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From traditional processes to innovative services: customized practices for systematic innovation at Posteitaliane

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Abstract

Within the general trend toward "servitization" of products, methods and tools for systematic innovation in general, and among them TRIZ, are expected to play a significant role to support the effectiveness and the efficiency of this transition. In fact, a few practitioner have shared their experiences about TRIZ application to services in the past editions of TRIZ Future Conference, as well as many scholars have published papers about Product-Service-System design. However, the debate about the role of TRIZ for service innovation is still open and a larger number of best practices should be shared in order to derive some general criteria and procedures.
Within this context, it is worth presenting a two-year experience at Posteitaliane, the biggest service company in Italy. The Postal Services segment of Posteitaliane provides mail, parcels, logistics and integrated services to citizens, small-medium-large Companies and Government. The first author of this paper, also through the support of the Italian Centre of Competence for Systematic Innovation, led a team aimed at the identification of the tools to be adopted by Posteitaliane for increasing innovation capabilities of the organization. Furthermore, by applying these tools (and TRIZ is part of them), he managed to set up a novel service infrastructure characterized by high flexibility. The implementation of this new platform has brought to the introduction of three big changes in the field operations: no more separated operating streams, but configurable service modules; complex services as requested by customers, but simple and standard activities as wished by operators; each peace (letter or parcel) tells to operator its specific workflow thanks to a QRCode. This approach has enabled the introduction of several accessory services such as packaging, appointments, strong authentication, documents digitalization, cash and electronic payments, data collecting, etc.
With the aim of exploiting the experience gained at Posteitaliane in the past two years on systematic innovation, the authors propose in this paper a review of the lessons learned, highlighting the strengths of the adopted tools and the limitations that still deserve to be addressed by further studies and applications. The paper briefly overviews the adopted methods and tools applied in the above-mentioned innovation projects at Posteitaliane and describes with further detail the case study and the related assessment. Eventually, a SWOT-like discussion will depict also the current plans for further development.

Keywords: Cabling; TRIZ; Inventive Design; R&D decisions

1. Introduction

"Servitization", a neologism referring to the transition from product to product-service system (PSS), is nowadays considered a general trend suitable both for B2B and B2C businesses. This trend appears as a valuable direction of evolution both to improve the benefits delivered to customers and users, as well as to improve the efficiency of benefit-delivery processes, i.e. reducing the consumption of resources. Ultimately, the trend towards PSS appears as beneficial to address today's sustainability issue.

Several methodologies and tools have been proposed so far to support this transition, i.e. product-service systems [10] and total-care products [1]. Nevertheless, many issues are still open, such as systematic means to overcome the barriers that hinder the implementation of a service. From this perspective,

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TRIZ and (more generally speaking) Systematic Innovation methodologies are a natural candidate to support activities like:

The analysis of the context in a comprehensive and yet manageable way; The proposal of innovative services capable to raise the perceived benefits from an user perspective;The identification of the directions for overcoming emerging obstacles.

However, despite some scholars have already proposed specific works aimed at demonstrating the potential synergy between TRIZ and PSS initiatives, there are no established practices, nor significant joined research projects in the domain.

This paper reports about a real industrial experience in the field of postal services. Beyond the potential specific interest for this application field, the readers might find it interesting as a further attempt to contribute to service innovation research. Among the others, sharing a larger number of best practices will allow deriving more general criteria and procedures.

Therefore, the paper first overviews published contributions about the application of TRIZ for service innovation. Then, it introduces the Italian company Posteitaliane and its recent moves in this domain. Furthermore, a specific presentation of its innovative service infrastructure is provided, before stepping into the concluding remarks.

Nomenclature

DP	Design Parameters
FR	Function Requirements
PSS	Product-Service-System
VOC	Voice Of the Customer
QFD	Quality Function Deployment
FMEA	Failure Mode and Effect Analysis
RPN	Root Priority Number

2. TRIZ for service innovation: related art

The transition from product to PSS has emerged as a logical consequence of the increased attention to user/customer need. The implications are multiple and involve the entire product cycle: among the others, the manufacturing focus is shifting from flexibility in production to velocity in customer delivery; the quality focus is transferred from a factory setting to a customer-centric focal point [7]. Such enhanced attention for the delivery of value to customers cannot be fulfilled just with the sale of a product. On the contrary, the product is just an element of a more complex and articulated system, namely a PSS. Therefore, the transition from product innovation to PSS innovation comes very swift. Besides, while at the beginning of the servitization process, any attention to a PSS perspective could lead to valuable outcomes, nowadays purely intuitive service innovation initiatives can bring to a dramatic market failure.

Not surprisingly, several methods and tools have been proposed in literature, as well as many consultants offer coaching and support services for PSS implementation. Among the others, one of the first comprehensive approaches is MEPSS, Methodology for Product-Service-Systems, that was developed within a FP5 European project and now appears as a free online tool for creating innovative PSS offerings (http://www.mepss.nl). Other methods of the like are Kathalys, Innopse, Eco-efficient PSS.

Despite those methods certainly contributed to create a structured approach to PSS development, they still appear as weak at supporting the concept definition phase, which still is the most important stage in product and service development processes. [6]. In fact, several scholars have addressed this issue, so as to embrace the most characteristic feature of a PSS.

In this perspective, some works propose the integration of TRIZ into the PSS concept definition phase: Kim and Yoon suggest a combined QFD and TRIZ approach for PSS concept generation [6]; Ericson et al. try to link the needs, as formulated in the economic theory, with requirements expressed in the form of the 39 TRIZ parameters [4]; a customized contradictions matrix for PSS innovation appears also in [3].

Overall, detailed surveys on PSS as [2] reveal that the research in the field still is in a kind of emerging phase, with not harmonized terminology, no shared reference models, promising but not integrated methods and tools, and above all very limited documented experiences of industrial practice. The latter is considered an essential resource to identify weaknesses and limitations of current approaches and to direct the research efforts.

This paper brings a contribution in this direction, by describing a real comprehensive experience on service innovation, and specifically on the adoption of systematic tools as TRIZ for service conceptual design. In the intention of the authors, both the description of the project and the balance about the benefits provided by the adopted methods and tools can provide meaningful insights to the researchers in the field, as well as to other practitioners interested in PSS development.

3. A pilot experience in Posteitaliane

Posteitaliane is the largest service operator in Italy that, with 26 billion Euro revenues and 143.000 employees, provides mail, parcel, logistics, financial, insurance and telecommunication services.

In the last 10 years the world’s postal market has been characterized by a continuous decline of mail volumes (up to 10% per year), due to technological substitution issues (internet, email, electronic billing, PEC, tablets, etc.).

In order to overcome the effect of this decline, Posteitaliane has pursued a differentiation strategy that allowed the Group to achieve a constant revenues increase (Fig. 1), thanks to the development of banking, insurance, telco and digital services.

Moreover, in the last years, the e-Commerce market has been growing, and e-Government is becoming a quite interesting opportunity for an integrated service provider like Posteitaliane.

It is worth to say that e-Commerce includes not only the delivery of goods purchased on the internet, but also to goods

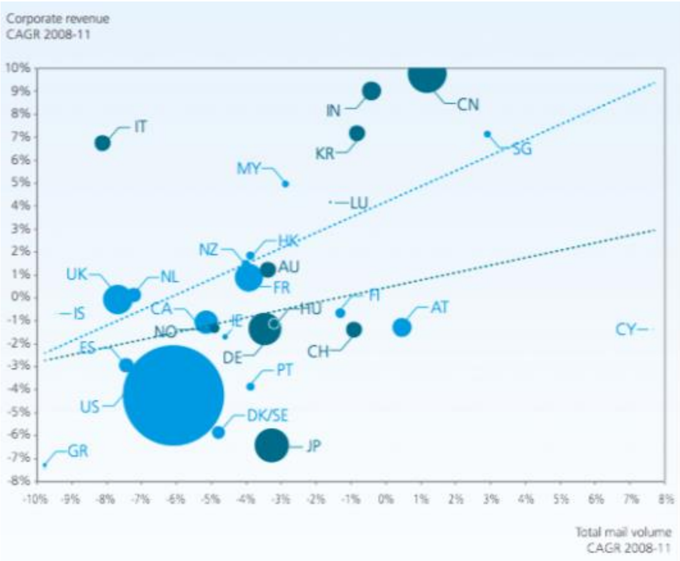

Fig. 1 Corporate revenue of national postal services: Posteitaliane's differentiation strategy led to a significant revenue increase despite mail volumes decline (IT - top left corner).

collection and replacement (i.e. electronic devices swap), data collection, contracts and document gathering, payments, etc.

Similarly eGovernment services refer to all those functions delivered to citizens in public offices and that could be offered at home thanks to an operator like a postman equipped with the right tools.

The last mile delivery network of Posteitaliane is a team of approximately 40,000 employees that every day work to serve about 16millions of delivery points. Today 75% (100% by the end of 2014) of postmen are equipped with a rugged smartphone, a printer and a POS by the end of 2014.

In the last two years, the engineering team of the delivery network department worked in order to reengineer all delivery services. A critical requirement for any innovation process to introduce at Posteitaliane is the ease of application by the available human resources, i.e. wide experience in the mail business, but without strong engineering and technical skills. Furthermore, the innovative applications for eCommerce and eGovernment have to suit the network complexity and the variety and number of Posteitaliane customers.

The strategic objective of the company was then formulated as the reengineering of all the delivery services (hundreds of customized services) into two main families of services, each made by modules that could be assembled and configured according to customers' needs.

4. The innovative Service Infrastructure at Posteitaliane

Given the above-presented context, the innovation initiative at Posteitaliane was focused on a business process reengineering of most of its services. The whole market consists of a large number of customers and needs that are usually stated as a set of specific business problems, each solved individually (with the exception of the simple massive shipments). This approach becomes harder and harder as soon as the customer base and the service complexity increase. Besides, two contradictions appear as system bottlenecks and, as such, must be overcome:

1. Overall project time and effort consumption increase with number of customers, but time and resources available for each customer decrease;
2. Customers require complex services, but operators wish simple and standard activities.

However, if each B2B, B2C customer has specific needs that imply a huge amount of specific problems, it is worth noticing that a complete mapping of customers' needs points out that a limited set of service needs recurs and can be assumed as a reference target (Fig 2).

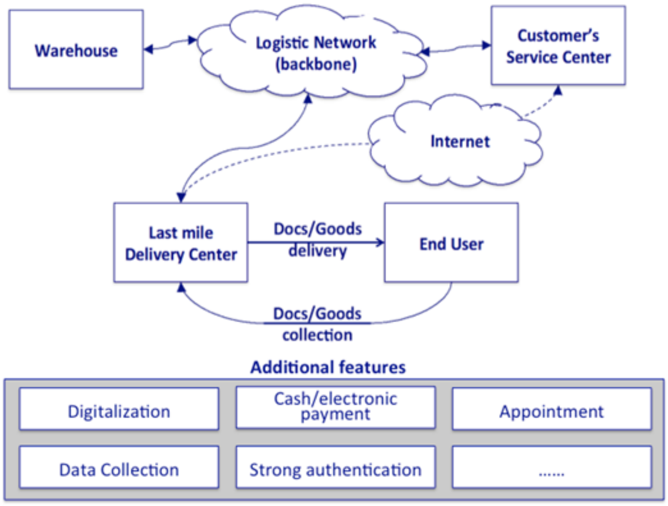

Fig. 2 Schematic representation of the Configurable Service Infrastructure of Posteitaliane.

Starting from this observation, the most recurring problem has been abstracted in order to allow the search for models of a general solution through the TRIZ knowledge base. Thus, the general solution, configured with specific parameters related to each Customer, identifies the specific solution itself. As a result, it has been obtained the "dynamization" of the infrastructure that allows complex services just thanks to combinable and configurable service modules.

The following paragraphs describe through a short example the main four steps of the TRIZ-based service reengineering that were used in this project.

4.1. Desired Service Descriptions

At the beginning of the project, the use of QFD in order to translate the Voice Of the Customer (VOC) was sufficiently consolidated, but needs and solutions (to meet those needs) were frequently confused by engineering people.

In order to overcome this issue, it has been adopted the approach suggested by Vermaas [10], particularly the so-called "intentional description" (Customer's Goal, Actions that must be performed in order to achieve Customer's Goal, Functions that enable Actions): each service to be designed is described in a manner that allows the identification of every single function that must be delivered (and re-used for other services).

This first step has been found quite useful, because it forced the team to distinguish between the description of Customer's needs and the identification of the possible ways to meet them (Fig 3).

4.2. Design Axioms

Once the Actions/Functions had been described, it was necessary to understand if they were well-stated, especially because "service infrastructure modularity" means "independent functions". The analysis was carried out according to Axiomatic Design [8], that is in an ideal design a

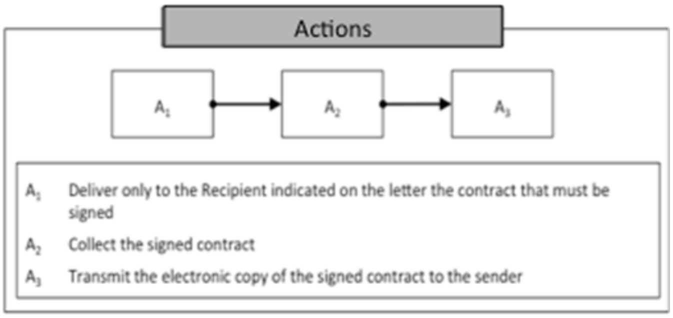

Fig. 3 An example of service description.

systems satisfies two axioms:

- **Axiom 1** - the Independence Axiom: maintain the independence of the Functional Requirements (FRs);
- **Axiom 2** - the Information Axiom: minimize the information content of the design.

The application of a first analysis according to Axiom 1 led to the FR-DP matrix (Functional Requirements-Design Parameters) that was neither diagonal (uncoupled design), nor triangular (decoupled design, that is uncoupled according a specific actions order), as shown in Table 1: FRs were dependent each other.

Table 1 An example of FR-DP matrix.

	Recipient sign	**Identity Card (or driving license)**	**Contract**
Deliver	X	X	
Collect	X	X	X
Transmit		X	X

Axiom 2 generally refers to systems whose parameters can be measured, but in services design it is often necessary to work with a qualitative approach. So, in order to define a sort of information content value, it was used the Root Priority Number (failure frequency x severity x detectability) obtained from the FMEA performed on the service process.

Taking into consideration that logistics services are typically made of a chain of elementary service modules, a third axiom has been postulated:

- Axiom 3 – the Chain Axiom: all state variables (of all functions) related to a transaction service can be obtained thanks to its transaction-Id.

The main consequence of the Chain Axiom is that a good design cannot lead to a diagonal FR-DP matrix, but mostly to a triangular one.

4.3. Design Contradictions Mapping

An ideal design cannot violate the three axioms, but in the early stages of a design process, several issues must be addressed. Such issues were represented in terms of physical contradictions in order to reduce them into something that could be dealt with TRIZ knowledge based problem solving.

Physical contradictions were preferred to technical ones because problems analyzed in this experience were lent to be represented as pairs of opposite characteristics [A; nonA] as shown in Table 2. Conversely, technical systems offer more opportunities to represent contradictions in terms of parameters.

Table 2 An example of contradictions due to axioms violation.

Contradicted Axiom	Contra-diction #	Characteristic A	Characteristic Non A	Applied Inventive Principle
Axiom 1	1	Check identity card	Do not check identity card	10
	2	Collect doc	Do not collect doc	17
	3	Open envelop	Do not open envelop	8, 10, 23
Axiom 2	4	Recipient at home	Recipient not at home	8
	5	Recipient with identity card	Recipient without identity card	17
	6	Transmit document	Do not transmit document	3, 9
Axiom 3	7	Actions reducible to a single transaction	Actions not reducible to a single transaction	3 4,19
	8	Postman has minimum needed information	Postman hasn't minimum needed information	5, 8, 10, 13

4.4. Contradictions Overcoming

Problems stated in this manner were manageable with TRIZ tools, such as the 40 principles, but two main issues made the work harder than expected mainly because:

- familiarity with TRIZ tools of most of team members was inadequate to project purpose;
- many principles were not directly applicable to such kind of problems without a deeper investigation of their suitable interpretation in the field.

The issue were addressed by reducing the 40 principles to 24 (essentially eliminating those related to physical-chemical-magnetic problems) and translated them into a language that was closer to the one used in services and logistics. The 24 adopted principles are listed in Appendix 1. The right end column of Table 2 shows which of the 24 principle were used to overcome each contradiction.

With these tools the team was challenged to reduce coupled designs to decoupled ones as shown in Table 3.

Table 3 An example of FR-DP triangular matrix after some problem solving session.

	Recipient sign	Identity Card (or driving license)	Contract
Deliver	X		
Collect	X	X	
Transmit			X

4.5. Some results

The described process led to a conceptual design of a modular service platform that permitted to implement the corresponding service infrastructure. Applying a QRCode on each letter or parcel item a good improvement of system completeness in terms of controllability has been achieved: each peace tells to operator its specific workflow thanks to a QRCode (that was the solution found working with the "the other way round" principle – the mail items tells the system what to do, instead the system).

Fig. 4 System Completeness improvement (1st Law of Engineering Systems Evolution)

The result was surprisingly satisfactory because the conceptual design was produced by the team in a few weeks. The team felt engaged in an iterative design process of problem formulation-solution in which they could apply their specific and wide knowledge.

Now the method formulation must be consolidated with the gained experience. It must be investigated the preparation of the development requirements for the IT department, because it is not clear enough how the defined approach could be adapted in this contest.

5. Discussion and conclusions

This paper describes a business process reengineering experience at Posteitaliane aimed at proposing innovative services with a systematic approach. The project, which has been carried out for two years already and it's still under further development, can be considered as a fruitful combination of state-of-the-art methodological approaches and tools with industrial needs in a context of dramatic reduction of traditional businesses and urgency for innovative solutions.

In detail, the service reengineering project has constituted an extended test case for the application of QFD, functional analysis, TRIZ and Axiomatic Design to service innovation.

The training and initial coaching within the engineering team of Posteitaliane delivery network department was conducted by the Italian Center of Competence for Systematic Innovation of Fondazione Politecnico. Then the team autonomously decided the preferred techniques and tools to be adopted more extensively in service innovation activities. Such clear distinction between the role of the trainers (i.e. focused on the proposal of methods and tools) and the role of the final users of those methods (i.e. the team at Posteitaliane who selected and customized their innovation toolkit) can be considered a best practice worthy of consideration also by other players.

Besides, the overall experience contributes to the collection of real industrial applications of systematic innovation techniques to service innovation; ultimately, this can then have a positive impact also on the scientific research in the field.

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Appendix 1: Subset of 24 Inventive Principles adapted from Classical TRIZ for service innovation.

#	40 Principles	Revised Principles	Application mode	#
1	Segmentation	Segmentation	modularize make pluggable	1
2	Taking out	Taking out	extirpate simplify	2
3	Local quality	Local quality		3
5	Merging	Merging	standardize organize ally link	4
6	Universality	Universality	universalize prune	5
7	Russian dolls	Russian dolls	nest processes nest objects	6
8	Anti-weight	Anti-weight		7
10	Preliminary action	Preliminary action	prepare prevent	8
11	Beforehand cushioning	Beforehand cushioning	redound compensate decouple alarm pokayoke	9
13	"The other way round"	"The other way round"	rearrange reverse actions invert flows	10
14	Spheroidality - Curvature			11
15	Dynamics	Dynamics		12
16	Partial or excessive actions	Partial or excessive actions	skip exceed	13
17	Another dimension	Another dimension	reduce increase	14
19	Periodic action	Periodic action	tune pulse change pace break make continuous	15
24	Intermediary	Intermediary		16
26	Copying	Copying		17
27	Cheap short-lived objects	Cheap short-lived objects		18
32	Colour changes	Colour changes	underline make readable	19
33	Homogeneity	Homogeneity		20
34	Discarding and recovering	Discarding and recovering		21
35	Parameter changes	Parameter changes	change aggregate configure	22
Extra	Principles for overcoming Physical Contradictions	Separation	space time	23
		Transformation		24