

HOW TO MODEL PEOPLE WORK PRACTICES FROM ONTOLOGICAL TRANSACTIONS

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ABSTRACT

This paper proposes a model to represent people's work from ontological business transactions according to the concepts of Activity Theory and Enterprise Ontology. With this model we aim at providing a comprehensive and structured modelling approach that, at the same time, avoids excessively detailed descriptions of technology-supported activities. The proposed model is complemented with a set of rules that enables the interrelating transactions described with the Enterprise Ontology language and task descriptions based on Activity Theory. An important benefit of this model is enabling the analysis of manifested contradictions to identify the aspects needing changes within organizational activity systems. The proposed model and rules were applied in a study case.

Keywords: Activity Theory; Enterprise Ontology; Organizational Modelling

JEL Classification: D83, O31, O33

1. INTRODUCTION AND MOTIVATION

The evolution of the Information Systems (IS) field has been marked by the importance given to models and modeling activities as a means of facilitating the communication among systems' stakeholders. The high inter-dependence between IS and an organization's structure, culture and processes, as well as the need of aligning IS and organizations, has led to an expansion of the IS field that includes organizational modeling as part of the systems development process.

Modelling an organization is a complex task due to several aspects: (Anderson,1999; DeBoever,1997): (1) the dynamics of change that characterizes the respective organizations and ecosystems; (2) the different concerns or perspectives, as well as their inter-dependencies that need to be represented and (3) the emergence of economies based on information and knowledge, which are now acknowledged as essential organizational assets, leading to dually regarding people both as actors and knowledge resources.

In spite of its complexity, organizational modelling is a valuable effort, since it enables a representation of explicit, organizational knowledge. Having a model of the organization (hereby referred to as "The organizational model") can improve access to information needed for people to understand decision-making and operations of the organization. This knowledge about how the organization works allows the development of a "collective consciousness" by sharing different but inter-related concerns, such as business goals and processes, organizational structure and resources including technological artefacts, people and materials, among others.

Research in Information Systems has provided several organizational, modeling frameworks. Some focus on specific sectors such as government, defense or finance. Other

frameworks are generic; that is, they can be applied to a wide range of organizations of any size, vertical sector or industry, or degree maturity in the enterprise architecture discipline. Some well-known generic frameworks are the Integrated Framework Architecture (IAF) (Cap Gemini, 2007), the Enterprise Architecture Planning (EAP) (Spewak & Hill, 1992), the Open Group Architecture Framework (TOGAF) (Open Group, 2003), and the Enterprise Unified Process (EUP) (Ambler et al., 2005). The most commonly depicted enterprise perspectives are **process**, **organization**, **information**, **application** and **technology** perspectives. It is noteworthy that these approaches are mostly centered on business activities and their inputs and outputs. Within this perspective, there is research aiming at developing collaborative approaches to capture and model business processes (Ventura & Zacarias, 2009)

Other frameworks have been identified as Language-Action Perspective (LAP) approaches. LAP modeling approaches are communication-centered because they emphasize how people communicate with others and how language is used to create shared understandings, as well as to co-ordinate actions (Schoop, 2001). There is also research aiming at developing methodologies

A well-known LAP approach is the Dynamic Essential Modelling of Organizations (DEMO) (Dietz, 2006) for the (re)design of business processes. According to Dietz, it is possible to manage modelling complexity through the integration of three different concerns of the organization; (1) Ontological Model, (2) Realization, and (3) Implementation of the organization are defined as follows (Dietz, 2011; Jong & Dietz, 2010):

1. **Ontological Model:** The essential model of an organization's view of the business regarded in terms of the transactions among its human actors. The ontological model reveals the deep structure of the organization that is more stable over the life cycle of the organization business.
2. **Realization of the Organization:** The integration of Business, Information and Documents.
3. **Implementation of the organization:** The actual operation of organization by its people and information technologies.

The work of Dietz focuses mostly on the former concern (Ontological Model) and only briefly refers to aspects related to realization and implementation. Dietz & Hoogervorst (2008) argue that the development of technological artefacts are based on a notion of theological¹ systems that is disconnected from the business construction and operation. However, the development of business artefacts is based on an ontological notion, which means that it is at the core of the construction and operation of the business itself. Despite this separation, cohesion is needed in the different approaches given that, in an organization, people (supported by technology) are collectively responsible for the construction and operation of the organization. They are also jointly responsible for the company's evolution (adaptation to the changing needs). These responsibilities can only be supported if people have adequate organization knowledge.

Dumay (2005a; 2005b) argues that Dietz's model is not sufficiently detailed to capture human interactions and does not explain how the work done by humans, supported by technological artefacts, can aid the achievement of a new organization's business goals, or improve its performance (Paternò et al, 1997; Norman, 1986; Diaper & Stanton, 2004; Busbach, 1996). Reijswoud and Rijst (1994) show how Dietz's work can only be used for analysis of high-level businesses. Lyytinen (2004) states that whereas it can be used for analysis of business processes models, it cannot analyse the actual implementation of business process.

¹ It is concerned with the function and the external behaviour of a system.

Our research aims at defining a model that complements Dietz's Ontological Model in order to capture the actual work done by people in organizations and their interactions with technological artefacts, allowing a cohesive representation of the Ontological Model of the organization and its Implementation. The proposed complementary model aims at enabling more detailed analysis of the Implementation of the organization. Understanding such implementation is essential in managing human resources, an important aspect of organizational performance (Gomes et al, 2010). An important requirement of our work is to achieve a balance between developing a precise, but technically difficult, formal model, and an easier, but excessively vague, informal model.

Our approach involves the use of Activity Theory (Leont'ev, 1978), which aims at analysis and redesign of human activities. Activity Theory incorporates notions of intentionality, history, mediation, motivation, understanding, communication, culture and context of the people and technology. This theory allows understanding the environment in which technological artefacts are used and support the work done by people in the organization. Several attempts have already been made to operationalize Activity Theory (Kaptelinin & Nardi, 2006; Korpela et al., 2002; Martins & Daltrini, 1999; Mwanza, 2001) in areas such as work analysis and human-computer interaction.

Aligning the ontological point of view with a view capturing work practices has been acknowledged in several works as a means of achieving a better knowledge of the people's work supporting business (Bødker, 1989; Nardi, 1996; Redmiles, 2002; Kaptelinin & Nardi, 2006). Our proposal aims at achieving such alignment by providing a model for the analysis of the organization that integrates the principles of Activity Theory and the Ψ^2 theory (the base of Dietz's approach).

This article is organized as follows: section 2 provides an overview of the DEMO³ methodology and theory Ψ . Section 3 introduces our proposal described in terms of a set of rules and supporting method, which can be applied to modelling the organization implementation. In section 4, the proposed solution is applied to a case study. Finally, in section 5, a discussion is made of the results obtained, along with the conclusions and future work.

2. THEORETICAL FRAMEWORK

2.1 DEMO and Ψ Theory

According to Dietz, there is an essential difference between organizations and other systems, such as technical systems. The technical systems belong to the category of rational systems. This implies that they do not make decisions, but only calculations, and in doing so support the decision only (Liu et al., 2003). Organizations belong to the category of social systems in which people in their category of social subjects have the ability to undertake commitments to each other through social interaction (Dietz, 2006), concerning things they bring to reality.

The DEMO methodology (Dietz, 2006), developed by Dietz, provides a means of dealing with the complexity of the representation of an organization and its dynamics, and it favours the Complexity Theory (Weinberg, 1975), to the detriment of deterministic models of organizations⁴. DEMO provides an immaterial⁵ specification of organization through an ontological model of organizations. DEMO emphasizes the description of the core business of the organization and is based on firm Ψ theory.

² Acronym for *Performance in Social Interaction*

³ Acronym for *Design & Engineering Methodology for Organizations*

⁴ System that attaches to the providential action determinations of human.

⁵ This is because abstracts are the people who perform specific acts in the social organization and the technology they use to do so.

The Ψ theory finds its roots in the scientific fields of the philosophy of language, particularly in the Language Action Perspective (LAP) (Barjis et al., 2002), in Austin's acts of communication (Austin, 1978) and in systemic ontology of Bunge (1979). It recognizes the dynamics, the incompleteness and uncertainty of the reality of the organization, as well as the multiple connections between the components of this reality, and focuses on the use of language to achieve mutual agreement and understanding between people.

According to the Ψ theory, through their social interactions, people engage in obligations relating to actions to be taken and agree on the results of these actions (Dietz, 2003; 2006). This is done via acts of coordination, through language that can be understood as issuing a sentence seen as an action. In this case, the act is called a performative utterance of contractual act, and it creates new facts or actions or part of an action. By stating the act, the announcer does not describe or even state the performing of an action. He is really performing it. The performative utterances do not describe or verify something, are not true or false, are not only the saying or stating, but are part of the action. In general, this means: When we say something, through a locutionary⁶ act, with the intent or effect of changing the world (or act upon the world), we are somehow performing illocutionary⁷ and perlocutionary⁸ acts that cause the intended change.

The Ψ theory consists of several axioms. A summary of the axioms of Ψ theory is shown in Table 1. A complete overview of the theory and associated methodologies is available in Dietz's book (Dietz, 2006) and a number of articles (Dietz & Hoogervorst, 2008; Dietz & Albani, 2005; Dietz, 2006b; Dietz & Hoogervorst, 2007).

In Ψ theory, the transaction axiom indicates that the acts performed by agents occur always and only in universal standards and business transactions and call the result of the execution of a transaction a fact. (Dietz, 2006). The default transaction consists of the following acts: request, commitment, affirmation and acceptance of acts of coordination. It features two actors, each with a distinct role: The initiator, which initiates and completes the transaction; and the performer, who performs the act of production acts.

Table 1. Performance in Social Interaction Theory (Albani & Dietz, 2011)

AXIOM	DESCRIPTION
Operation	The activities of the actors constitute the operation of a business. In exercising, these subjects perform two kinds of acts: production or coordination acts. These acts produce definitive results: production and coordination facts.
Transaction	The transaction axiom defines the relation between acts, so the transaction can be defined as a universal standard in which there are executed acts of coordination and production, involving two actors always aiming to achieve a certain result.
Composition	Describes the interrelationships between transactions
Distinction	The axiom of distinction establishes the existence of three human capacity determinants in implementing the roles of the actors during operation; these capabilities known as Performa, Inform and Form: Form: formal aspects of communication and information; Inform: content aspects of communication and information; Performa: relates to the appearance of new things, directly or indirectly, through communication.

An example of standard business transactions looks like the negotiation of buying fruit at a grocery store:

⁶ Corresponds to the act of uttering something.

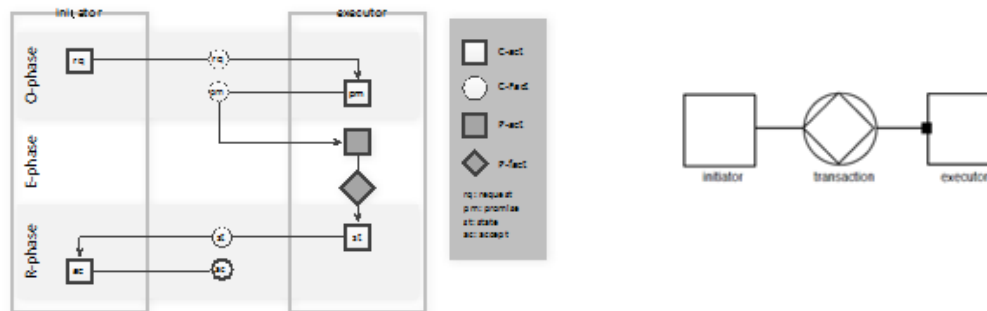
⁷ They represent the actions that take place within language, containing the value in the statements.

⁸ The effects obtained by the use of language (to convince, persuade), i.e., the result of the actions performed by the language

1. Person A asks (order), person B that wants to buy a certain amount of fruit;
2. Person B makes a commitment (promises) to person A to fill a bag of fruit with the amount requested;
3. **<act of production: effective delivery of the “bag of fruit”>;**
4. The person B states to person A that has manufactured the “bag with fruit”;
5. Person A accepts from person B the bag with the fruit in accordance with his expectations

A transaction is a journey through this whole pattern, and each business process in every organization is a collection of transactions linked together in different phases of the acts of coordination. Figure 1 is a graphical representation of the standard ontological business transaction.

Figure 1. Standard Business Transaction (right) and its constituent acts (left), adapted from (Dietz,2006)



2.2 Activity Theory

Activity Theory, developed from the work of Vygotsky, Leont'ev and Luria is understood as a systemic and collective theory, with a structure that aims at analysing human activities. Activity Theory takes into account the interaction between the participants in the sociocultural context in which they operate (Vygotskiï & Cole, 1978; Veer, R., Valsiner, 1993). Interest in applying Activity Theory in the field of Information Systems arose in the 90s, and it is reflected in various publications under the topics of Human-Machine interface and Cooperative Work (Bødker, 1989; Nardi, 1996; Redmiles, 2002; Kaptelinin & Nardi, 2006).

Leont'ev postulated that human activity is always social and cooperative, thus it is collective, and takes place within a division of labor (Leont'ev, 1978). The collective activity is linked to the object (purpose) of the activity and the subjects performing it, of which community members (individually) are not often aware. The concept of the object of the activity is subsumed in the concept of activity, in the sense that there is no activity without an object. One thing or a phenomenon becomes the object of an activity as a means to satisfy a given human need or motivation.

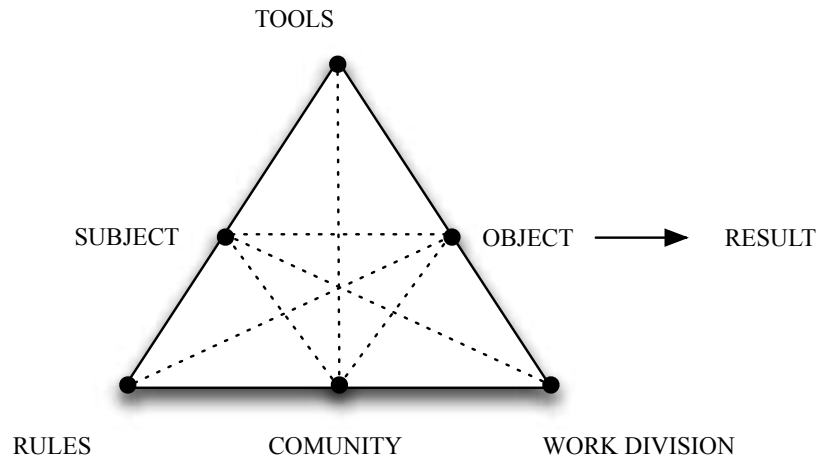
Table 2. Hierarchical levels of activity proposed by Leont'ev (1978)

LEVEL	ORIENTED	COMPOSITION	PERFORMED BY
Activity	Objects that satisfy a need or desire (motive)	Made by actions	Community
Action Can only be understood in the context of the activity to which it belongs	Directed towards a conscious goal	Composed of other actions or operations	Individual or group
Operation The means used to implement the actions	Instrumental conditions	Are initiated by specific environmental situations	Individual or machines

An activity produces outcomes and is performed through actions. Nevertheless, the activity can not be reduced to actions, which are temporary and have a clearly defined beginning and end. Rather, an activity is developed throughout time within a socio-historical process. Individual actions are linked to specific targets or goals that are more or less conscious (Leont'ev,1978). In Activity Theory, goals are not fixed. As subjects act, new goals can be formulated or revised from existing goals. Actions are performed through operations. Operations are performed in an automatic, unconscious fashion and are not clearly related to goals. Operations depend on the conditions in which actions are performed. In this context of three levels, Leont'ev proposed structure for an activity as shown in Table 2.

Engeström departed from the theoretical basis of Vygotsky and expanded his studies to emphasize the notion of mediation. For him, the evolution of the activity occurs through various forms of interaction between organisms and their environment (Engeström,1987; 2000; 2006). The author proposes a system of representation of human activity that encompasses the various components of an activity and their interdependences. According to this author, individuals participate in activities defined by conditions provoked by the division of labor, even without being fully aware of the object and reasons of such activities. Activities are performed by subects through actions to satisfy the object of the activity, which is in turn driven by given purposes or motifs (Engeström,1999). Activities are normally mediated by instruments or tools. Tools can be physical (e.g. a hammer) or psychological (e.g. signs). The model proposed by Engeström to represent the structure of the activity is illustrated in Figure 1, where the constituent elements of activities and their inter-relationships are graphically depicted.

Figure 2. Triangular Model of Activity Theory, adapted from Engeström (1999)



The constituent elements of activities are defined below:

- **Object.** This component reflects the nature of human activity, which enables control of behaviour in order to meet the results identified.
- **Subject:** Participants in the execution of activities. Element representing the individual and social nature of human activity. Includes discussion and collaboration to achieve a common goal. Subjects are individuals or a group of individuals involved in the activity that are guided by a purpose or reason (the object). Hence, subjects form a community share the same general object and constitute a community distinct from others. This element is part of the activity that allows investigating the socio-cultural context in which individuals operate.
- **Tools:** The relationship between subjects and the object is mediated by the use of tools. Tools can be psychological (influence behavior) and/or physical (influence the manipulation of objects). Tools are resources used to transform the object in order to get a result. They can be any resource used during the transformation process: hardware, software, models, methods, theories or even language. Tools themselves can change and, in turn, change the activity. Tools are an essential notion in capturing work practices within an organization.
- **Community:** Social and cultural context of the subjects in which the activity is developed. The community consists of all individuals sharing the same object and, hence, includes all activity stakeholders. This element is also important in the study of the socio-cultural context of subjects.
- **Rules, norms and sanctions:** Boundaries (rules and regulations) affecting the direction of development activities. Rules can be explicit and implicit (e.g. standards of social behaviour within a specific social community). Rules, norms and sanctions specify and regulate, explicitly and implicitly, providing the correct procedures and acceptable interactions between participants within the system activity. Rules mediate the relationship between subjects and their community.
- **Division of labour:** Refers to the allocation of responsibilities. Framing the role to be played by each subject in the development of an activity in the community. Both the horizontal division of tasks between the members of the community, and the vertical division of power and status, continuously mediate negotiated distribution of tasks,

possession of power and responsibilities between the community and the object of the activity system.

According to the Engeström's Triangular Model of Activity Theory, the focal point of the analysis of an activity system is the midpoint of the right side of the triangle (the production of something), which happens when the activity takes place. In the production of outcomes of any activity, participation includes: the subject, the object of the activity, the tools used and the actions and operations that act on the object and produce the result (Engeström, 1999).

The triangular model developed by Engeström's analysis suggests the possibility of multiple relationships within the triangular structure activity; however, the main task is always to understand the whole rather than their separate connections. For Engeström, Activity Theory is an important framework to understand the totality of human work and its praxis, since work cannot be understood or analysed outside the context in which it occurs. Thus, when analysing human work, we must take into consideration not only the actions of individuals, but also who is involved, what are their motives and goals, what rules and procedures exist and the community where the activity occurs.

3. PROPOSED APPROACH

Our approach allows analysing the work done by people from the ontological transactions of Dietz's Enterprise Ontology. The solution consists of a set of rules, which integrate representations of ontological transactions using Dietz's Enterprise Ontology (section 2.1) with notions drawn from Activity Theory (section 2.2). Section 3.1 describes the set of rules, and section 3.2 describes a model with a graphic representation of the concepts and relationships defined in such rules.

3.1 Proposed Rules

An integrated view of Activity Theory and Enterprise Ontology is achieved through the following set of rules:

- **Rule R1 (Work Unit [WnT]):** Understanding work practices entails defining and analysing minimum units of work (which we designate simply as **Work Unit**) involving work (which we designate by acts). Acts are actions performed by members of the organization that are considered relevant for the organization. Acts can be performed consciously or unconsciously. It also entails identifying the following elements: **stakeholders**, who are the people that request a product or service, and the people who satisfy such request. This rule is drawn from Activity Theory, where work always results in a collective effort (e.g. always involves the participation of several people performing acts towards a common result). We associate the product (or service) of the work unit to the result (product or service) of the ontological transactions. It is noteworthy that people working in a **WnT** are not always aware of its result. **WnT** have a dynamic nature, constantly changing over time, because the performance of acts is understood as part of a socio-historical process.
- **Rule R2 (Operational Classification):** The acts performed by people in a **WnT** can be acts of **coordination** or **production**. In **production acts**, people contribute to the achievement of the result of each **WnT**. By performing **coordinating acts**, people meet the commitments related to **production acts**. Once done, the **act** results in the

creation of a **fact**, which will be a production or coordination fact according to its related act. This policy stems from the concepts present in the Ψ theory;

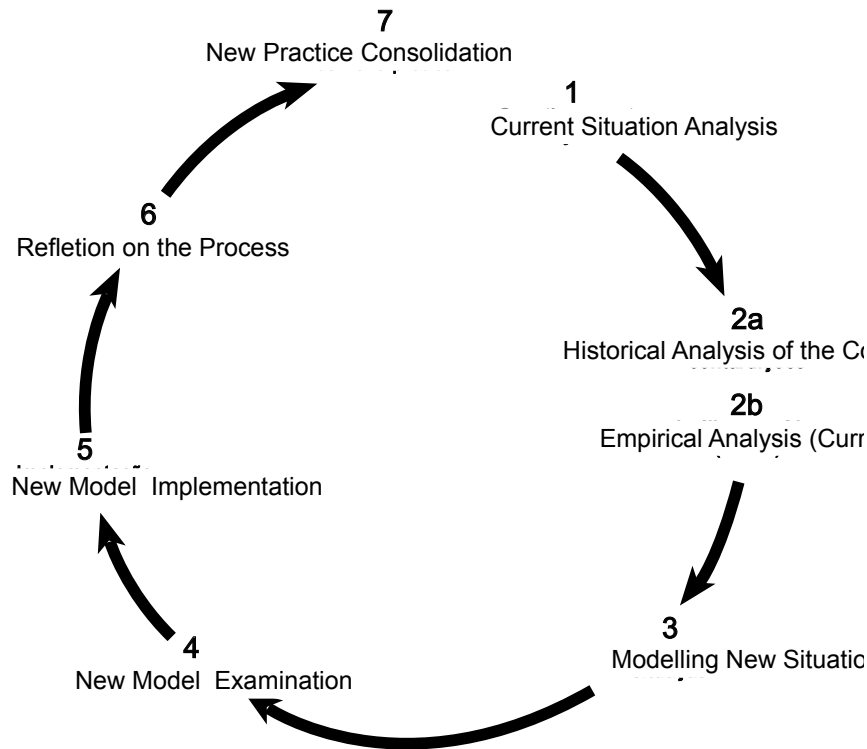
- **Rule R3 (Life Cycle of Acts):** In a **WnT**, coordination and production acts follow a sequence of **acts**: *request*, *promise*, *produce*, *state* and *accept*. These acts are organized into three distinct phases: the **Order Phase** (O-phase), the **Execution Phase** (E-phase) and the **Result phase** (R-phase). In O-phase, people try to reach an agreement on the desired outcome in the **WnT**, which is the intended **fact** by that work unit and encompasses *request* and *promise* acts. In the E-phase, production is performed, comprising the **acts** of *producing* a result of interest to business. In the R-phase, comprising the *state* and *accept* acts, people try to reach an agreement whether the result is that which was agreed in the O-phase. The first and last step are *performative* in the sense that they do not affirm or deny anything, but that they perform an act when they are announced, and they are used to reach an agreement, respectively, on the *request* and on its *acceptance*. The intermediate phase is the action associated with the request (and triggered by it). This policy stems from the concepts present in the Ψ theory.
- **Rule R4 (Decomposition of the act):** Every act (e.g. request, promise, producer, state and acceptance) consists of a sequence of actions and operations that are created and maintained in the organization. Actions are held in a conscious way. Operations are conducted in an unconscious manner, always subordinated to actions and dependent on execution conditions (environmental and sociocultural). An action will be performed by a set of operations. The operation of an action is not a fixed plan or prescription of the work to be performed. Rather, it is only a roadmap that can be modified according to the context in which it is executed. Due to the unconscious and contextual nature of operations, it is unlikely to describe a priori what operations will be part of the actions that people take. Still, from an afterthought and observation of real work, it becomes possible to conduct a survey of the most common operations used by the subject during the work. This rule follows the hierarchical structure of an activity proposed by Leont'ev in Activity Theory;
- **Rule R5 (Mediation):** Actions and operations on the environment are performed through artefacts that can be physical or mental tools such as rules, signs, contexts and work divisions used to control behaviour, improve communication and motivate people. An artefact evolves over time, thereby adding to the history of development within a **WnT**. Since actions and operations depend on mediating artefacts, they both constrain or enhance the way that people perform them. Outside the context of the **WnT** in which the artefacts are used, it becomes difficult to understand their usefulness. Ideally, people should not be aware of artefact usage, unless those who develop the artefact desire it. This rule results from the analysis of the systemic model proposed by Engeström to represent the structure of social activity;
- **Rule R6 (Agents):** People who participate in a work unit play the role of agents in an organization. **Agent roles** specify the responsibilities, competencies and authority necessary to participate in given **production** or **coordination** acts. Agents can be active or passive. Active agents have coordination roles. Passive agents are limited to production roles. The purpose of this rule is to model the work carried out by people, mediated by tools, rules and division of labour, taking into account the roles cast in ontological business transactions.

Figure 3 depicts a graphic representation of the concepts and their relationships described in the previous rules.

3.2 Supporting Method: Finding contradictions

The expansive cycle allows us to understand the evolution of work units through the identification of time periods marked by innovation, transformation and change, as well as others marked by cultural reproduction and/or the learning of the innovations produced. To make it possible to integrate the learning cycle in the context of the work units, it was decided to incorporate it in the Boyd Decision Cycle illustrated in figure 5 (Breton & Rousseau, 2005; Bunge, 1979).

Figure 4. Expansive Learning Cycle



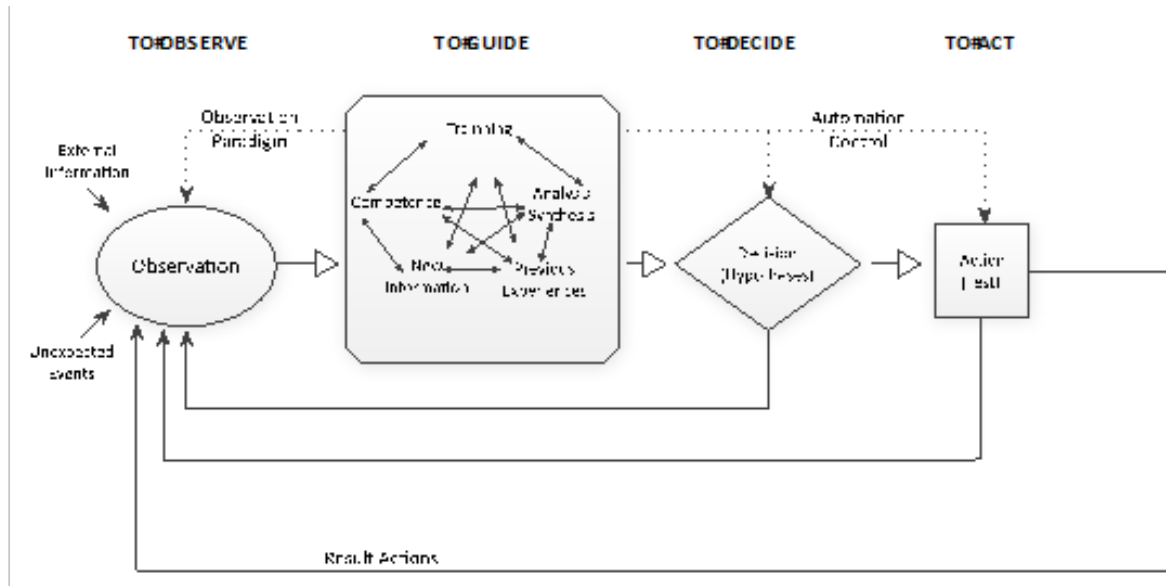
The Boyd Decision Cycle includes the perception that the process comprises a set of steps executed iteratively. These steps are: “observe - orient - decide - act.” Each phase of the cycle is explained below:

- 1. Observation** includes the collection and compilation of data and information about the organization, particularly in ontological process diagrams, new requests made by organizational structures, external information about existing technologies to support business, historical knowledge of the solutions found over time to the issues raised, as well as the knowledge of their weaknesses and strengths;
- 2. Orient** is to interpret scenarios based on observations, previous experience, an organizational view, an organizational culture, viewpoints, etc. The orientation results in the construction of diagrams that represent the reality in order to make sense of the actions to be performed. The orientation is highly dependent on the existing view, which in turn is dependent on the tacit knowledge that each element has of a team. Helping a team to observe and get a global sense of what is observable, respecting the particular vision of each element, is a key task. The orientation is a way of promoting the sharing of tacit knowledge that each individual has and that is usually difficult to be formalized or explained to others, because it is subjective and inherent to the abilities of a person. It leads directly to the decisions but also configures observation and action, allowing the definition of alternative solutions;
- 3. Decision** is made from the image produced in the orientation step, and it defines the most appropriate response to the current situation. The outcome of the decision may

flow into both sides: Immediate action, or return to observation if there is not enough information for a decision;

4.Action is a decision that will then be implemented through the selected action.

Figure 5. Boyd Decision Cycle



This method yields better results through quick iterations. The speed of iteration overcomes the quality of iteration, which is achieved from a process of continuous improvement of the solutions encountered. Based on this vision, we define the steps (see table 3) that incorporate rules and the expansive learning cycle:

Table 3. Steps of the proposed method

STEPS	NAME	DESCRIPTION
1.1	Observation	Map each Ontological Transaction to a Work Unit (WnT), as defined in Rule D1.
1.2		Associate the object of the WnT to the product of the Ontological Transaction
1.3		Associate the result of the WnT acceptance product to the Ontological Transaction, specifically the fact of the transaction when it is run successfully.
2	Orientation	Through observation, decompose the stages of the cycle of acts (O-step, E-step and R-step) in the list of people who perform the actions and identify the list of possible procedures to perform the actions. Identify the tools that mediate iteration between people and actions according to the Rules D2, D3, D4 and D5.
3	Decision	Historical analysis of the tasks and procedures and used tools based on the operation of the organization to detect changes that may be proposed (Expansive Learning Cycle 1, 2 and 2b).
4	Action	Reflection about operation and consolidation of the new practice and impact assessment (Expansive Learning Cycle 3-7).

4. EXAMPLE

We illustrate our approach by applying the model and method to an example described by Dietz in his book (Dietz,2006), described below:

A person wants to buy a bouquet of flowers, and may use different ways to order it (eg by telephone, email, going to the store). To order it is necessary to mention information for the invoice (ie name, tax number, corporate headquarters) and information about the type of bouquet it proposes to buy.

When the bouquet is ordered in the internet it indicates the day and time that it will be picked up at the store. The person who manages the customers requests follow them up through the reception of the different means whereby requests are received and checks if the information provided is complete. If not, communicates with the client in order to complete the data. If an application is complete, the bouquet is produced.

Then, the person responsible for the invoices calculates the amount that has to be paid and prepares the issue of the invoices for payment, receives and checks money, and delivered presentially, if the customer is at the store. Payments must be made by bank transfer or cash. Once payment is received the bouquet is delivered to the customer in the store

4.1 Example Ontological Model

As aforementioned, the starting point is the Ontological Model of the organization, which was built using the DEMO methodology. Figure 6 provides a general view of transactions, which in this example are transactions T1 (Bouquet Order) and T2 (Bouquet Payment). Both transactions involve the actors A1 (Client) and A2 (Organization). Transaction T1 is initiated by actor A1 and executed by actor A2 (i.e. the Bouquet Order transaction is initiated by the Client and executed by the Organization). Conversely, transaction T2 is initiated by actor A2 and executed by actor A1 (i.e. the Bouquet Payment transaction is initiated by the Organization and executed by the Client).

Figure 6. Ontological transactions of the example

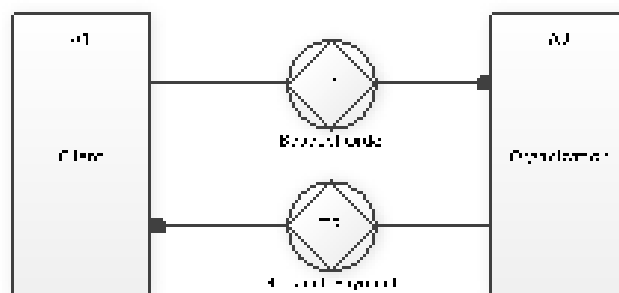


Figure 7. Internal structure of transactions T1 and T2

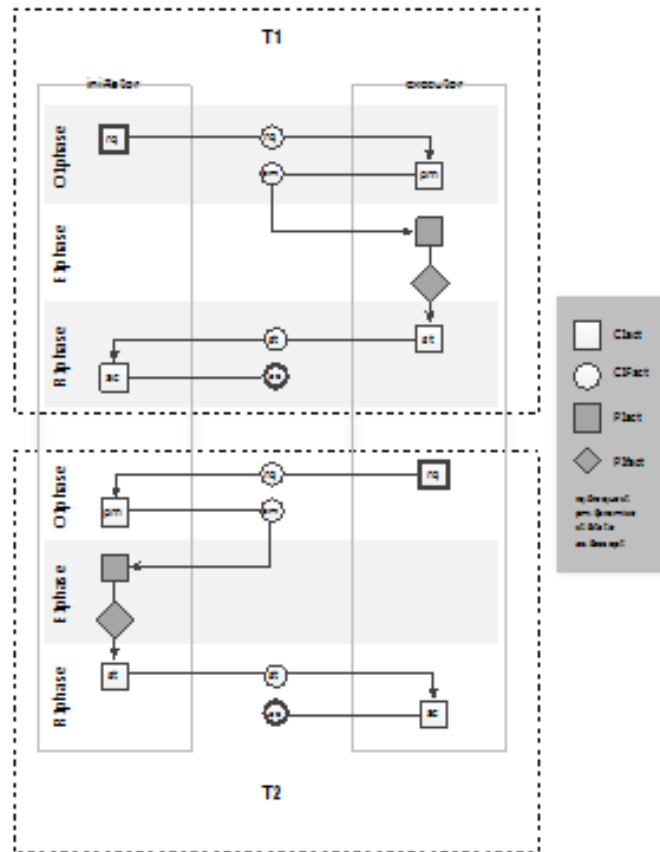


Figure 7 illustrates the internal structure of each transaction in terms of phases, as well as the associated acts and facts. The O-phase of Transaction T1 is initiated by the coordination act request *rq* (*client requests a bouquet*). The request creates a coordination fact *rq* (*bouquet ordered*) that coordinates a response from the organization expressed through a coordination act *pm* (*promiste bouquet for a given date*) and its corresponding coordination fact (*bouquet promised for...*). The latter coordination act triggers a production act (*ellaborate bouquet*) and its corresponding production fact (*bouquet ellaborated*), which correspond to the E-phase. The R-phase encompasses a coordination act *st* (*the organization states that the bouquet is ready*) corresponding to a coordination fact *st* (*information about the bouquet stated to the client*). Once the client knows that the bouquet is ready, it triggers a coordination act *ac* (*the client accepts the bouquet*) and a related coordination fact (*bouquet accepted*).

Based on the ontological model, we proceed to complement it by adding associated work units with information specific to work practices, using the proposed method described in section 3.2.

4.1.1 Observation

Observation describes the Work Units that will be subject to detailed analysis. As aforementioned, a mapping is established between work units (WnT) and corresponding ontological transactions work. This includes associating work units with ontological transactions, and identifying the work unit object, result, and participating agents (active and passive).

Table 4. Mapping ontological transactions and work units

WORK UNIT	OBJECT	RESULT	ACTIVE AGENTS	PASSIVE AGENT
Bouquet order	Bouquet order	Bouquet is ordered	Clients and organization members responsible for taking bouquet orders	People who elaborate the bouquet
Payment order	Payment	Bouquet is paid and the customer receives it	Organization members responsible for bouquet payments and the client, who is responsible for making the payments	

4.1.2 Orientation

In the orientation phase, each identified **WnT** is described in detail. This detailed description entails identifying the **WnT** goals, actions, procedures and tools for each phase of the transaction. As an example, we present a detailed description of the **WnT** “Order Bouquet”.

Table 5. Bouquet custom order: O-PHASE

WNT: ORDER BOUQUET: O-PHASE			
GOALS	ACTIONS	PROCEDURES	TOOLS
1) <u>MAKE REQUEST</u>	1.1 The customer makes a request for a bouquet	1.1.1 Access a bouquets catalogue 1.1.2 Make choice 1.1.3 Send choice to Company	Catalogue Telephone Email Log book
2) <u>ACCEPT REQUEST</u>	1.2 The organization accepts the request to make the bouquet	1.2.1 Access Registration Customer Choice and day and time of delivery 1.2.2 Check if the choice made by the customer is possible 1.2.3 Store in the organization indication of when the customer comes to get the order 1.2.4 Confirm to the customer that the bouquet will be done	Catalogue Telephone Email Log book

Table 6. Bouquet custom order: E-PHASE

WNT: ORDER BOUQUET: E-PHASE			
GOALS	ACTIONS	PROCEDURES	TOOLS
1) <u>MAKE THE BOUQUET</u>	1.1 Manufacturing	1.1.1 Make the bouquet according to the logbook 1.1.2 Store the bouquet	Flowers Mechanical tools Log book

Table 7. Bouquet custom order: R-PHASE

WNT: ORDER BOUQUET: R-PHASE			
GOALS	ACTIONS	PROCEDURES	TOOLS
1) <u>DELIVER THE BOUQUET</u>	1.1 The Organization delivers the bouquet	1.1.1 Access to the register of bouquets 1.1.2 Find bouquet 1.1.3 Register Bouquet Delivery	Log book
2) <u>ACCEPT THE BOUQUET</u>	2.1 Client accepts bouquet	2.1.1 Customer confirms the reception of bouquet 2.1.2 The organization registers the Delivery of Bouquet	Log book

4.1.3 Decision and Action

In the decision phase, manifestations of contradictions were analysed from the observation of the tensions in interactions between people. We sought to analyse and categorise the types of manifestations of people involved in the operation of the organization. As a way of analysis, we tried to find the manifestations of conflicts at each stage of Unit Work: Order Phase, Execution Phase and (Result) Delivery Phase.

In the Order phase, the manifestations found were related to the inability of the customer and organization reaching an agreement about the type and the desired Bouquet or because the catalogues were not updated within the range of existing bouquets or, otherwise, the prices were not the same because they have changed.

In the Execution phase, we found a difficulty in understanding the composition of special bouquets that were ordered: those who had the task of building Bouquets did not perceive the language used by those who registered the order. This difficulty was reflected in a bouquet composition that was different from the type that the customer had ordered.

In the Delivery phase, there were two types of stresses, especially in clients who made the order by phone: The orders were not ready on the day and time agreed, and the product delivered was different from what was requested by the client. Customers didn't appear to collect the product; and, because the payment was made only at the time of delivery, the result was a loss to the organization. There were also delays in the delivery of the bouquet that was ordered by phone, because the bouquets of customers who went to the store were made while the customer was in the store, which delayed the production of bouquets ordered by phone.

From the previous contradictions, it was decided to implement the following solutions:

1. Customers who made the request by telephone have gained access to a web catalogue with access to a set of standard bouquets.
2. There was no possibility to compose different types of bouquets by phone.
3. It became mandatory for customers to pay before the elaboration of the product when the order was made by phone.

This decision led to the adoption of new tools of mediation, including the availability of an electronic Catalogue on the Internet, together with a company website and an order management application, which included payment verification. However, new tensions emerged due to the amendments made that will require a second iteration of the proposed cycle.

5. CONCLUSION AND FUTURE WORK

This article addresses the description of work practices using Dietz's organizational ontological model of Ψ Theory and Activity Theory. The Ψ theory used to represent essential (ontological) transactions is composed of business processes and identifying the actors participating in such transactions. Actors of an organization perform two kinds of acts: production and coordination acts that produce corresponding production and coordination facts. Acts are organized in patterns defined as transactions that ultimately create a relevant business result (a production fact).

The Ontological Model provides an initial base of analysis but does not provide information regarding labour division, which technologies are used, or the specific actions and operations executed that result from specific socio-cultural rules. Activity Theory is used to complement information related to the particular implementation of a transaction. In particular, we use Engeström's diagrams to describe the key elements of activities that allow the analysing of human practices such as tools used, subjects involved, as well as actual actions and procedures resulting from specific socio-cultural rules. To this end, we adopted a set of rules and applied them to allow the capture and analysis of these elements.

The interconnection of these theories provides a basis to analyse the organizational activities both from the perspectives of its essential transactions and the particular way people perform their work through actions in the organization. We use the Activity Theory notion of contradictions to identify activity aspects requiring changes. In other words, the focus of the analysis is the contradictions present during activity execution. The identification of contradictions allows identifying problems and proposing solutions.

In the future, we plan to expand the information captured in work units by explicitly including socio-cultural rules governing actions and procedures. Furthermore, the cycle of expansive learning will be explored as means for a continuous analysis and resolution of tensions and contradictions in an organization according to a base ontological model. Our purpose is to define a systematic and socio-technical approach of organizational analysis through a redesign so that it is possible to inter-relate abstract models with concrete situations through critical discussions, rejections, reformulations, and the proposal of proper solutions. This approach aims not only at identifying areas of improvement but also learning from them, by first determining if they have been identified and resolved in the past. Since solving contradictions cannot take place at the individual level due to their social nature, we plan to include graphical models of activity contradictions in the DEMO methodology in order to support their communication and discussion.

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