
Decisional Institutional Analysis Development (DIAD) Framework

Marco de Desarrollo del Análisis Institucional Decisional (DIAD)

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Abstract: Decisional Framework for Institutional Analysis and Development is based on conception of Agents as free adaptive complex systems; in this way, it shows process of interactions between Agents and how this influences achievement of permanence of organization over time; incorporating not only learning product of results, but also learning product of Agents' decisions. This framework incorporates a decisional approach, bringing Agents to fore in reconciliation with institutions and contexts, making explicit their interactions and the decision itself as the basis of governance system. In this way, it helps to position elements that make up complexity of reality of organizations that share resources in common use to govern it.

Key words: Decisions; Interactions; Interdependence; Governance; Learning; Sustainability; Dynamism; Organizations; Environment; Free Adaptive Complex System.

Resumen: El Marco Decisional para el Análisis y Desarrollo Institucional se basa en la concepción de los Agentes como sistemas complejos adaptativos libres; de esta forma, muestra el proceso de interacción entre los Agentes y cómo este influye en el logro de la permanencia de la organización en el tiempo; incorporando no sólo el aprendizaje producto de los resultados, sino también el aprendizaje producto de las decisiones de los Agentes. Este marco incorpora un enfoque decisional, poniendo en primer plano a los Agentes en conciliación con las instituciones y los contextos, explicitando sus interacciones y la propia decisión como base del sistema de gobernanza. De esta forma, ayuda a posicionar elementos que componen la complejidad de la realidad de las organizaciones que comparten recursos de uso común para gobernarla.

Palabras clave: Decisiones, Interacciones, Interdependencia, Gobernanza, Aprendizaje, Sostenibilidad, Dinamismo, Organizaciones, Ambiente, Sistema Complejo Adaptativo Libre.

I. INTRODUCTION

E. Ostrom mentions in her book *Governing the Commons*, that although design principles characterize solid institutions of common use resource systems (RUC); they are not sufficient conditions to ensure the sustainability of the institutions over time. The author leaves the door open for the development of new theoretical and empirical research that allows to complete the core of institutional strength conditions, which is part and is the basis of a governance system. In this regard, subsequent studies have enriched E. Ostrom's approaches, incorporating new analysis variables into the IAD framework, which has allowed for new approaches that expand the analysis capacity of the IAD framework.

The pending challenges in the subject of organization, as well as the need to incorporate a broader theory about the behavior of the Agents, give rise to the identification of the possible contributions that derive from the anthropological model based on the theory of human action proposed. by Juan Antonio Pérez López.

When carrying out a comparative analysis between the premises that underlie the proposals of E. Ostrom and Pérez López, similarities and differences are identified. The similarities between both approaches are: 1) orientation towards the solution of real problems, 2) consideration of the diverse motivations of the human being, 3) recognition of the existence of a social learning process, 4) strong influence of the decisions of individuals; and 5) influence of environmental conditions; Therefore, it can be affirmed that both approaches can be complementary, taking as a starting point the object of solving real problems and the decision analysis methodology, making adjustments necessary from the consistency of the action over time.

The incorporation of the anthropological model poses a new orientation regarding the type of system to which an organization corresponds. This new orientation makes a leap from a complex adaptive system to a complex adaptive free system; as well as incorporating the verification of the consistency with respect to the internal learning of the organization of the Agents that share the RUC. That is, a new approach is achieved where the organization responds not only to adaptability but also to real consistency as a future objective.

Likewise, the use of the anthropological model poses a new orientation that focuses on the challenge of governing organizations that share the RUC, bearing in mind the context, the resources, the multiple motivations, and the

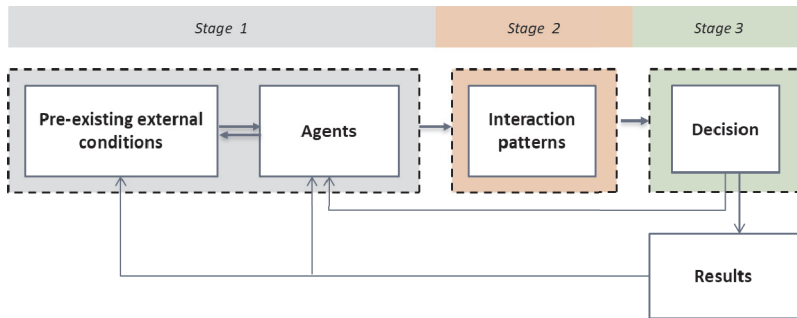
decisions of the organizations, making explicit the need for leadership. In this way, it makes a leap from the management of resources and the definition of rules to the government of organizations.

Decisional Institutional Analysis Development (DIAD) enriches approaches of E. Ostrom, integrating the most relevant variables of subsequent studies, to which contributions of anthropological model proposed by Juan Antonio Pérez López are added; allowing to show cybernetics of interactions between Agents in a context of interdependence, where governance that is achieved is product of decisions that Agents take over time. In this way it incorporates a decision-making approach, it makes explicit to Agents, their interactions, and decision itself, laying the foundations of elements that set up the government of organizations that share resources of common use.

II. ANALYSIS UNIT

Analysis unit of DIAD framework corresponds to social situation of action where preexisting external conditions converges, as well as Agents. This unit of analysis is viewed dynamically as a process that feeds initial conditions (see Figure 1). Agents, with their decisions, configure and reconfigure the social situation of action, making it in this systemic and dynamic way.

Figure 1.-Analysis unit of the DIAD framework seen dynamically

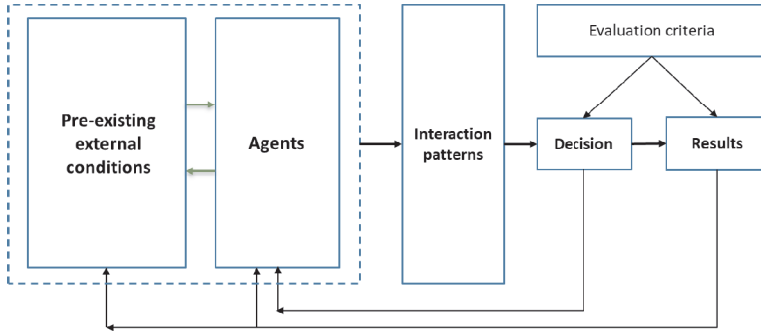


Source: own elaboration

The simplest and most aggregated way of representing the focal level of analysis is shown in Figure 2. Looking from left to right, the first block corresponds to the pre-existing external conditions, which affect a second block called the Agents. These Agents interact giving rise to the set of interaction patterns (third block), and then give way to a fourth block “the decision”. Eva-

evaluation criteria are used to examine the quality of decision and results. The decision modifies the Agents. The results (fifth block) feedback the Agents; over time, results may also affect some of the pre-existing external conditions.

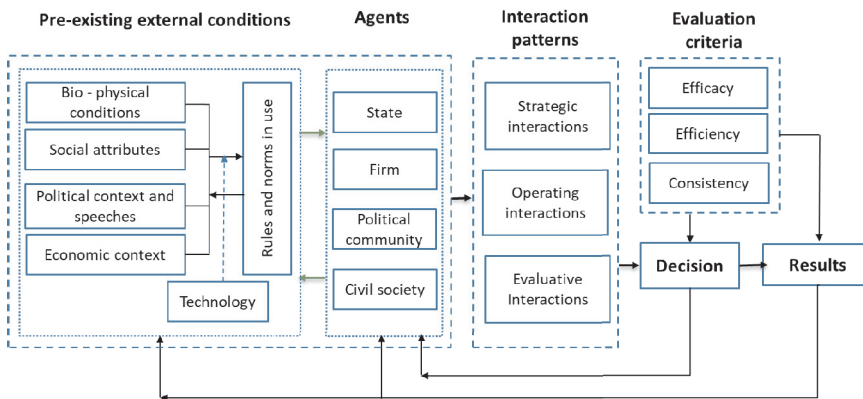
Figure 2.- DIAD Framework



Source: own elaboration

Figure 3 shows in a disaggregated way the main elements of each of the blocks mentioned above.

Figure 3.- DIAD Framework



Source: own elaboration

Preexisting external conditions are: 1) Biophysical and material conditions, 2) Social conditions, which includes the attributes of the communities involved, 3) Political conditions, which includes both the political context and the existing speeches, 4) Economic conditions, 5) Technology, and 6) Rules and norms in use.

Agents include: 1) State, 2) Firm, 3) Political community; and 4) Civil society. It is all these Agents that generate the set of interaction patterns, which are part of the social situation of action.

Interaction patterns are developed at three levels: 1) Strategic interactions, 2) Operational interactions, and 3) Evaluative interactions, which integrate short and long term. The set of interaction patterns reinforces or weakens the structural relationship of the organization that is formed between Agents.

Decision synthesizes the decision-making process and the implementation of the action plan, reflecting the preexisting external conditions, the participation of the Agents and the aims of the organizational action of the meta-organization. In the decision it is possible to synthesize the positions of the Agents, their preferences and practices resulting from past interactions, giving way to a group of possible interaction actions, and subsequent decision. The decision feeds the Agents and modifies their practices beyond the results. Government action becomes tangible with the decision.

Evaluation criteria examine the type of decision and the results. They include the criteria of effectiveness, efficiency, and consistency.

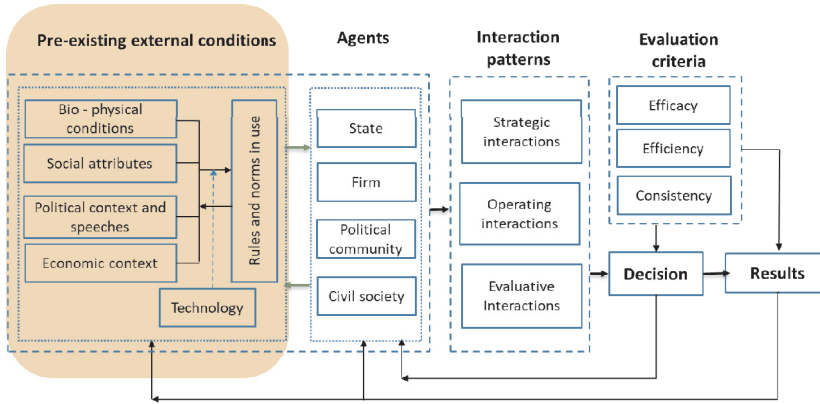
Results are a function of the implementation and implementation of the decision, which requires an explicit role of facilitating leadership that makes its achievement possible. Since results are achieved over time through various actions, these may differ from the results initially proposed, their evaluation corresponding to the criteria indicated above. Results feedback the social situation of action, modifying the Agents and modifying the preexisting external conditions.

III. PRE-EXISTING EXTERNAL CONDITIONS

This first block of the DIAD framework (See Figure 4) broadens the approaches of the IAD framework of E. Ostrom presenting the following qualities: 1) The incorporation of the variables “political context and speeches” and “economic context”; from the contributions developed by the politicized IAD and the critical institutionalism, 2) The incorporation of the variable “technology”, not only independent of biophysical conditions, but with the possibility of affecting the structuring of the rules and norms in use; based on the proposal of Arild Vant , 3) The relocation of the variable “rules and norms in use”, as a variable that feeds and feeds on the other variables that make up

the external conditions (biophysical conditions, social attributes, political context and discourse, and economic context) .

Figure 4.- Pre-Existing External Conditions in DIAD Framework



Source: own elaboration

3.1. Biophysical conditions

Biophysical conditions refer to resource units in their natural state and/or modified by man; they also include service infrastructure.

Biophysical conditions can act as the first factor that makes cooperation difficult or easy; It is based on these conditions that the Agents analyze their action strategy. Whaley and Weatherhead (2014) state that, in a social action situation, biophysical conditions affect what actions are possible, what results can be produced, and what information Agents require to decide. Some of the biophysical conditions that affect the actions between the Agents can be: 1) The mobility of the resource, 2) The size of the resource system, 3) The productivity, predictability, and irregularity of the resource, 4) The cost of exclusion of the resource, 5) The forms of infrastructure; etc.

Biophysical conditions also determine the interdependencies between the Agents that share a RUC, which can act as a factor that forces cooperation by outlining a situation where the most convenient strategy would not be to compete but to cooperate in the long term.

3.2. *Social attributes*

Social attributes refer to characteristics of Agents that interact. Social attributes affect social situation of action and may facilitate or hinder the organization of cooperative action. Attributes of a community that can affect the structure of a social action situation include: 1) norms of behavior, generally accepted in the community, 2) level of understanding that potential participants share about the structure of types of action problems, 3) degree of homogeneity in the preferences of those who live in a community, 4) distribution of resources among those affected, 5) number of participants, 6) Gender, 7) Race, and 8) Age (Whaley; Weatherhead, 2014).

3.3. *Political context and discourses*

The political context and discourses, as a variable, have been considered as part of the DIAD framework to make explicit the existing power relations between the Agents; regardless of whether these relationships are visible or not.

The political context is related to the general politics of the system in which the social situation of action is immersed. Politics strongly shapes the overall trajectory of the system. Whaley and Weatherhead (2014) argue that co-management networks are embedded in a broader politics that shapes power relations, interaction structure, and network characteristics at scale, influencing ways of sharing power, building trust, and making rules between Agents. This in turn affects the processes of problem solving and social learning.

According to the definition taken by Clement (2010), citing (Hajer, 1995: 60), discourses are “Specific set of ideas, concepts and categorizations that is produced, reproduced and transformed into a particular set of practices and by which physical and social realities are given meaning. In this way, by dictating how social and physical phenomena should be conceptualized, discourses shape beliefs, norms, and values (Clement, 2010: 10). Therefore, discourses are both an expression and an instrument of power and knowledge, which continually transform society (Clement, 2010: 11).

The conflicts that arise around the RUCs serve as a trigger for joint management. These are constructed and negotiated by the Agents concerned using discourses. Discourses operate to sustain or challenge power relations between Agents, positioning Agents according to histories, as certain dis-

courses are normalized or undermined. Discourses are also vital to developing and sustaining institutions that enhance collaborative learning-based approaches.

3.4. Technology

Technology is a variable that acts as a modifier or “buffer” of the biophysical conditions in which the resource is found. Technology can modify the conditions in which access to the resource becomes more difficult, as well as limiting the ability to access it, allowing a reconfiguration of the rules on the use of the resource.

Technology is not only capable of modifying biophysical conditions, but it can also affect the structuring of rules and norms of use; and how the political and economic context is perceived.

3.5. Rules and norms in use

Rules and norms in use have been the most detailed variable by E. Ostrom within his IAD framework. In what corresponds to the DIAD framework, this variable retains the same characteristics as those indicated by E. Ostrom; however, it is in a different position with respect to the rest of the pre-existing external conditions. Rules and norms in use are in a vertical position, receiving information from the other external conditions and providing feedback to them. In this way, rules are the result of the conjunction of various external conditions, being able to feedback and/or modify these conditions. Likewise, the existing rules and norms in use may be mediated by the availability and access to technology, which may modify pre-existing conditions. The rules and regulations in use constitute, with each of the pre-existing external conditions, the system under which the action of the Agents is regulated.

Preexisting external conditions are also represented by the coupled infrastructure approach of Anderies et al. (2016). This serves as a basis, to show later the complexity of the relations between the Agents and the RUC.

Biophysical conditions = $f(\text{IN}, \text{I}^{\text{h-hm}})$

Biophysical conditions can be expressed as a function of natural infrastructure and man-made “hard” infrastructure¹.

Social attributes = $f(\text{IS}, \text{IH})$

Social attributes can be expressed as a function of social infrastructure and human infrastructure².

Political context and speeches = $f(\text{I}^{\text{s-hm}}, \text{IH})$

Political context, and speeches can be expressed as a function of “soft” human-made infrastructure and human infrastructure³.

Economic context = $f(\text{IN}, \text{I}^{\text{s-hm}})$

Economic context can be expressed as a function of natural infrastructure and “soft” human-made infrastructure⁴. This context is created in turn by the different interactions generated by the Agents.

Technology = $f(\text{I}^{\text{h-hm}})$

Technology can be expressed as a function of “hard” human-made infrastructure⁵.

Rules and norms in use = $f(\text{I}^{\text{s-hm}})$

Rules and norms in use can be expressed as a function of the “soft” human-made infrastructure⁶.

Note: IN: Natural infrastructure, IH: Human infrastructure, I^{s-hm}: soft human-made infrastructure, I^{h-hm}: Hard human-made infrastructure, IS: Social infrastructure

IV. AGENTS

Agents correspond to all those who in some ways are part of the social situation of action, interact with each other and decide; thus, affecting present and future interaction patterns. Agents are those who configure the so-

1 According to Anderies, 2014: 11.

2 According to Anderies, 2014: 11.

3 Posed based on the variables of the CIS framework: Anderies, 2014; Anderies; Janssen; Ostrom, 2016.

4 Posed based on the variables of the CIS framework: Anderies, 2014; Anderies; Janssen; Ostrom, 2016.

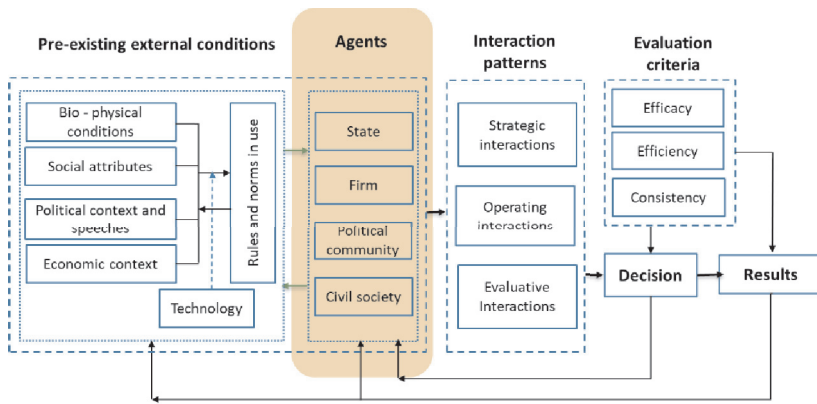
5 Posed based on the variables of the CIS framework: Anderies, 2014; Anderies; Janssen; Ostrom, 2016.

6 According to Anderies, 2014: 11.

cial action situation. Agents in the DIAD framework refer to organizational agents or individual (personal) agents. In a social situation of action, the majority will face organizational agents; however, individual agents are involved if they are direct participants or are part of the organizational agent involved in the social situation of action.

In the DIAD framework Agents are grouped into a) State, b) company, c) political community and e) civil society (See Figure 5). This form of grouping is based on the four domains of Friedmann’s social practice: this being useful for a first approach of the assessment of the concentration of power of these groups of Agents.

Figure 5.- Agents in DIAD Framework



Source: own elaboration

Agents form what is known, according to what was stated by Anderies (2014), as human infrastructure (IH). Therefore, it contains the motives-interests, motivations, and capabilities of these Agents, who then with their actions shape the fabric of social infrastructure, and man-made infrastructure. IH can be represented as follows:

$$IH = f(\text{motives-interests, motivation, abilities})$$

Agents, who act within the social situation of action, learn with each of the decisions they make and with the impact generated by the results of joint action. The process is explained below.

Suppose that the Agents initiate an interaction in a social situation in a time (t0), in this understanding the Agents will have a) certain positions depending on the context and rules; b) preferences, product of their motives-in-

terests, motivation and abilities; and c) practices, product of the previous interactions, that shape the social capital created by them. Agents learn a) from the new conditions of the environment that reconfigures their positions, b) from the conditions of the RUCs they share, c) from the behavior of the other Agents, d) from their decisions; and e) of the results obtained. Agents for the following interaction in a time (t_1), have been modified by their own performance and that of the other Agents, revealing the dynamic basis of the social situation of action, beyond the dynamism that may come from the RUC. Agents begin with a reputation that they bring with them to the social situation of action, forged according to their previous practices and habits, which constitutes their social capital. In that sense, the social capital previously formed by them is the starting point that facilitates or hinders the formation of a structural relationship between the Agents; without neglecting the importance that configures the positions of the Agents, as well as their preferences.

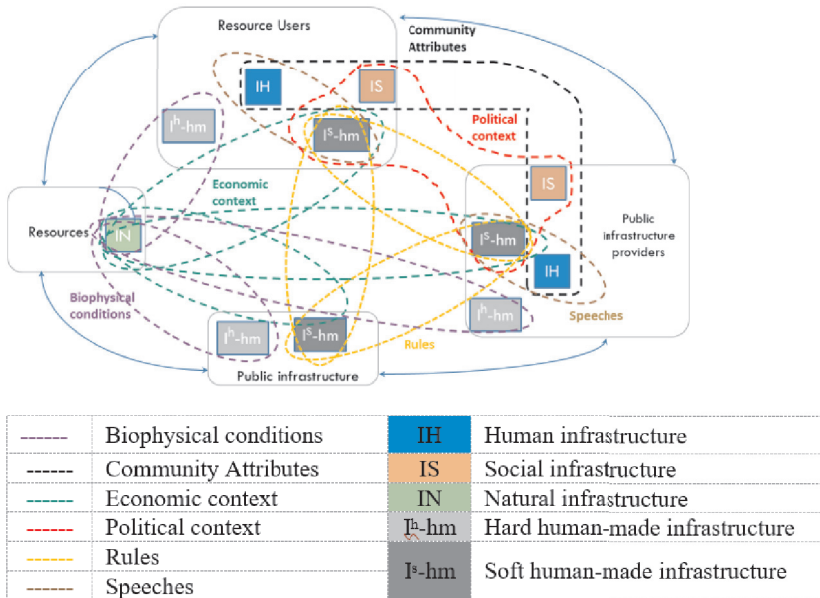
Social situations of action where RUCs are shared have been represented as a socio-ecological system (SSE). An SSE is an elaborately linked ecological system and affected by one or more social systems (Anderies et al., 2004). In this case the RUC would be part of this ecological system, and the Agents would be part of the social systems. Representation of social situations of action in which the RUCs are shared as an SSE and therefore as a complex adaptive system, requires a couple of clarifications, under the anthropological conception, to avoid confusion: 1) Agents are free adaptive complex systems, not simply adaptive complex systems, 2) Interaction patterns occur between Agents facing an interdependence situation due to RUCs, not between Agents and RUC. As Pérez López (1991) would say, the environment is really another Agent.

Regarding the first point, Anderies et al. (2004) indicate that, in general terms, social systems (Agents) can be considered as systems of interdependent organisms. This may seem appropriate at first sight; however, it is necessary to remember that organisms correspond to a complex adaptive system (SCA) but not to a free adaptive complex system (SCA). SCALs have a free adaptation process, their orientation is not predetermined, the interaction between the SCALs therefore includes a choice of orientation. It is in these interactions that the DIAD framework is focused, which have been called interaction patterns.

Regarding the second point, to make the interactions between the Agents more evident, Figure 6 is shown. This is based on the representation of coupled infrastructure system proposed by Anderies et al. (2016), which has been adapted to the approach of the DIAD .

Figure 6 shows the network of relationships in a social situation of action where RUCs are shared, showing how this network is generated mainly through the relationships between human infrastructure, social infrastructure, man-made infrastructure (hard and soft). It is the human infrastructure and its derivatives, which is mainly constituting that external environment with which the Agents (human infrastructure itself) interact. In short, Agents interact with each other and with the result of their own interactions.

Figure 6.- DIAD framework under the coupled infrastructure approach

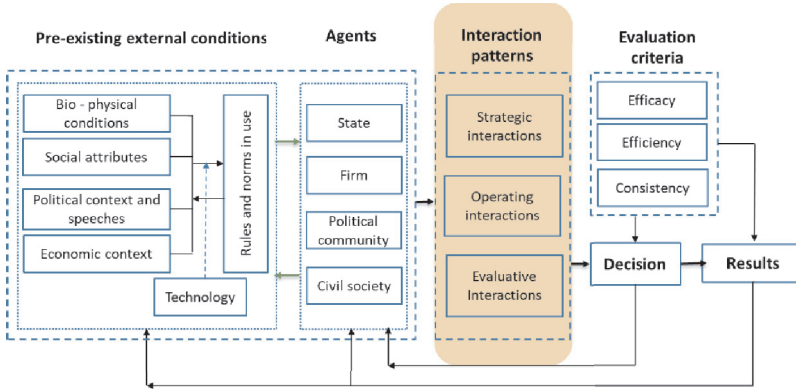


Source: own elaboration

V. INTERACTION PATTERNS

Interaction patterns describe the purposes that the interactions between the Agents can follow, which are classified into three (03) levels: A first-level or strategic interaction, a second-level or operational interaction and an interaction of third or evaluative level (see Figure 7). Interaction patterns incorporate dynamism in the DIAD Framework when considering the actions of the Agents as a sequence of interactions, through which the Agents are solving problems that they are having successively.

Figure 7.- Interaction patterns in DIAD framework



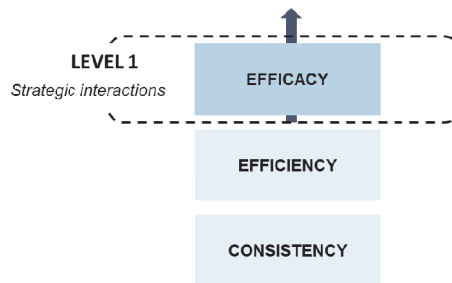
Source: own elaboration

Interaction patterns that are part of the DIAD framework refer to three levels of interaction due to their object and projection over time. These should not be confused with the interaction patterns referred to in the IAD framework, which refer to specific types of interaction such as decision making, agreements, definition of rules, etc. Below is a description of the level of interaction referred to.

Strategic interactions

Strategic interactions refer to the first level of interactions focused on solving the problem immediately (effectiveness) (See Figure 8). Agent learning is not included at this level.

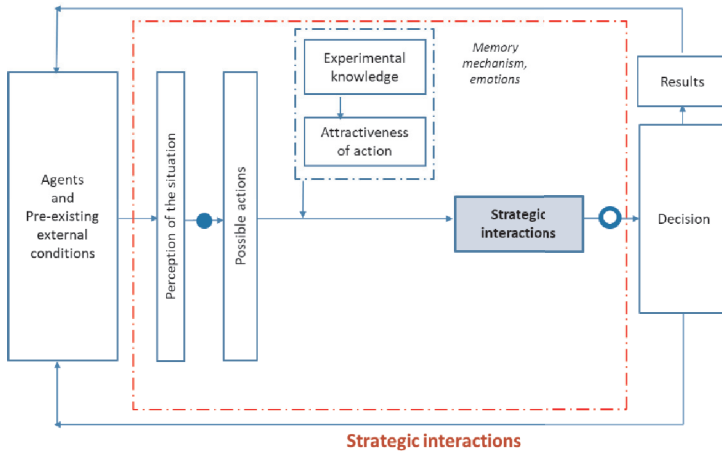
Figure 8.- Strategic interaction level



Source: own elaboration

Strategic interactions are based on the attractiveness of the action for Agents; in what they suppose is going to happen according to their experience (experimental knowledge). Strategic interactions are fed with the perception of the situation, from where possible actions are derived. In this first level, experiences based on memory and emotions are put into play, therefore, it is one of the levels most exposed to manipulation (See Figure 9).

Figure 9.- Strategic interactions



Source: own elaboration

A representation of strategic interactions is given in terms of possible actions and efficacy.

$$Ie = f(\text{possible actions, efficacy})$$

According to Pérez López (1991), efficacy refers to solving the immediate problem, therefore, it refers to the attractiveness of the action and to experimental knowledge. Similarly, the author affirms that experimental knowledge is nourished by memory and emotions. Strategic interactions can be represented as follows:

$$Ie = f(\text{possible actions, attractiveness of the action, experimental knowledge})$$

$$Ie = f(\text{possible actions, attractiveness of the action, memory, emotions})$$

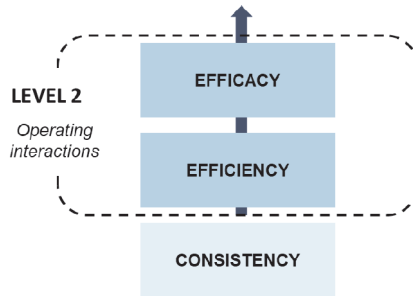
When interactions are only referred to the first level, they become transactional or exchange. The evaluation carried out is static, as if the achievement of the objective depended on a single interaction.

In situations where RUCs are shared (where conditions are constantly changing) a static valuation becomes a risk that can involve a vicious cycle of transactions. Degeneration of the interaction process is the cause of multiple social conflicts, where the change in conditions is one of the triggers. Uncertainty generated by changing conditions makes experimental knowledge (established in memory and emotions) less valid and less likely to be repeated.

Operating interactions

Operating interactions refer to the second level of interactions, which aim to obtain learning (efficacy and efficiency) (See Figure 10). At this level of interactions learning is only about the environment.

Figure 10.- Operating interaction level



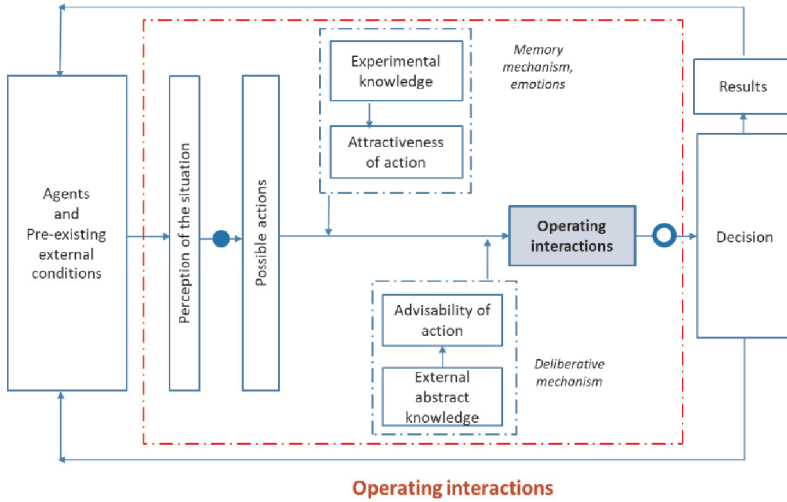
Source: own elaboration

In situations where RUCs are shared, Agents' learning is collective; and it occurs through a trial-and-error approach. Agents, before the environment, try to find the repetitive patterns. Therefore, learning obtained is based solely on knowledge of environment or external conditions (external abstract knowledge).

Operating interactions (See Figure 11) are based on convenience that the action generates for Agents; in what is convenient for them to do according to the available knowledge about the RUC (external abstract knowledge).

At this second level, deliberative mechanism is put into play, for which reliability, quality, and availability of information about RUC is key to avoid possible error induction.

Figure 11.- Operating Interactions



Source: own elaboration

A representation of operating interactions is given in terms of possible actions, efficiency, and efficacy:

$$Io = f(\text{possible actions, efficiency, efficacy})$$

$$Io = f(\text{possible actions, advisability of action, attractiveness of action, external abstract knowledge, experimental knowledge})$$

When interactions are only related to the second level, they become operative; These have an external dynamic assessment, that is, they only consider learning with respect to external conditions.

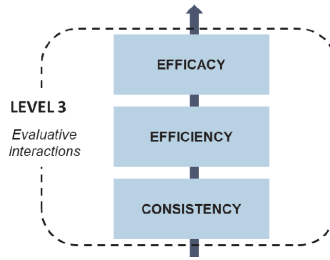
In situations where RUCs are shared (where Agents change with each interaction), it is a risk to omit learning from other Agents (internal dynamic assessment) with whom you will continue to interact by virtue of the existing interdependence. When concern is focused solely on the conditions of the RUC, process degenerates and can be cause of multiple social conflicts where the consideration of other Agents has been omitted.

In this level 2, uncertainty generated by changing conditions of environment has been incorporated, it is still pending to include uncertainty generated by actions of other Agents.

Evaluative interactions

Evaluative interactions refer to the third level of interactions whose purpose is the sustainability of the objective in the long term (efficacy, efficiency, and consistency) (Figure 12).

Figure 12.- Evaluative interaction level

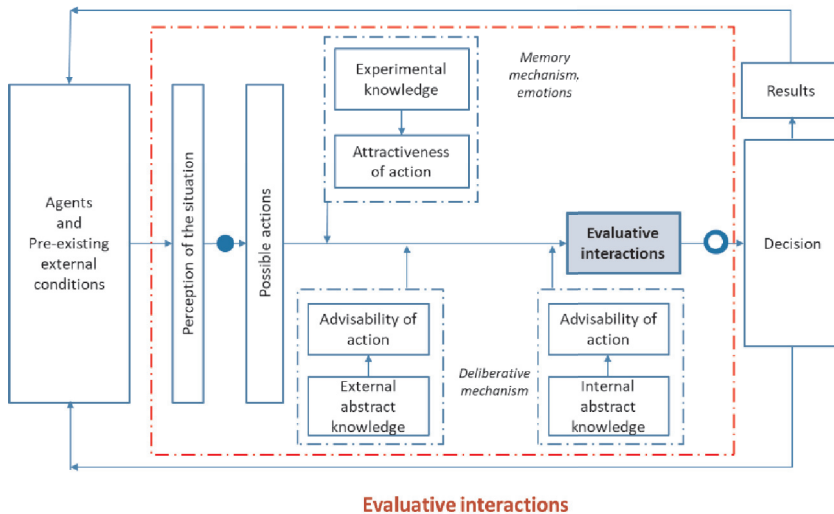


Source: own elaboration

At this level of interactions, learning includes the environment (external abstract knowledge) and the actions of the other Agents (internal abstract knowledge). (See Figure 13)

Evaluative interactions complete the depth of the interaction. A relationship between Agents at the third level of interaction is much stronger than one that occurs at the first or second level.

Figure 13.- Evaluative interactions



Source: own elaboration

A representation of evaluative interactions is given in terms of possible actions, efficacy, efficiency, and consistency.

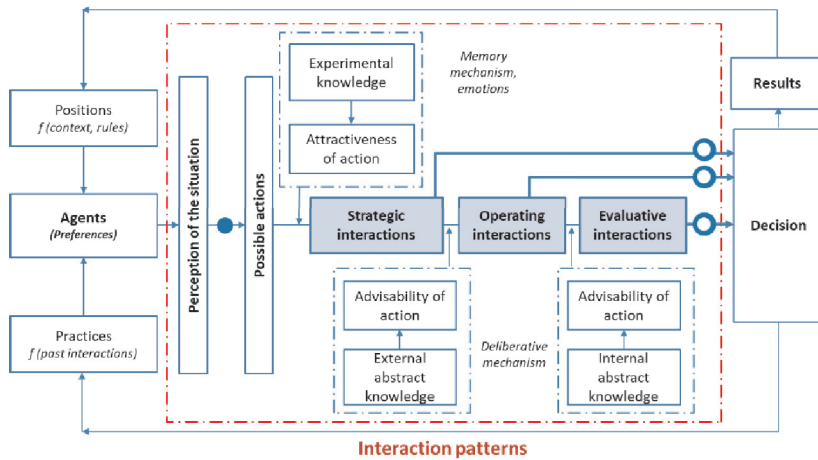
$$\text{Iev} = f(\text{possible actions, consistency, efficiency, efficacy})$$

$\text{Iev} = f(\text{possible actions, advisability of action, attractiveness of action, internal abstract knowledge, external abstract knowledge, experimental knowledge})$

In this third level of interactions a virtuous circle can be generated, where uncertainty generated by changing conditions of environment has been incorporated and uncertainty generated by the actions of other Agents.

Interactions between Agents have as a previous point, the set of preferences of Agents, positions they have according to context and rules; and their practices based on their past interactions (see Figure 14). Interactions begin with a perception of the social action situation and ideally with the definition of the problem that Agents want to solve.

Figure 14.- Interaction patterns

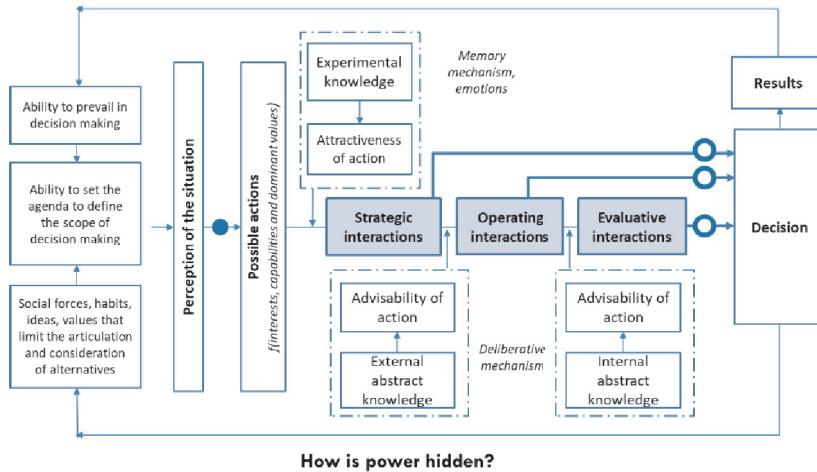


Source: own elaboration

Definition of problem may not be entirely clear and therefore be faced with a problem that needs to be structured. Structuring of problem to be solved and selection of objective to be undertaken, which satisfies the Agents beyond short term, is essential to generate a virtuous circle of interaction. Problem will not be solved through one action, but through repeated interaction; however, without having managed to overcome the first structuring of problem and selection of objective, it will be difficult to continue.

The perception that each of the Agents has regarding the social action situation will depend on preconditions regarding their positions, and on their interests, preferences, and past practices. However, it is enlightening to note that joint perception of social situation of action is affected by those same preconditions, which modify perception of situation that each Agent has. In other words, exercise of power, in its different forms, modifies perception of situation, influencing approach and structuring of problem.

Figure 15.- Power



Source: own elaboration

When the interaction starts, Agents enter it, exercising their capacity for action, from their positions, preferences, and practices. Brisbois, Morris and Loë (2019) affirm that the power exercised by agents can be manifested through their ability to: a) prevail in decision-making, b) define the scope of such decisions and set the agenda; and c) influencing through different habits and ideas that limit the articulation and consideration of alternatives (See Figure 15).

Manifestations of power shape perception that Agents have about the social situation of action and may be influenced in their decisions. An example of this is the ability to access information that Agents have regarding the RUC, information that some Agents may access while others do not due to their cost and specialization. Ideally the RUC information should be available to all Agents in a language that is understandable to them; however, it assumes that at least one Agent takes care of it, in whose absence access to information can become a collective action dilemma.

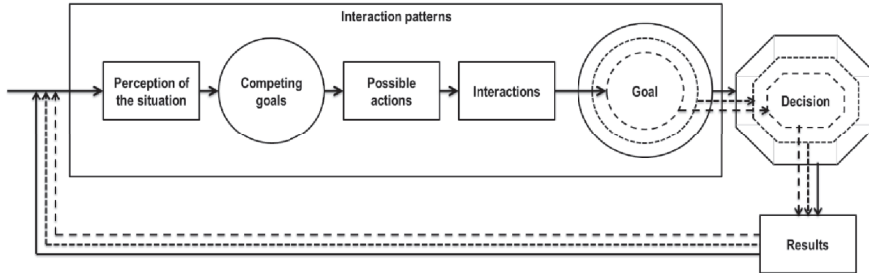
In this sense, the exercise of power that Agents make in the social situation of action contributes or hinders the achievement of a correct perception of the situation, which then serves as the basis for determining possible actions. Power can skew and limit the alternatives that are made available and therefore also expand or limit the possibility of future interactions. In this sense, exercise of power that Agents make in the social situation of action contributes or hinders achievement of a correct perception of situation, which then serves as the basis for determining possible actions. Power can skew and limit the alternatives that are made available and therefore also expand or limit the possibility of future interactions.

Possible actions to undertake achievement of objective are based on the interests, capacities, and dominant values in the group of Agents. Once these actions have been identified, a universe of possibilities opens, which may expand or restrict the possibilities of future interaction. In this way, interactions between Agents can be oriented to be strategic interactions, stay at a level of operating interactions, or integrate a level of evaluative interactions.

The approach to an objective of well-being of all Agents is usually utopian in a medium of multiple Agents with their own decision systems; and where it is required to face multiple dilemmas of collective action. Agents' choice of course of action is preceded by the choice of objective. Various objectives compete to be chosen by the Agents, to generate a first change in the conditions of the RUC, which will be perceived by Agents as a small gain of joint success that contributes to repetition of interactions.

Relationship between Agents due to the interactions generated by interdependence with respect to the RUC, requires that the Agents select an initial project (initial objective) projected towards a general objective of the set of Agents. This initial project will generate the mechanisms to continue the interactions at a more operational level, and to be able to form, little by little, that structural relationship between Agents (Meta-organization). (See Figure16)

Figure 16.- The goal in interaction patterns



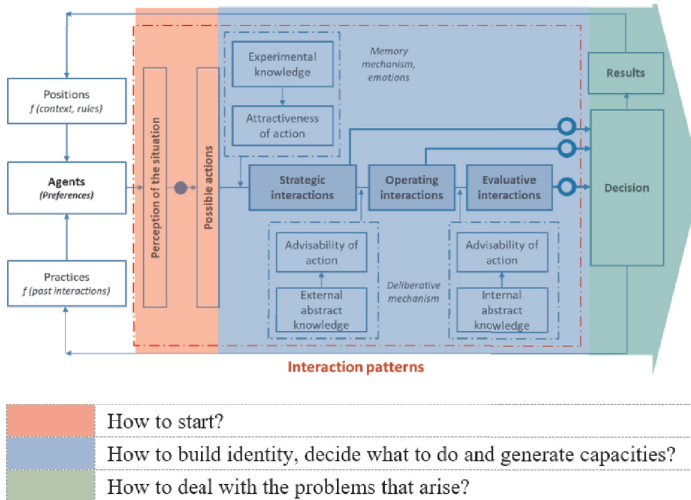
Source: own elaboration

The need to continue interactions is key; without these, relationship between Agents will not be consolidated, it will not reach a structural relationship; without these, the meta-organization will not be formed. We would be facing a situation with a group of Agents who share a RUC with actions limited to their own organization and their individual influence on external conditions. In this situation, the possibility of capitalizing on the synergies of action and achievement of a common objective are lost.

Leadership is critical to achieving shared goals (Imperial et al., 2016: 126). In the DIAD Framework, leadership is the capacity for action that Agents can exercise through their interactions; exercise of this capacity makes it possible for the meta-organization to be formed. In this sense, leadership is present in entire process of interactions and decision, although sometimes it is not completely explicit. Some Agents will assume explicit leadership, depending on the positions and roles they play; on other occasions, leadership may be assumed by other Agents regardless of their roles and positions.

Leadership can be divided into three stages that answer the questions posed by Imperial et al. (2016): a) how to start? b) How to build identity, decide what to do and generate capacities? and c) how to deal with the problems that arise? The first two stages can be evidenced at the level of interaction patterns, while the last stage is evidenced at the decision level (See Figure 17)

Figure 17.- Location of the leadership role



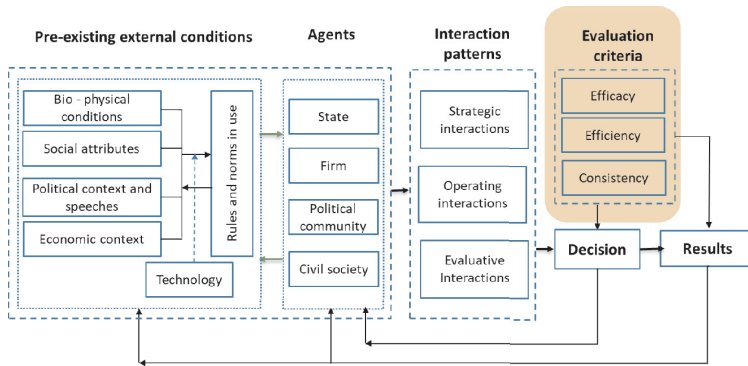
Source: own elaboration

Further development of the leadership role is presented later in the item corresponding to decision and results of the DIAD Framework.

VI. EVALUATION CRITERIA

E. Ostrom (2005) lists as examples of suitable criteria to examine the overall performance of an institutional arrangement: (1) economic efficiency, (2) fairness, (3) adaptability, resilience, and soundness, (4) accountability, and (5) conformity with general morality. However, for the purpose of the DIAD Framework a broader set of criteria is presented containing the above criteria. Evaluation criteria in the DIAD Framework are Efficacy, Efficiency and Consistency (See Figure 18)

Figure 18.- Evaluation criteria in the DIAD Framework

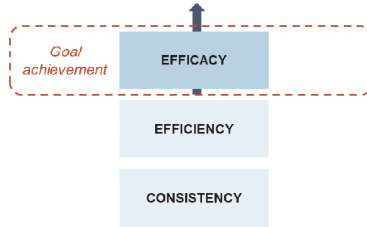


Source: own elaboration

These criteria are guiding of agents' decisions and are proposed to evaluate decision to be made and its results in a social action situation where RUC are shared. DIAD Framework criteria go beyond evaluating institutional agreement; because they consider that learning produced by Agents when experiencing interaction, affect future interactions. When conducting an evaluation, it is possible to verify a single criterion, two or all three together. Criteria are not exclusive and ideally coexist; however, implementation of a decision (an action plan) that satisfies all three criteria is complex, even more so in a scenario where RUCs are shared. For Agents immersed in the social situation of action, use of these criteria adapted to their specific situation will allow them to make explicit the level of commitment to other Agents and possibility of better future interactions.

A decision incorporating only the criterion of efficacy will be incomplete. Unique incorporation of this criterion shows that the decision-maker has not considered the changes and learning resulting from interactions, worrying only about objective as if it were a single interaction. Efficacy criterion evaluates in result the achievement of objective set-in situation where RUC is shared (See Figure 19)

Figure 19.- Goal achievement

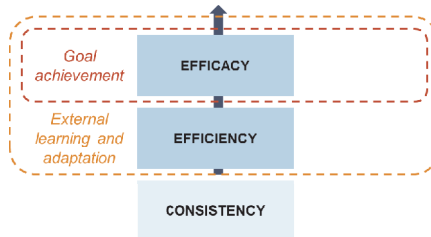


Source: own elaboration

To a public policy analyst, this criterion will lead him to consider the design of incentives that guide actions of Agents towards achievement of common objective over achievement of individual objectives.

Efficiency criterion evaluates incorporation of learning and adaptation of Agents and the meta-organization to various external conditions (See Figure 20).

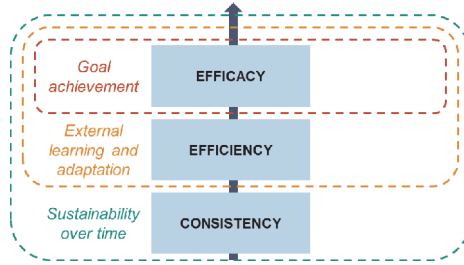
Figure 20.- External learning and adaptation



Source: own elaboration

Consistency criterion, in a social action situation, assesses the incorporation of internal learning and therefore possibility of continuing with interactions, which will make possible the meta-organization and its sustainability over time. This criterion includes not only external but also internal learning, that is, learning from the other Agents, which makes it possible to continue interactions between them (See Figure 21).

Figure 21.- Sustainability over the time



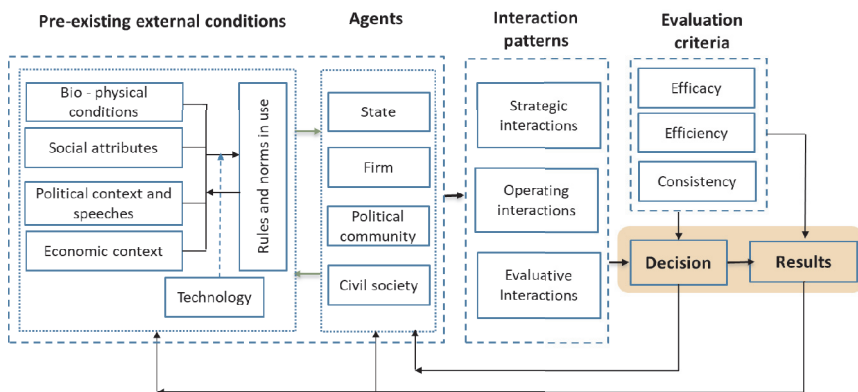
Source: own elaboration

VII. DECISION AND RESULTS.

DIAD framework incorporates a decision-making approach of the Agents, as the basis for governance of organizations that share RUC. Previous items have detailed process prior to decision, showing complexity that Agents face in a situation where RUCs are shared. Decision reveals complexity of analysis of a) pre-existing external conditions, b) Agents and c) interaction patterns, as a process prior to decision-making and its implementation (See Figure 22).

Complexity that exists between preexisting external conditions, Agents and interaction patterns generated between them, lead us to argue that it is virtually impossible to consider all variables in possible action alternatives. Decision is the most concrete synthesis that an Agent can evaluate. Act of governing becomes tangible with the decision.

Figure 22.- Decision and results in DIAD Framework

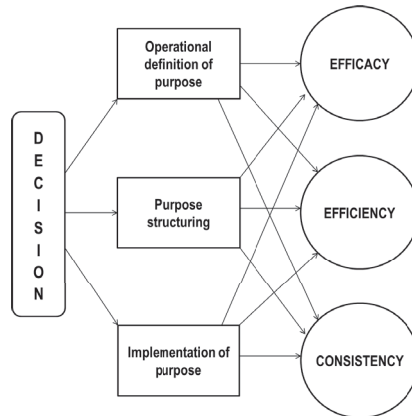


Source: own elaboration

Governing is prioritizing what values and interests to protect. Since governing involves favoring certain interests and values, this may mean that some Agents win while others lose. In this sense, it is not very useful to evaluate decision by results that are perceived by Agents; being of more utility to evaluate if decision is configured in a complete way that ensures governance of system that is formed from social situation of action or, in other words, that ensures governance of meta-organization.

In DIAD framework, a Decision is completely configured if it meets three characteristics: definition, structuring and implementation of the purpose. There is no decision if these three characteristics are not satisfied, although not satisfying them can be seen as the decision to do nothing. Additionally, the decision requires satisfying, for each of its characteristics, evaluation criteria of efficacy, efficiency, and consistency (See Figure 23).

Figure 23. - Inherent complexity of decisions: Full decision



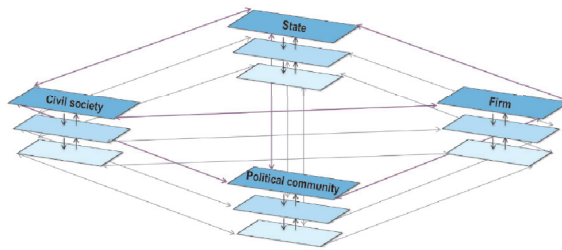
Source: Pérez López, 2006: 145.

In a social action situation where RUCs are shared, emphasis of decision is usually concentrated on structuring, that is, on definition of institutional arrangement (set of rules) between the Agents. In these cases, definition of Agents's joint purpose is often omitted; therefore, purpose of meta-organization is usually omitted, and consequently how this purpose is going to be put into practice. Decision is incomplete by focusing only on a set of rules that are not put into practice, but until a specific problem is solved.

DIAD Framework Decision is not restricted to definition of the arrangement (set of rules), but especially to ensure implementation and sustainability of relationship that is formed between the Agents that make up the future meta-organization. Decision becomes the basis of the governance system of the social action situation where RUCs are shared. A complete configuration of Decision, added to orientation of criteria, will contribute to sustainability of relationship (meta-organization) that is formed between Agents that share RUC.

Decision in situations where RUCs are shared requires considering a) the multiple Agents, b) the multiple levels of government, c) the understanding of the situation to be undertaken, and d) keep in mind that this process is developed in a network of interactions between public and private agents, who have an infrastructure that comes into play when implementing or starting decision (see Figure 24).

Figure 24.- Interactions between Agents at multiple levels of government

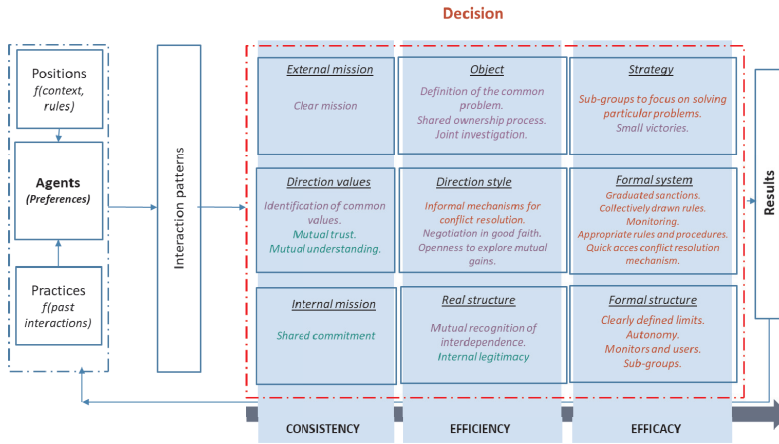


Source: own elaboration

DIAD framework incorporates dynamism in interaction patterns, linking interactions to a timeline of organizational objectives. Synthesis that is achieved in decision-making incorporates dynamism and therefore incorporation of time as a variable in the analysis. There can be no future if you cannot survive in present; however, it is quite possible to mortgage future by thinking that decision made is the only way to survive in present.

Figure 25 shows configuration of Decision in full according to the “Octagon” scheme (Pérez López, 2006). Observing this Figure from left to right, first block refers to external mission, direction values and internal mission of meta-organization. Second block refers to object, management style, and actual structure of meta-organization. Finally, third block refers to formal strategy, system, and structure of meta-organization.

Figure 25.- Decision in DIAD Framework



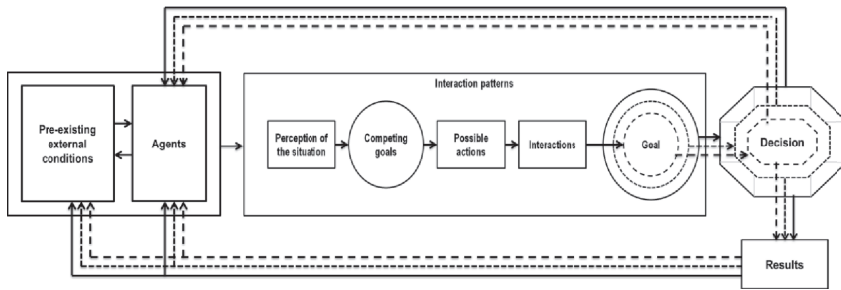
Source: own elaboration

In previous figure you can see the elements corresponding to design principles of E. Ostrom marked in red. These principles, corresponding mainly to institutional arrangements between RUC-sharing Agents, are located at level of efficacy. Levels of efficiency and consistency have been completed with elements from Ansell and Gash (2008) and Emerson et al. Collaborative Governance models. (2012) in purple and green respectively, which are concordant with variables of the “Octagon” tool.

E. Ostrom’s design principles have been included as part of the representative elements of decision, while these principles have already been validated as relevant elements for the sustainability of organizations that share RUC.

Given that decision has been considered basis of governance system of organizations that share RUC, it is necessary to bear in mind that configuration of mode as presented in Figure 25 does not happen from one moment to another but is the product of a continuum of interactions in which Agents manage to identify a common objective, which they work progressively. Figure 26 shows this process that constitutes the formation of meta-organization that forms between the Agents.

Figure 26.- Decision as the basis of the governance system: Formation of the meta-organization



Source: own elaboration

Results are product of decision-making and its corresponding implementation. Implementation is again subject to interaction patterns and linkage of different types of infrastructure, which occurs within the social action situation system. Decision modifies each of the Agents and therefore their share capital, which they will have available for the next interaction. Results on other hand modify positions of Agents and pre-existing conditions. In this way, a dynamic cycle of interaction and change that shapes the meta-organization as a governance system is verified.

Feedback that is given towards social action situation is influenced by decision. Decision made by Agents causes results that affect the social action situation (Agents and pre-existing external conditions). Results, as a product of decision-making, do not necessarily correspond to what would be expected, while all other conditions continue in a continuous dynamism.

It is necessary to explain an ordering of social action situation as a result of feedback proposed in the DIAD framework.

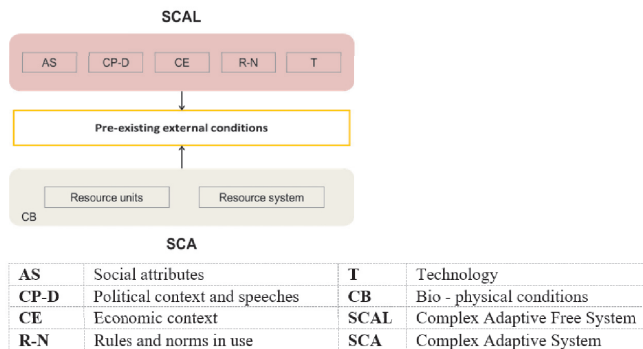
Pre-existing external conditions are affected by decisions resulting from interactions (between Agents) that occur in the social action situation. This affectation is not characteristic of the pre-existing external conditions but of social situation of action in which Agents intervene, who with their actions modify them. Pre-existing external conditions are usually analyzed as a product of an endogenous determination of the social situation of action. This is understandable as it is a simplification of the closed systems used for the analysis. However, these conditions are not isolated; Rather, they correspond to a set of conditions that are specific to it and that would be identified as relevant to action situation under analysis. Therefore, external conditions may

vary due to conditions unrelated to social action situation that is subject of analysis.

Variations in external conditions require to differentiate those that are influenced by human agency and those that are not. Human agency can influence all pre-existing external conditions; however, biophysical conditions additionally have a dynamism typical of resource systems and resource units where human agency does not intervene. Other external conditions (social attributes, political context and discourses, economic context, technology and rules and norms in use) are difficult, if not almost impossible, to separate from human agency, as they are a product of it.

DIAD framework enables pre-existing external conditions to be displayed as systems. Figure 27 shows how pre-existing external conditions are formed from systems: Complex Adaptive System (SCA) and Complex Adaptive Free System (SCAL). Where “environment” includes biophysical conditions, that is, natural conditions of RUC.

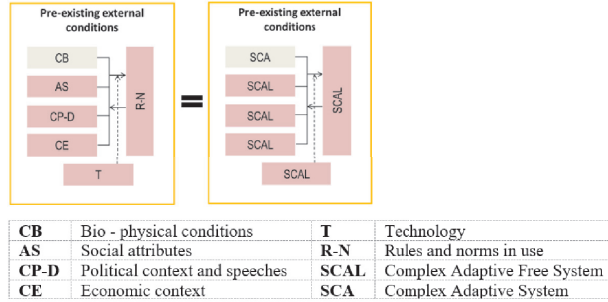
Figure 27.- Conformation of external conditions



Source: own elaboration

Pre-existing external conditions (environment) can be grouped (See Figure 28) as follows: a) conditions of the RUC, such as an SCA, b) conditions of the Agents, such as a SCAL. These include social attributes, political conditions and discourses and economic context, while they are part of the human hard and soft human infrastructure (Agents).

Figure 28.- Pre-existing external conditions according to type of systems

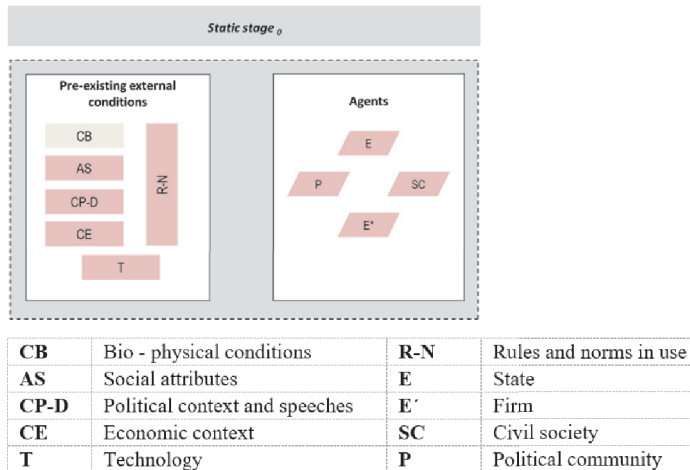


Source: own elaboration

SCA and SCAL systems will be affected as they move from a static state to a dynamic state in social situation of action. These systems do not behave in the same way forgetting the properties of each of these could imply destruction of SCA as a RUC system, and impossibility of achieving governance as a result of interactive balance between a) interaction patterns that occur between the Agents and b) RUC system. Social action situation is shown below through a static and dynamic ordering of phases:

a) Phase 1.- The two systems are presented without interacting (See Figure 29).

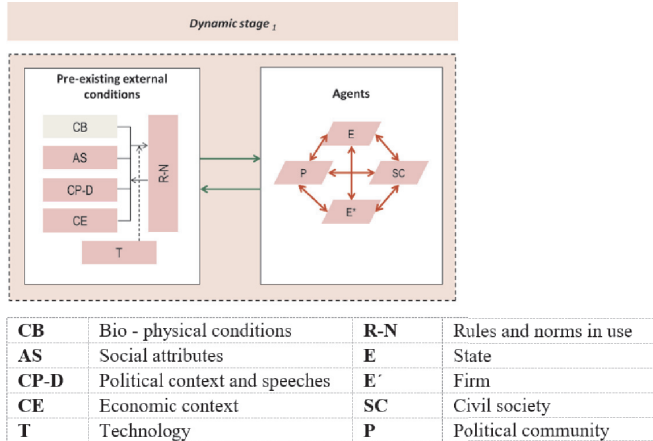
Figure 29.- Phase 1 – Systems without interacting



Source: own elaboration

b) Phase 2.- In action. Double interaction in social action situation is recognized, concentrating attention on interaction patterns that occur between the Agents (See Figure 30)

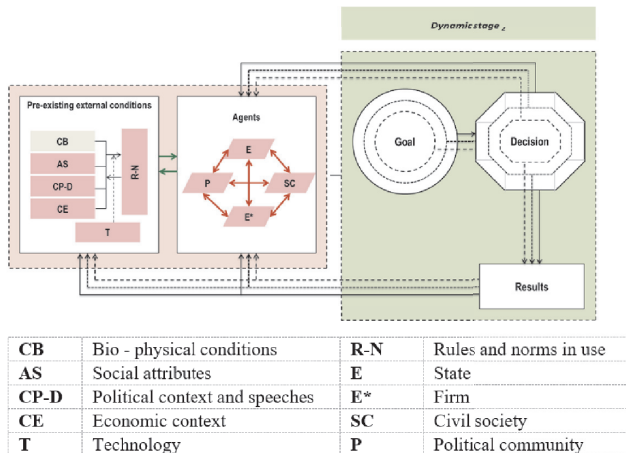
Figure 30.- Phase 2, systems in interaction



Source: own elaboration

c) Phase 3.- Modification of initial conditions of both SCA and SCAL. In this phase the formation of structural relationship (meta-organization) begins, not as emergent but as intentional, product of continued decisions of Agents. While acknowledging participation of the SCA. (See Figure 31)

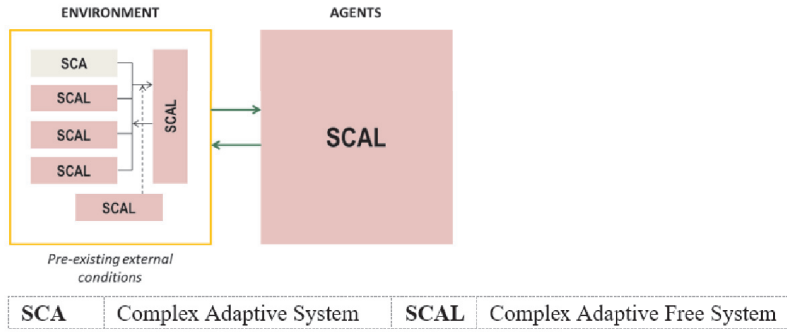
Figure 31.- Phase 3 - Feedback systems



Source: own elaboration

DIAD framework can be understood as interaction of two types of systems: SCA and SCAL (See Figure 32). It is this interaction that shapes the social situation of action.

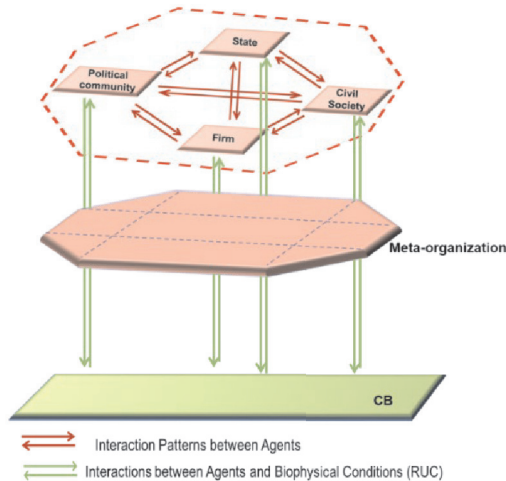
Figure 32.- Interaction of two types of systems



Source: own elaboration

Similarly, in Figure 33, SCA (biophysical conditions) corresponds to lower platform, SCAL (Agents) corresponds to upper platform, and meta-organization corresponds to intermediate platform.

Figure 33.- Formation of meta-organization from interactions



Source: own elaboration

As shown in Figure 33, meta-organization as a governance system does not depend solely on the SCA, nor does it depend solely on the SCAL, it depends on both systems, on their interactions.

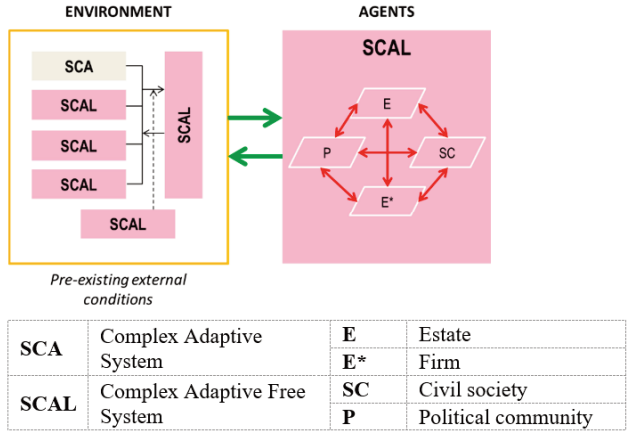
Figure 33 should not be misinterpreted and consider that governance results from a spontaneous emergence of interactions. Nothing further from it. Complex network of interactions that occur between systems will hardly allow us to single out a single variable as causal. Under concept of DIAD model, to achieve such governance requires (among other variables) existence of intentionality. Such intent does not guarantee the achievement of governance; however, without it, governance will be at random from changing conditions.

Within the DIAD framework, governance has as factors social conditions, economic policies, and rules, including Agents. These conditions by themselves do not make governance. A governance system implies by itself a government, a direction, it implies Agents, it implies intentionality.

Although the DIAD framework considers the two (02) types of systems, it places the focus of attention on SCAL. It is in the SCAL where patterns of interaction and decision are made that make possible the achievement of governance and the formation of the meta-organization.

DIAD framework highlights the double interaction (interactions and interaction patterns), as well as statement that “environment” is another “agent”. Figure 34 shows the double interaction, the red arrows correspond to the interaction patterns between Agents like SCAL and green arrows correspond to interactions between environment and Agents. In environment, natural infrastructure (IN) as part of biophysical conditions, is the only one that would not behave like SCAL. Therefore, it is more relevant to focus on the types of interactions that occur between SCALs, than on interactions between SCAL and SCA; without ceasing to recognize them.

Figure 34.- Double Interaction



Source: own elaboration

Governance that is achieved will have much more to do with the interactions that take place between SCALs than between interactions that take place within the SCA. Governance as an achievement of Agents therefore depends to a greater extent on their patterns of interaction. Conditions of the RUC (SCA) are only the medium that influences but does not determine the double interaction.

Interactions that occur between SCAs, that is, between the systems that are part of the RUC, are different interactions from those that arise between SCALs. SCA has an internal order that allows them to adapt to new circumstances, this form of adaptation is always oriented in a direction typical of that natural system (positive learning). Therefore, it is necessary to make the efforts to know the order that this natural system follows (RUC).

SCALs have a free adaptation process, their orientation is not predetermined, the interaction between SCALs therefore includes a choice of orientation. It is in these interactions that the DIAD framework focuses, which have been called interaction patterns.

Pre-existing external conditions are like a snapshot of the conditions at any given time $T(n)$. These conditions will be product of characteristics and internal ordering that the RUC follows as SCA and the product of the results of the double interaction given at time $T(n-1)$. This double interaction will include patterns of interaction that occur between Agents, and interaction that occurs between external conditions and Agents.

Multiple studies have focused attention on biophysical conditions (RUC), and on other occasions the rules; this has made us forget what kind of systems we are dealing with and product of what kind of interactions are situations generated (before and after the interactions). Rules may modify the actions of Agents; they are that set of incentives aligned to an objective that is required as basic conditions. However, nobody assures us that this set of rules will be complied with, accepted, and incorporated by Agents. This has been the subject of study as part of the questions addressed by E. Ostrom, and their findings were incorporated into what he called design principles of solid institutions. However, as E. Ostrom said, these principles are not sufficient; the disposition (the will) of the Agents is required: “I do not believe that it is possible to specify necessary and sufficient principles for long-term institutions, while carrying out institutional work requires a fundamental disposition of the participating individuals. No set of logical conditions is sufficient to ensure that all sets of individuals will be willing and able to make an institution characterized by such conditions work” (Ostrom, 2011: 168). Agents, as SCAL are, as the name says, free, therefore, the possibility of their performance remains open.

DIAD framework makes explicit the opening to the different possibilities of action of the Agents. Result is not always a tragedy; it is not always a utopian cooperation. Opening of possibilities to achieve governance of the organizations that share RUC is in the decisions that Agents make, in the quality of their interactions.

VIII. CONCLUSIONS

- Common Use Resource establishes the relationship of interdependence that exists between Agents that share it; however, Common Use Resource by itself is not a source of conflict or opportunity. Agents, with their decisions, under circumstance of interdependence, choose to build a path of conflict or opportunity of cooperation.

- Interaction patterns configure purposes of Agents. The set of interaction patterns over time strengthens or weakens the relationship that is formed between Agents. Each interaction, each decision, beyond results, will modify Agent himself and his available social capital, and therefore will make it more

or less feasible to continue future interactions. Incorporation of this learning in each of interactions between Agents will be basis for formation of Agent meta-organization as a governance system.

- Decision becomes the basis of the governance system of the social situation of action where resources of common use are shared. A complete configuration of Decision, added to orientation of criteria, will contribute to sustainability of relationship (meta-organization) that is formed between Agents that share Common Use Resources.

- Governance does not emerge, it is result of interactions, it requires intentionality. Intentionality does not guarantee achievement of governance; however, without such intentionality, it will be momentary chance of changing conditions.

- Governance that is achieved will have much more to do with interactions given between Agents as Free Complex Adaptive Systems (SCAL) than between the interactions that occur within the Complex Adaptive System (SCA). Conditions of RUC (SCA) are only the means that influence, but do not determine interactions between Agents.

- DIAD framework opens a door where everything is pending work, because it is first framework that incorporates dynamism as not only positive learning, making actions of agents explicit. In this sense, exploration of patterns of interaction that occur in the various situations, their orientation towards application in practical world of complex project management and their repercussion in the understanding of the governance of society is of interest. This will imply, among other things, going far beyond proposing a logic of structural equilibrium of perfect interactions, explaining the complexity behind the interactions to understand the degrees of freedom that the agents have (linked to the roles they play in society) and the capacities (cognitive and operational) to put their freedom into action, that is, their personal decision.

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