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Co-constructing organizational autopoiesis: the Developmental Laboratory as a model and means of Enabling Interventions

Gianna CARTA¹ and Pierre FALZON²

^{1,2} Research Centre on Work and Development, Conservatoire National des Arts et Métiers
41 rue Guy Lussac, 75005 Paris, France
gnn.carta@gmail.com; pierre.falzon@lecnam.net

Abstract. This paper presents a model for an ergonomic intervention with developmental and autopoietic aims. It is based on the organizational change of an entity in charge of the signalling devices maintenance for the Parisian subway. Its developmental goal is to empower actors to redesign their work processes in an enabling, autonomous and sustainable way based on the emerging needs of a cross-functional activity that is to be imagined. The intervention was conceived and equipped as a formative process. The methodology put in place is called the "Developmental Laboratory" (DL). The DL impels two levels of cross-functional inquiry. The DL1 concerns the production work or even the redesign of maintenance processes (functional dimension). The users have jointly constructed new more able organizational solutions (processes, tools, methodologies, forms of coordination and management, etc.). The DL2 deals with the practices underlying the previously organizing process (metaflective dimension). In other words, the results and processes in DL1 were investigated in DL2. The users were therefore mobilized in co-design and formalization of new organizing standards and routines. The place of the real work analysis and the roles of Enabling Ergonomist are investigated. These appear to be key elements to translate the developmental potential of the actors (Ergonomist included) and their practices into actual productions.

Keywords: organizational autopoiesis, Developmental Laboratory, processes participatory design, enabling interventions.

1 Introduction

This intervention-research aimed at designing and implementing an enabling methodology for organizational development. This methodology had a double goal, developmental and sustainable. First, an intervention environment was set in order to allow the actors to design organizational solutions meeting the current needs of cross-functional activity. Second, it attempted to make actors able to redesign their processes in a continuous, enabling and autonomous way, beyond the end of the ergonomics intervention. The design of the intervention apparatus builds upon the autopoiesis model [1]: a support was provided for the design of organizational components and

coordination network; particular attention was paid to the development of self-reference skills, aiming at achieving a continuous organizational development.

This intervention-research is grounded in assumptions regarding the nature of organizations and the means and purpose of participatory interventions on organizations.

We approach organizations according to a process perspective [2], [3]. Organisations are not seen as stable structures, imposing rules, norms and procedures, but rather as self-designing systems [4], as permanent processes of articulation between various actors defending various interests. Organizational processes result from a collective sensemaking process [5]: agents produce “organizational work”. In this view, cross-functional practices are central to organizational design, and actors play a central role as creators of their work practices.

In this perspective, ergonomic interventions aim at facilitating "design-in-use" processes, so as to empower actors [6]. The intervention was designed according to the Constructive Ergonomics perspective [7]: the objective of ergonomic actions is both to foster processes of development throughout the ergonomic intervention and to design work systems that promote development. Enabling interventions integrate development as a means and as a purpose. Intervening means setting up, during the intervention itself, a dynamic apparatus that encourages experimentations [8] and debates about the multiple representations of work [9], [10]. Thus, intervention is seen as a formative process [11] that allows actors to learn and to develop themselves and their processes. Development is a means and a goal of the intervention.

1.1 The context: the insourcing of the signalling devices maintenance activity

This organizational development project was conducted for the Railway Transport Company of Paris (RATP). The Subway Signalling Maintenance Unit performed a partial insourcing process of the maintenance function in order to achieve strategic and economic goals. This process required to develop operators' competence and bring together operational and supporting functions, i.e. Maintenance Engineering, Service Quality, Logistic, Railway Work Management. This reorganisation led to several difficulties shortly after being implemented, impacting availability, reliability and resilience of the maintenance system. The ergonomics intervention started at this stage. A work analysis of the maintenance system was performed. The results highlighted a techno-centred approach to the organisation. It led to management practices characterized by reactive routines, centred on technical and mitigation solutions, a top-down change management, a lack of cross-functional analysis of organizational dysfunctions, distance between HR policy and operational needs, project management practices disconnecting departments, a supremacy of the construction service, a very limited risk assessment. This led to a breakdown of cross-functional actions, and impeded knowledge management and management development. To cope with this issue, a participatory project was proposed in order to design enabling solutions regarding processes, IT tools, standards, methods, collaboration rules, etc., and to develop an enabling and autopoietic organizational functioning.

2 Methodology

The organizational development was conducted through an ergonomics approach to project management, with various meetings (kick-off, steering committee and follow-up meeting) and workshops for designing cross-functional processes [12].

The Enabling Intervention focused on the global life cycle of signalling devices. The transverse activity of the involved professionals, i.e. Designers, Constructors, Commissioners and Maintainers, was analyzed. Concerning the Maintenance Department, the production units (maintenance centres) and the support functions both at local level (Maintenance Engineering, Quality Service Assurance, Logistic, Railway Site Work) and central level (HR, Safety and Quality) were enrolled in the project. Globally, 44 managers of the Department were involved. They belonged to five hierarchical levels, from operational to top managers. At the production level, 78 maintenance agents were involved as well. The project lasted from April 2011 to August 2015 and included three phases (see Fig. 1):

- a « *preimplantation* » phase lasted almost two years. A preliminary diagnosis of interactions and transactions between professions over the life cycle of signalling devices provided information on the requirements for design of the developmental laboratory (DL; see below).
- a « *cross-functional organizing* » phase, that lasted eight months, aimed at supporting the actors in the participatory design of the new and enabling maintenance processes.
- an « *autopoietic mechanism anchoring* » phase, that lasted fourteen months, aimed at developing a self-reference practice, which is supposed to enable a future and durable organizational redesign.

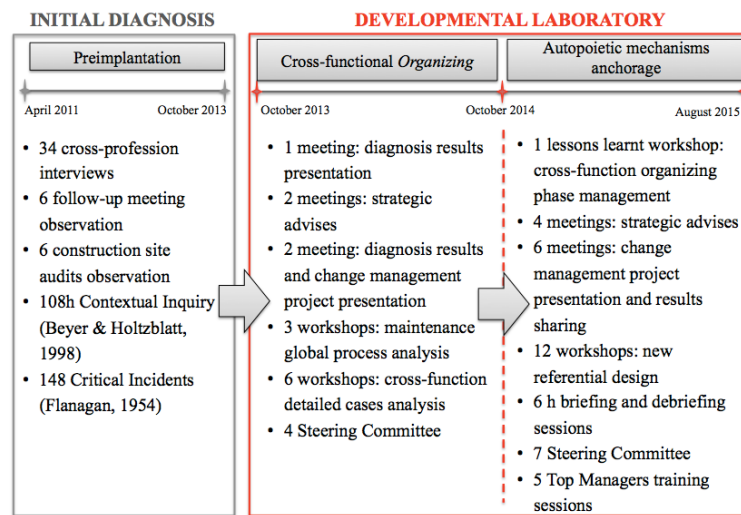


Fig. 1 – Enabling Intervention phases

We propose to see organizational interventions as the implementation of a “developmental laboratory” (DL). When a DL is implemented with an enduring, sustainable ambition, it is composed of the embedded DLs.

The DL has been designed as a “model environment” aimed at giving the framework for an enabling sensemaking and the model for the cross-functional design practices. The DL looks like and functions as a FabLab allowing the actors to draft, prototype, test and formalize new maintenance processes and management practices. The constructive dimension of processes design was used as a lever. Through a scaffolding process [13], we helped actors to reach pedagogical and functional achievements. Actors were requested to apply a cross-functional inquiry method [14] mediated by boundary objects¹ [15]. Particularly, two embedded levels of practices inquiry have been set up (see fig. 2).

The first one (DL1) focused on the maintenance processes (operational tasks) and aimed at developing functional (operational) knowledge. Enabling methods and tools drove the actors from the analysis of the current situation to the design of new organizational solutions (i.e. processes, tools, methods, cooperation and management practices, etc.). During these achievements, the actors developed a global and shared vision of the maintenance processes and a new way to act together as well.

The second one (DL2) focused on the practices that allowed actors to redesign maintenance processes. In other words, the first level (DL1) was itself analyzed in the next level (DL2). DL2 aimed at developing metareflexive knowledge. Enabling methods and tools allowed the actors to carry out an inquiry on the way they managed the redesign of maintenance processes. The result expected was the definition of success criteria for enabling processes of redesign.

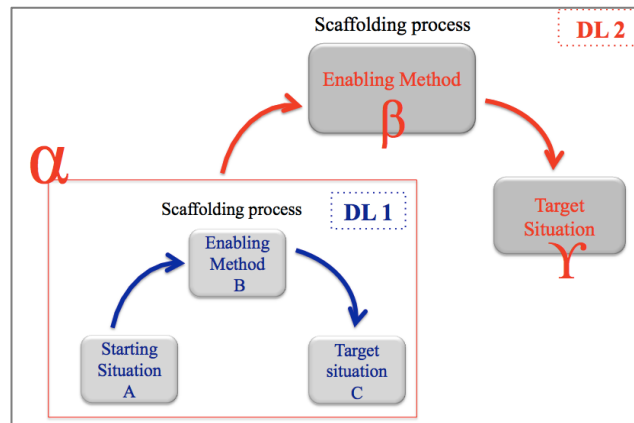


Fig. 2 – Development Laboratory model

Accordingly to autopoiesis theory, DL1 aimed at supporting the actors in shaping the Maintenance Unit components (functional teams) and underlying coordination net-

¹ A boundary object is an object shared between actors of a collective task. For instance, for a team of architects, the provisional plan of a building being designed.

works. The DL2 led the actors to a self-reference skill development, which allows them to continuously redesign both the production processes and the practices to ensure their sustainability. The global LD produced two kinds of outcomes at the same time: operational (organizational solutions, organizational processes) and intangible one (knowledge and skills). These achievements are detailed below.

3 Results

3.1 LD 1: Co-designing the Signalling Maintenance components and production processes

Stage 1: Mapping the signalling devices life cycle as a tool for developing a shared and systemic vision of the maintenance activity

The results of the initial diagnosis were synthesized by the ergonomist in a global processes map (see Fig. 3). The interactions and transactions between professions and related blocking points were drafted. This boundary object was used to trigger a sensemaking process through a collective analysis, debate and reshaping of the global maintenance processes.

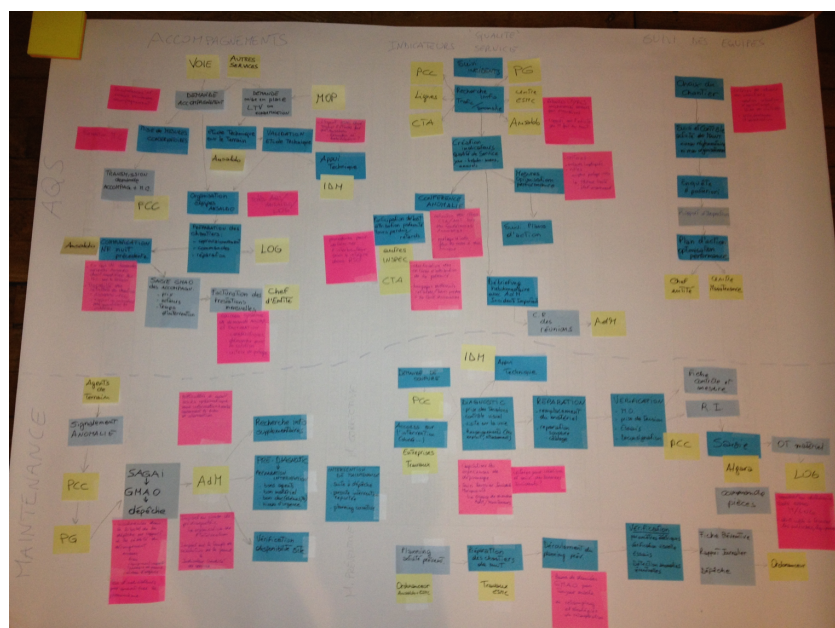


Fig. 3 – Signalling devices cycle life processes mapping

The participatory debate on the cycle life processes over the workshops resulted in three intangible outcomes:

- 1) *The development of a common and holistic vision of the maintenance processes.* For the actors this meant: becoming aware of the place and responsibilities of the maintenance unit in the cycle life of signalling devices, ac-

knowledging the inefficiency of a silo functioning, being able to identify the sociotechnical components of a working situation and developing a shared language and understanding of maintenance concepts.

- 2) *The development of a mutual intelligibility.* The actors became able to recognize the specific role of each functional team in the maintenance unit, and the reciprocal functioning requirements and impacts as well.
- 3) *The development of interdependence awareness.* The actors learnt to identify the key stakeholders of collective tasks and their functional links, and to identify the elements of a work situation that may either empowers or prevents a cross-functional activity.

From a functional point of view, this participatory processes analysis led to the identification of the main dysfunctional areas of the maintenance process. For each area, in a participatory way, the actors identified 3 critical cases, which were then collectively analyzed in stage 2.

Stage 2: Mapping incident stories as a tool for co-designing maintenance unit components and production processes

Starting from the dysfunctional areas, the actors were asked to map the processes and events underlying the cases previously selected. The story of the incident was progressively shaped interactively (see Fig.4). This allowed actors to produce a shared vision of the situation and of related blocking points and to design organizational solutions.



Fig. 4 – Incident story mapping

The incident story mapping performed during the workshops resulted in two intangible outcomes:

- 1) *The development of a cross-functional problem setting and problem solving skills.* For the actors this meant: becoming able to define the problem statement, to define a shared temporal chain of events and the plausible stakeholder interactions leading to the event, developing reciprocal inquiry skills and co-design skills.
- 2) *A gradual rise in initiative in the cross-functional inquiry.* Over the workshops the actors proposed new boundary objects, and used current organizational artefact to support co-design. They suggested further cases for deeper processes analysis and involved external stakeholders as to enlarge boundary processes co-design

The functional outcome was an action plan for the maintenance processes redesign. Eighteen issues were tackled in the organizational solutions. For each issue, several solutions aiming at improving the maintenance practices over the global life cycle of signalling devices were considered. The solutions addressed internal function processes, cross-functional and cross-unit processes. The improvements concerned new production workflows, new templates and standards, new roles and responsibilities sharing, new IT solutions, new interaction rules.

3.2 LD 2: Anchoring the autopoietic functioning in the maintenance division culture

Stage 3: Analysis of lessons learnt as a means to encourage self-reference

A continuous work analysis was conducted both on the outcomes (functional and intangible) and on the way to reach these outcomes, allowing the ergonomist to set the requirements for the design of this stage of the DL2. Starting from the elements which led to poor performance during the previously DL1, the ergonomist translated them into a “lessons learnt” grid. The grid was supposed to help actors to conduct a retrospective analysis of the cross-functional design management. This grid used five key performance indicators in order to analyze the participatory processes design dimensions:

- 1) *Relevance* : pointing out the elements leading to a poor or successful performance during problem setting tasks;
- 2) *Effectiveness*: analyzing the quality of participatory action;
- 3) *Efficiency*: analyzing planning efforts;
- 4) *Impact*: pointing out the improvements (achieved or missed) of organizational solutions;
- 5) *Durability*: discussing the future involvement of top management to ensure a continuous improvement of the maintenance processes.

The lessons learnt performed on processes design management resulted in three intangible outcomes:

- 1) *The development of a cross-functional metareflective skill.* The actors learned to take themselves as objects of analysis. Starting from their choices and behaviours leading to good or poor performance, they pointed out the factors to be implemented in future enabling design situations. Particularly, the facilitation of the workshops, the availability of the re-

sources for active involvement of the stakeholders, the visibility of the current situation and of the design progress, a continuous communication flows on results were selected;

- 2) *The development of the awareness of being change makers.* The actors recognized their responsibility in the contribution to the success of the management of processes change. They have shifted to a “waiting for expert solution” mind-set to an “active change-maker” one;
- 3) *The ability to transfer the concepts to other situations.* The actors have generalized the golden rules for participatory processes design to the maintenance unit management practices. Particularly, a participatory management of the unit, a work analysis as basis for change management, a cross-functional inquiry routine to manage organizational issues have been identified as success factors to be sustained over time.

Stage 4: Transferring the steering of processes design as a means to empower autopoietic functioning

The next step towards the autopoietic functioning target was the transfer of the steering of the continuous processes improvement to the actors. The intangible and functional outcomes produced throughout the ergonomics methodology were operationalized into two levers of improvement:

- 1) the success criteria and the best practices previously identified were shaped in new functional standards and methods aiming at driving the cross-functional processes inquiry and the knowledge management regarding the experience;
- 2) the actors have performed a detailed cross-functional processes mapping in order to point out new processes to be designed and to act on current processes to be improved.

Regarding these two levers of organizational development, the actors took the lead and managed the design sessions, i.e. the workshop facilitation, the problem statement definition, the root-cause analysis, the prototype drafting, the process deployment and test stage, the formalization of the standard and the communication plan.

During this stage the ergonomist gradually shifted towards an observer status, using several strategies:

- 1) *Coaching the “champions” and the “sponsors” to become leaders of continuous improvement actions.* Champions were those who played a key role in sustaining and promoting collective involvement in autopoietic functionings. Sponsors were the function managers and the unit manager. The content of the coaching sessions were set up to meet the operational specific requirements gathered by the ergonomist during work analysis. These sessions focused on techniques and strategies to lead and facilitate collective sessions of processes design, and generally collective inquiry tasks.
- 2) *Briefing and debriefing sessions.* These sessions aimed at supporting the leaders of workshops for processes design. Briefing sessions focused on the way to set up the workshop facilitation (agenda, methods for supporting collective design, choice of boundary objects). Debriefing sessions concerned a metareflective action on the cause-effect relation between the

expected targets, the leading and facilitation strategies, and the achieved results. Both kinds of sessions aimed at developing the scaffolding competences (steering and collective work animation and development) of the concerned leaders.

- 3) *Renewing stakeholder involvement.* The methodology and the achieved outcomes were analyzed by the ergonomist in order to set up several events aiming at fostering the sensemaking of the project. During these events, doubts, lacks of information, loss of motivation, fears, passive or negative attitudes were collectively discussed, analyzed and fought by action plans definition.

3.3 The Enabling Ergonomist's roles

The roles played by the ergonomist in such enabling interventions went beyond the traditional one, which tends to focus on health or physical design issues. The enabling ergonomist is a promoter and guarantor of the organizational autopoiesis. To fulfil this goal, enabling ergonomists should spread their action over three levers of organizational development:

- 1) *Operational lever.* The enabling ergonomist played three roles. 1/ Project director, by defining planning, resources and methods and by ensuring the compliance with project milestones. 2/ Supporter of the collaborative design, by fostering and tooling a cross-functional analysis and production. 3/ Work specialist, by making sure that real work remains at the centre of process design.
- 2) *Political lever.* Through the initial and the on-going work analysis, the enabling ergonomist gathered the operational data needed for stimulating organizational development and for negotiating margins of action. The aim was to develop an autopoietic management and to integrate an ergonomics approach into the organizational strategy and policies.
- 3) *Pedagogical lever.* The enabling ergonomist engineered learning spaces. In order to develop a collective autopoietic competence, on the basis of situated operational requirements, learning mediators tools were designed, collaborative learning was supported and promoted, a reflexion and debate of real work were triggered and sustained, actors were taught of techniques and methods for an enduring organizational development.

4 Discussion and conclusion

This intervention-research presented a model for organizational development in a sustainable aim. From this contribution, three conclusions could be drawn for ergonomics intervention on organisations.

First, acting for a sustainable achievement entails that the ergonomist is to perform at three parallel levels.

- At a political level, the need for and the legitimacy of ergonomics intervention in organizational development should be justified and renegotiated with decision-makers. The ergonomist has to perform a continuous translation of

ergonomics messages in a more “acceptable industrial language” and has to develop a marketing activity so that ergonomics contribution to organizational strategy can be acknowledged.

- At an operational level, the ergonomist has to bring together human requirements in work situation design and the global coherence of the methodology for organizational development.
- At a pedagogical level, the ergonomics contribution is not limited to training at enabling tools nor to the design of “learning by doing” situations. Enabling interventions should imply methods for triggering metareflective competences, for enhancing implicit knowledge externalisation and for making it sustainable.

Second, bringing together multiple levels of intervention means that the ergonomist needs to develop and master various competencies, which enrich traditional ergonomics framework (health, human errors and physical issues for design). The organisation should be analyzed and understood under a systemic and global view. The ergonomist should thus master organizational issues (strategy, management models, performance measurement) and pedagogical issues (knowledge models, learning methods and techniques).

Third, real work analysis (ergonomics diagnosis) is not limited to the first stage of an ergonomics intervention. It is rather an on-going process, allowing the ergonomist to develop a fine understanding of work situations. In fact, the analysis of real work points out the main dysfunctions and opportunities for improvement both in organizational processes and in intervention methods and practices. Additionally, real work analysis highlights the main competencies that the actors (ergonomist included) should develop both for performing the task expected and for making it sustainable. Thus, on-going real work analysis can be seen as a developmental tool contributing to enabling processes, developing intervention methods and empowering actors.

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