element or a characteristic of an element of the internal process of another object. The notion of object changes, it is a process or a fragment of a process, since every object encloses its own internal process or is a fragment of some process. In this way, realities and objects of a reality may be considered as processes or fragments of processes.

Problems are identified in contexts, namely in processes, where agents act and interact on knowledge of a domain. These actions and interactions constituent the problem context.

In the education field, the problems that require the definition of educational purposes of a program and the corresponding curriculum are identified in the problem context.

Agents affected by problems considered for defining the education purposes, and the agents who participate in the curriculum construction realize agents' actions and interactions that determine the problem context.

Solutions are material or immaterial objects of a domain, which are placed in contexts, namely in a process in order to achieve a result and satisfy individual or collective goals of intervenient agents. Solutions contain the knowledge to be treated by agents in the solution context.

A curriculum constitutes a solution that contains education purposes, education areas, curricular units, academic activities, extra-academic activities and oriented to the attainment of students competences. These ones indicate the capacity of students for contributing to the solutions of problems identified in the problem context. A curriculum is placed in the solution context, where the agents' actions and interactions determine the accomplishment of program goals and education purposes of the curriculum. Solution context enhances normally the problem context to the extent of the amplitude and projection of curriculum objectives.

In the practice, in an exercise of their competences engineers act and interact with multiple social agents for the development of engineering projects. These agents' actions and interactions constitute a context of engineering practice. The multiplicity of engineering areas, new demands, and new developments of the science and technology increase and consolidate this context. Considering the Engineering as an active and cooperative agent of social development the context of Engineering Practice becomes a Context of Social Engineering. In this context may treat fundamental problems of society, humanity, nature, and universal knowledge; for example, the social peace which is the focus of our research.

The contribution of engineering to social peace is developed in the context of social peace engineering. This is a specialization of the social engineering context. Social peace is one of the greatest objectives that society should achieve. Ultimately, Engineers are compelled to work in this direction.

In particular, peace engineering presents special challenges that determine an ample set of agents representing universal areas, such as society, the economy, knowledge, nature, and engineering.

This process concept introduces operative capacity in context and allows the treatment of knowledge and information associated with interacting agents, physical and conceptual objects, means, methods, all types of resources, and the agents' interactions themselves. The two knowledge categories used are integrated with the process concept, which supports the representation of the society, social communities, and organizations as a process with identifiable results. The realities are also expressed as processes. The objects are in reality fragments of processes, micro-processes. An organization represents a big process, which transforms some inputs into outputs, executing micro-processes and their business processes.

III. METHODOLOGICAL APPROACH TO ENVISION THE SOCIAL PEACE CONSTRUCTION

In our research on social co-innovation we construct some models of social realities in terms of agents, objects, activities, functional and non-functional goals and requirements, states, events, situations, processes, scenarios, frames, categories, strategies, features, qualities, characteristics, properties, etc., aiming at the construction of manageable solutions. For the construction of social peace, we present here a methodological approach based on the quality features that a society should attain in order to have sustainable peace.

A. Identification of Quality Features of a Peaceful society

Considering diverse definitions of social peace and characteristics mentioned in academic and non-academic research that identify a society in peace, we configure a set of 22 categories of quality features, in Table 1, which are categories of competences that should reach a society for living in peace.

TABLE 1. GENERAL SET OF QUALITY FEATURES CATEGORIES

ID	Categories	ID	Categories
1	Integrity	12	Responsibility
2	Cohesion	13	Scalability
3	Solidarity	14	Stability
4	Productivity	15	Harmony
5	Cooperation	16	Management
6	Justice	17	Freedom
7	Equity	18	Consistence
8	Knowledge	19	Coherence
9	Learning	20	Enterpreneurship
10	Critical Thinking	21	Autonomy
11	Incorruptibility	22	Tolerance

In order to achieve the referenced qualities, we identify 29 general processes developed currently by societies and recognize 33 social agents cooperating in the realization of these processes. The central aim of the present work is the establishment of detailed processes to attain the goals that are needed for a society living in peace.

B. Processes Required to Achieve the Goals of a Society living in Peace

The procedure to establish the processes required to achieve the goals of a society living in peace consist of the following steps:

1. Recognize general processes developed by a society.
2. Identify the social agents who cooperate in general processes developed by the society.
3. Identify a general set of categories of quality features that characterize a society living in peace.
4. Assign a particular set of categories of quality features, extracted from the general set to each general process.
5. Identify problems to be solved in each general process developed by the society that is looking to accomplish each one of the categories of its particular set of quality features.
6. Formulate goals to be reached by the society in order to overcome the problems identified in each process for each one of the categories of its own particular set of quality features.
7. Select the particular social agents convened to intervene in processes envisioned to attain the formulated goals.
8. Establish the processes in terms of social agents' actions and interactions for attaining the formulated goal.

In this way, the goals to reaching the set of categories of quality characteristics that distinguish a society that lives in

peace are expressed. In the same sense are expressed in manageable processes the goals established by a society leading to reach the set of categories of quality features that characterize a society living in peace, the main purpose of the present work. The next sub-section illustrates in an application case the manageable process for accomplishing a goal leading a society to live in peace

C. Definition of Problems of the Goals of a Society living in Peace

For each one of the twenty-nine general process developed by a society, a sub-set of quality attributes to be assured in this process was selected from the entire set of quality attributes that characterize a peaceful society. The achievement of each quality attribute, in each general social process, involves overcoming some problems, which their solutions are expressed as goals. Problems indicate limitations of results of this process in relation to the ideal result hoped by the society for this quality attribute. Goals express solutions to the mentioned problems. Table 2 shows the problems and goals identified for reaching the quality attribute *cohesion*, in the first-mentioned social process enounced as *Support Social Integration, Human Development, Regional Services, and Welfare construction for communities and people*.

Table 2. PROBLEMS AND GOALS FOR ACHIEVING THE ATTRIBUTE COHESION IN A SOCIETY

Fundamental Social Processes: Support Social Integration, Human Development, Regional Services, and Welfare Construction for Communities and People	
Quality Atributes: Cohesion	
Problems	Goals
Persons and communities have difficulties for communication and meeting	Establish, promote and warrant from the State and Government the secure and responsible access of persons and communities, without perturbing agents, to public spaces and scenarios, such as streets, parks, sports places, etc.
	Beautify and endow public spaces with facilities, amenities, and access facilities in order to convene families, turn spaces into emblems of the municipalities, and have a reason for the pride of its inhabitants.
	Organize cultural, sport, entertainment, training and pedagogical events that bring knowledge, individual and collective experiences in constructive communication to communities and persons.
Insecurity in public spaces, carelessness in administration and the little affection or the lack of awareness of people about the importance of these spaces.	Assume, with depurated security forces and state and government institutions the control of all urban and rural sectors.
	Manage public spaces as a valuable heritage of society for coexistence, rest, sharing, with strict respect for each other.
The population, in general, does not have either knowledge of the state concept and its importance, nor a favorable concept about state institutions.	Integrate population in civic activities and pedagogical practices, in plural and apolitical contexts, aiming at the recovery of trust in the state organizations looking for joint common goals of convivence.
	Redefine and implement a model of an equitable, consitent, respectable state, which consitutes a fair and trustworthy representation of the society.
	Transforming, depoliticizing state institutions, giving them a character of autonomy and independence, with a real social sense outside economic, political, and electoral interests.
The loss of prestige and the loss of trustworthiness in branches of public power, as well as the loss of legitimacy of governments, politicians and state security forces.	Reconstruct the government system and its power branches in order to conduct a state that represents the essence and the principles of a equitable, cohesive, integral society and recovering trust and respect, and reaching legimacy.
	Define and implement a model of nation that leads communities and people to a real, equitable, stable, autonomous social, economic and human development.
	Incorporate the concept of security forces as organisms for serving society, taking care of the coherence between society and the concept of state that this has adopted, helping to government in the construction of the society towards the achievement of its goals, framed in the defined model of nation, in consonance with the adopted state model.
Fragmentation of the society in reason of the economic and social conditions	Reconstruct the concept of democracy more direct based in knowledge, critical thinking capacities, centered in communities and people as essential components of the society, independent of communication media and economic power, according to the state model and in function of the defined nation model.
	Promote and warrant the collective use of public spaces, transport, education, health services, cultural events without social, economic, race, beliefs discrimination.
	Eliminate the concept of social strata and promote public education, health, and social security, domiciliary and organizational basic public services, high-quality public transport.
Inequitable participation of communities and people in the wealth of society.	Homogenize housing, transport, preschooler, primary school, middle education, domiciliary and organizational basic public services, health and social security in all sectors of cities and towns and in rural zones.
	Increase the minimum salary in order to increase saving and consumption capacities for the entire population.
	Apply taxes according to income levels that are looking for the necessary resources required for the homogenization of public services in all sectors, cities, towns and rural zones.
	Ensure that taxes are entirely used to the mentioned public services and development programs.
	Establish that the ground, the subsoil, the water the natural environment belong to the society, and the proprietaries keep the possession, use, and exploitation rights in the frame of respect to the social rights.

D. Application Case for the Achievement the Goals of a Society living in Peace

A society living in peace was characterized by a general set of categories of quality features; and each general process of a society was characterized with a particular sub-set of categories of quality features, selected from a set of general categories. The first announced process among the twenty-nine general processes recognized in the life of human society is expressed as; *Support Social Integration, Human Development, Regional Services, and Welfare Construction for Communities and People*. The particular subset of quality features categories,

selected from the general set is depicted in Table 1. For this first general process, the particular subset of quality features categories contain the following categories: *Integrity, Cohesion, Solidarity, Justice, equity, Knowledge, Learning, Critical Thinking, Harmony, Governance, Freedom, Autonomy, and Tolerance*.

In Fig.1 the six social agents interrelated constitutes a context for accomplishing the goal: *Establish that the ground, the subsoil, the water, the natural environment belong to the society, and the proprietaries keep the possession, use, and exploitation rights in the frame of respect to the social Rights*.

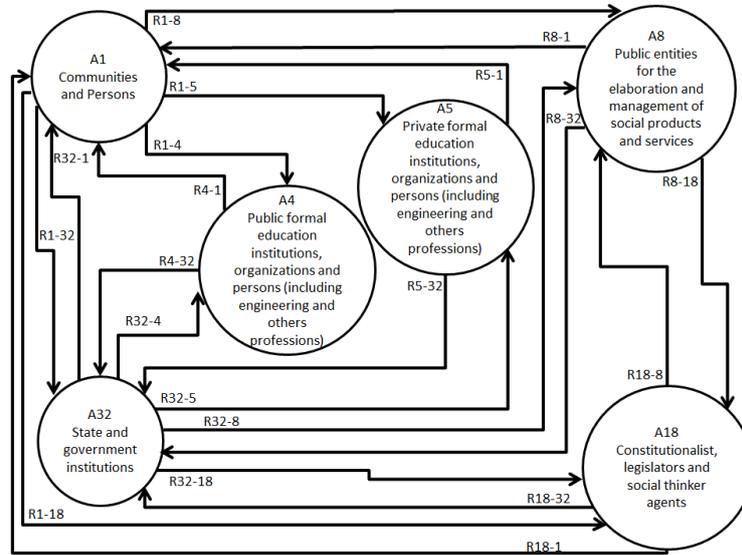


Fig1. Context for Accomplishing the Described Goal

The six social agents involved in the process for accomplishing this goal are coded with the numbers 1, 4, 5, 8, 18, and 32 in Fig. 1, and belong to the set of 33 identified social agents cooperating in the construction and conservation of peace. The agents’ interactions of the identified agents are detailed in Table 3.

The complete sets of general processes and the entire set of social agents are the subject of other works, not included here for the sake of space. For the same reason in this section, we illustrate the methodological approach to formulate the manageable processes only for one goal among twenty-three goals formulated only for the quality feature category denominated *cohesion*. This category is only one among thirteen categories of quality features belonging to the particular set characterizing the first general process, among the twenty-three processes recognized in the life of a modern human society.

IV. CONCLUSION AND FUTURE WORK

Our research on social co-innovation welcomes the project oriented to the adoption of methods that contribute to the construction of peace societies. The proposed approach for the formulation of manageable processes aiming at the accomplishment of goals of a peaceful society opens ways to

face the search for solutions from a multidisciplinary perspective.

Professionals, in particular engineers, are part of many categories of identified social agents playing a recognized role in important social transformations required for the peace construction.

The identification of social agents, the general processes developed by a society and the general categories of quality features characterizing a peaceful society support the identification of problems to be solved in order to reach a peaceful society.

Goals that overcome the identified problems convoke pertinent social agents involved in manageable processes, overcoming in this way the mere description of washable achievements.

Ongoing works complete the formulation of processes for the achievement of quality features for all social processes. The variability of problems and goals, as well as, the different grades of achievement the quality features determine a variability model that allows us to implement a line of processes and a line of quality features for different types of societies. The empirical validation of processes, quality features, problems and goals constitute a future work also.

TABLE 3.AGENTS' INTERACTIONS DEPICTED IN FIG.1

GOAL: Establish that the ground, the subsoil, the water, the natural environment belong to the society, and the proprietaries keep the possession, use, and exploitation rights in the frame of respect to the social rights.	
Agents' Interactions	
ID	Description
R1-32	Communities and people demand to State and Government reincorporate in the constitution the fundamental principle consisting of the ownership of the society over the land, air, water and natural resources.
R32-1	Government elaborates and processes a project leading to the restoration of the principle consisting of the ownership over the elements and resources provided by nature and convene the communities and people to cooperate in the development of the project and in the implementation of its results.
R32-18	Government convokes constitutionalists and social thinkers to cooperate in the elaboration of a project leading to the restoration of the principle consisting of the ownership over the elements and resources provided by nature.
R18-32	Constitutionalists and social thinkers elaborate and discuss with government the project.
R18-1	Constitutionalists and social thinkers use collective work spaces and technological means to consult and discuss with communities and people about the elements of the project that are being developed.
R1-18	Communities and people provide ample cooperation and give elements for the elaboration and development of the project.
R32-8	Governments formalize the inclusion in the constitution of fundamental principle consisting of the ownership of the society over the land, air, water, and natural resources; and ask the public entities for the implementation of this principle in social products and services.
R8-32	Public entities manage the application of the ownership principle and report its accomplishments to the Government.
R1-8	Communities and people demand public entities the provision of services and resources in accordance with the principle of social ownership
R8-1	Public entities promote and supervise the responsible cooperation of communities and people in the conservation and proper use of soil, water, air and other associated natural resources.
R8-18	Public entities request constitutionalists and social thinker orientation and proposal of designing social products and services.
R18-8	Constitutionalists and social thinkers elaborate contributions about social products and services looking for the social, human, economic progress in harmony with nature, and aid to public entities in the introduction of these contributions for the definition of products and services.
R32-4	Governments demand public formal education institutions, organizations, and persons (including engineering, other professions) to include in their programmes and services education activities and their direct contribution to develop in professional life the principle of social ownership.
R4-32	Public education institutions, organizations and persons (including engineering) implement, with their graduates, communications nets and presence and remote meetings in order to support the application of social ownership principle in the professional practice and capitalize and report to the Governments their realizations.
R32-5	Governments demand private formal education institutions, organizations, and persons (including engineering, other professions) to include in their programmes and services education activities and their direct contribution to develop in professional life the principle of social ownership.
R5-32	Private education institutions, organizations and persons (including engineering) implement, with their graduates, communications nets, and presence and remote meetings, in order to support the application of social ownership principle in the professional practice, and capitalize and report to the Governments their realizations.
R4-1	Public education institutions, organizations and persons (including engineering and other professions) coordinate with communities and persons in programming and realization of practices in these communities, as well as, in the application of social ownership principle in the practices of engineers and other professionals anywhere in the territory.
R1-4	Communities and persons cooperate with public education institutions, organizations and persons (including engineering and other professions) in the application of social ownership principle in projects of engineers and other professionals and in the realization of professional practices anywhere in the territory.
R5-1	Private education institutions, organizations and persons (including engineering and other professions) coordinate with communities and persons in programming and realization of practices in these communities, as well as, in the application of social ownership principle in the practices of engineers and other professionals anywhere in the territory.
R1-5	Communities and persons cooperate with private education institutions, organizations and persons (including engineering and other professions) in the application of social ownership principle in projects of engineers and other professionals and in the realization of professional practices anywhere in the territory.

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