Sales and innovation

Architecture of the organizational interface in new product development

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Abstract

Building on earlier research on customer involvement in innovation processes in business markets showing that development of an innovation is entwined with development of a business relationship, we examine how engaging with customers affects the boundary conditions and roles in the supplier and customer organizations. Focusing on the role of sales in interfacing the customer and supplier organizations in early stages of development of the new solution we look at the task of selling when it concerns something that does not yet have a precise form, features or name, and examine how the innovation artefact under development is transformed throughout the innovation journey. Empirically, we build on an account of development of a new product over a five years period, from multiple data sources – direct involvement of one of the authors, company internal materials and interviews. The case material documents a continuous interplay of internal (e.g. R&D) and external forces (e.g. client's requirements) that intersect in the sales function and illuminates the task of coping with and orchestration of these forces.

Key words: sales, innovation, KAM, interaction, boundary

(Competitive paper)

INTRODUCTION

Involvement of users in innovation processes and the benefits from engaging customers in new product development have been a recurrent topic in marketing and innovation literature (Ahuja, 2000; Coviello & Joseph 2012; Chesbrough, 2003; von Hippel, 1988). Research on innovation in business-to-business markets too has dealt quite extensively with the role of customer supplier relationships as locus of innovation (Håkansson, 1989) and examined various issues in relating producers and users in innovation processes (Baraldi & Strömsten, 2009; Håkansson & Waluszewski, 2007; Harrison & Waluszewski, 2008; La Rocca & Snehota, 2014a).

Prior research has shown that in business markets novel solutions (product and service innovation) are rarely conceived in isolation and then transferred to customers, rather, it has evidenced that new offering solutions tend to arise concurrently with problem identification in interactions between the producer and user (Baraldi, 2008; Johnsen & Ford 2007; Harrison & Finch, 2009). Extensive customer supplier interaction has been argued to be beneficial not only for generating ideas for solutions but also for putting them into use (Johnsen & Ford, 2007). It has also been observed that in new venturing, *relating* is a precondition for turning an innovation into a viable business (La Rocca & Snehota, 2014a).

While the benefits of customer engagement in product development have been increasingly acknowledged, relatively little is known about how customer engagement affects the customer supplier interface. There have been calls for more detailed studies of how engaging customers affects the intra- and inter- organizational arrangements and organizational practices (Griffin et al., 2013; Laage-Hellman, Lind & Perna, 2014). Our aim in this paper is to unpack the consequences of customer involvement in developing new solutions for the organizational interface between the selling and the buying businesses focusing on the role of sales.

New product offerings are developed in situations such as a new venture of a start-up company, when relationships to customers hardly exist beyond some initial contacts, but in business markets also in ongoing business relationships with existing customers. While the two situations have some common traits the issues that need to be addressed are likely to be different. In both cases the boundary functions in the customer and supplier organizations are involved and it has been shown that the architecture of the organizational interface plays an important role for the outcomes of the development process (Håkansson & Ingemansson, 2013; La Rocca & Snehota, 2014b; Wiessmeier, Thoma & Senn, 2012; Workman, Homburg & Jensen, 2003). The role of the organisational interface for the outcomes makes it to an issue that is both theoretically and managerially highly relevant; yet we find that in particular the role of sales in the creation of value in business relationships appears relatively under-researched (La Rocca & Snehota, 2014c).

In this paper we focus on the development of new offerings in an ongoing business with pre-existing business relationships. In order to examine customer involvement in development of an innovative solution we will take a relational process perspective (Tuli, Kohli & Bharadwaj, 2007) which involves observing changes in patterns of interaction across organizational boundaries. The aim of this study is to investigate and map the interaction pattern concurrent to the development of a new product solution in on-going business relationships; to identify the factors that shape the interaction patterns and to examine the role played by the sales function in the supplier organization.

Three research questions have guided our study: 1) what is the pattern of inter-functional collaboration in the selling and in the buying firms; 2) how the interaction pattern and the features of the solution are being transformed over time; 3) how is the customer-supplier interface organized and how does the organization change over time. Based on the picture of the evolution of the customer-supplier interface and of the solution over time we identify the factors and forces that shape the interface and the emergent solution.

Empirically the paper is about an innovation journey (Van de Ven, et al., 2008) that brought about an innovative robot for control and measurements of railway switches. The robot was conceived and developed in a lengthy iterative process that involved various functions and units in the buyer organization (Italian Railways Networks) and in the seller organization - a medium sized company (Loccioni) operating in the field of industrial process control equipment. In documenting and reporting the case history we draw on the experience of the Key Account Manager (KAM) of the supplier (one of the authors) and on extensive company internal material that document the communications between various actors involved in both organizations.

SELLING INNOVATION – ENGAGING CUSTOMER

There is no shortage of studies showing potential benefits of customer involvement in innovation processes underlying the development of new product offerings (Biemans, 1991; Coviello & Joseph, 2012; Gadde, Hjelmgren & Skarp, 2012; Gruner & Homburg, 2000; Johnsen & Ford, 2007; Håkansson & Waluszewski, 2007; Munksgaard & Freytag, 2011; Öberg, 2010; von Hippel, 1986). A common thread in these studies is that conceiving, developing, producing and marketing novel product / service offerings involve various functions in the supplier and customer organizations. Since purchasing and sales appear to play a central role among the functions involved, we take the sales function and related activities as a starting point in investigating how the interaction pattern and architecture of the organizational interface affect the process of development of an innovative product/service offering.

The connection between sales and innovation is in a way obvious but also ambivalent and can be framed in two different ways. One way is to think of sales as a function that is important for bringing the innovations to customers once the new solution has been developed and is embodied in a product or service which is combined into an effective offering. Sales have then an important function to communicate the novel offering to customers and, in B2B markets in particular, to support fitting the new solution into the operations of the customer business, which may or may not include adapting the offering to the needs of a specific customer. Such a view of the task and activities of sales fits the situations when the product service offering is well defined and stabilized and the target customers and their needs are rather well known. Following such a framing of the sales function it can be concluded that sales play an important role in "executing" innovation, but mainly at later stages of the innovation process – when the innovation artefact has been developed and stabilized and the offering is reasonably well defined.

On the opposite extreme there is the picture of sales function in situations when the offering is undefined and needs yet to be developed. Situations that fit this picture range from 'entrepreneurial selling' in early stages of development of a new business venture when perhaps not even a prototype has yet been developed, to situations where the new solution

and offering is to be developed with an existing customer. Our main concern in this study is the latter kind of situations – development of a new offering in relationship to existing customers which is a rather common case in business market. The main task of sales (often jointly with other company functions) is then to engage the customer/user in the innovation process and involves engaging the customer in the early stages of the innovation process and supporting the customer and user involvement in the various phases of the process of developing the new product service offering solution. This role of the sales has been labelled as 'outside-in' function of sales (Day, 1994).

In business markets, the outside-in role of sales in engaging customers in various phases of development of new solutions appears particularly critical for the effectiveness of the solution for customers and users. It has been shown that "solution effectiveness depends on supplier and customer behaviors" (Tuli et al., 2007: 13). A recent study shows that in new ventures in particular, an early engagement of potential customers is critical (Onyemah, Pasquera & Ali, 2013). However, innovating the offering solutions includes more than just new product (or service) development; in customer perspective the solution is "a customized, integrated combination of products, services and information that solves a customer's problem" (Sawhney, Wolcott & Arroniz, 2006:78). It is the importance of the "integrated combination" that makes the role of sales critical since sales tend to be the organizational function that is best positioned to monitor and connect the customer and supplier organizations.

In order to capture the factors that shape the innovation outcomes in buyer seller relationships "relational process perspective" is needed (Tuli, Kohli & Baradwaj, 2007). Investigating the new solution development can also benefit from focusing on the interaction processes in business relationships that has been identified in several studies as central for both development of business relationships and in executing innovations (Baraldi, 2008; Johnsen & Ford, 2007; Harrison & Finch, 2009; Håkansson et al., 2009). Since in business to business context new offering solutions are often not a priori conceived and implemented; rather they are jointly enacted as actors interact and relate the customer and supplier operations (Johnsen & Ford, 2007; La Rocca, Ford & Snehota, 2013), it is plausible to turn the attention to interactive solutions development.

Several observations have surfaced in past research regarding the effects of interaction patterns in business relationships on the outcome of the innovation process. Yet, these have not been brought to a more coherent hole. However, scatted observation on the organizational interface between supplier and customer and its effect on new solution development, like the ones below, suggest that it could be fruitful to research the topic more systematically. It has been remarked about purchasing that "more people … within the organization are playing pivotal role in sizing up offerings, so the path to closing sales has become more complicated" (Lingqvist et al., 2015). "R&D and KAM together constitute the inside-out supplier and outside-in strategic customer perspectives that are necessary to identify, design, and commercialize joint value creation projects across the innovation stages" (Wiessmeier, Thoma & Senn, 2012). While R&D - generally credited for being the locus where innovations originate – has been largely researched, the role of KAM in the creation of value in business relationships appears under-research (La Rocca & Snehota, 2013). A recent study of the solution development process from the customer perspective concludes that "supplier involvement in a buyer's new product development is a longitudinal process where working relations and inter-dependence play a significant role" (Yeniyugurt, Henke, & Yalcinkaya, 2014). The impression from prior research related to our topic is that considerable attention has been given to the benefits deriving from an early involvement of customer in developing

innovations, but the efforts required to sustain such a complex architecture of collaboration have been less explored.

Set to investigate the interaction patterns in developing novel solution in customer supplier relationships in business markets empirically, we will draw on the interaction model of business relationships (Håkansson et al., 2009) and on a 'relational process perspective on customer solutions' proposed in marketing (Tuli et al., 2007). The latter, based on a study of about hundred managers from buyer and seller organizations, has concluded that customer solution development can (and should) be conceived as four interrelated processes (Tuli et al., 2007: 5):

1. Requirement definition
2. Customisation and integration
3. Deployment
4. Post deployment support

The same study concludes that the effectiveness of the new customer solution for both the customer and the supplier depends on the execution of the four processes which in turn depend on certain variables of the customer organization (Customer adaptiveness, Political counselling and Operational counselling) and certain supplier variables (Contingent hierarchy, Documentation emphasis, Incentive externality, Customer interactor stability, and Process articulation). We find this study useful to orient our investigation as it concludes that "solution effectiveness depends on supplier and customer behaviors" and stresses the "importance of developing mechanisms for coordinating the different functions and units that perform the four relational processes" (ibid:13). On the whole the study points to the importance of the architecture of the organizational interface for how the innovation process unfolds. In our study we will depart from the above relational perspective on customer solution development combining it with the IMP research framework to analyse interaction processes in business relationships (Håkansson et al., 2009).

METHODOLOGY

The case analysis reported here aims to explore the role of sales in interfacing the customer and supplier organizations in early stages of development of the new solution. Following a single case theoretical sampling (Eisenhardt & Graebner, 2007), we have selected a case of innovation/new product development, pursued by the Loccioni Group from 2010 to 2014, for its revelatory potential as it allows us "to gain certain insights that other organizations would not be able to provide" (Siggelkow, 2007, p. 20). Using case studies is the preferred strategy when the focus is on a contemporary phenomenon within some real-life context (Eisenhardt, 1989) and when research aims at providing managerially relevant knowledge (Amabile et al., 2001). Three broad questions guided the data collection and analysis: 1) what is the pattern of inter-functional collaboration in the selling and in the buying firms; 2) how has the interaction pattern and the features of the solution been transformed over time; 3) how is the customer-supplier interface organized and how does it change over time?

Data collected were first used to reconstruct and report on Loccioni's organizational setting at the customer's interface. In a second step, guided by our initial frames of reference (Siggelkow, 2007) on the phases of solution development (Tuli et al., 2007), we analysed the case in order to provide insights on the relation between new product development and

organizational setting at the interface with customers, identifying key organizational features that enable the realization of an innovation project.

The main source of information was the KAM of Loccioni (and co-author of the paper) and repeated meetings and interviews with the R&D Manager of Loccioni (Mr. Salvucci). In terms of secondary data we could rely on thousands pages of documents, notes, product presentation and communications between the various members internally and across the organisations. This data were systematically collected during the entire period the KAM followed the Felix project. The adoption of multiple sources of data, which came from direct informants (two managers with different perspectives) and from indirect informants in the customer organization with whom key informants interacted for the entire period of the research, allowed for triangulation (Denzin & Lincoln, 1994; Yin, 1994). Member checks in the form of follow-up interviews, telephone calls and email correspondence were used to solve open issues and verify that the researchers understood correctly the data collected. The prolonged internal engagement in the project of one of the authors allowed the researchers "to be certain that the context is thoroughly appreciated and understood" (Lincoln & Guba, 1985, p. 302). The access to information by the second of the authors was of a unique character in this instance, and facilitated significant and rich access to information that would not have been available. Furthermore, engaging the key account manager of Loccioni in the writing of this paper responds to repeated calls for bridging the academic/practitioner gap (Baraldi et al., 2014; Brennan et al., 2014; Gummesson, 2014). It also is an attempt of considering 'relevant knowledge' as something that 'has to emerge' from collaborative industry-academic collaborations, rather than being "a matter of diffusing or failing to diffuse knowledge from academia to practice" (Knights & Scarbrough, 2014, p. 1287). Potential biases introduced by the multiple role of the second author have been balanced by the fact that the other three authors were outsiders to the company. For confidentiality all names in Loccioni's partner organizations have been disguised.

CASE STUDY – THE STORY OF FELIX

The setting of the case is the development of a relationship between a customer and a supplier concurrent to the development of a new solution (a robot) to measure and control railway switches between 2009 and 2014. The customer organization is the Reti Ferroviarie Italiane (RFI), a company in charge of development and maintenance of the railway infrastructure in Italy. RFI is fully owned by the Italian railways - Ferrovie dello Stato Italiane (FS). The supplier is Loccioni S.A. a mid-sized company in the field of advanced industrial automation and control systems.

2009-2010 the origin of the project

The first idea to develop a new solution for inspection and control of railway switches can be traced back to December 30th 2009. On that day, Mr. Tabocchini, who occasionally worked for Loccioni R&D department as a consultant, brought Mr. Mirto, a manager from RFI, to Loccioni company headquarters in central Italy for a tour of the premises. Loccioni has previously done some minor business for the Italian Railways (FS) mother company of the RFI. During the tour on the company premises the two men accidentally run into Mr. Loccioni, the president and owner of the company, and Mr. Mirto started talking to Mr. Loccioni about a long-standing issue in RFI - the need to perform measurements of the railway switches which, at that time, was done manually by means of callipers and caused a

lot of problems with reliability of the data. He argued that these measurements were rather important for safety of the railway traffic and needed to be improved. Mr. Loccioni took some notes during the talk and at the end wished the guests happy New Year. Once back in his office Mr. Mirto sent an e-mail to Mr. Loccioni enquiring whether Loccioni might be interested in developing a new solution for the measurement and control of railway switches. Mr. Loccioni forwarded that e-mail to the marketing manager, Mr. Lazzari, and to Mr. Lucarini who was the key account manager of Italian Railways (FS) within Mr. Loccioni's business unit Services. Since Mr. Lucarini declined to contact Mr. Mirto because he had other sales goals to reach, Mr. Lazzari decided to forward the email to Mr. Moscatelli one of his assistant, who worked as junior marketing assistant at the business unit Environment and has been previously involved in a few minor projects with FS. Mr. Moscatelli has then got in touch with Mr. Mirto at RFI and accepted the invitation to participate at a meeting that Mr. Mirto arranged at RFI' premises in Foligno (Umbria region) in early 2010 together with other 3 colleagues from Loccioni: Mr. Salvucci (Loccioni's R&D manager), Mr. Concettoni (Mr. Salvucci's assistant) and Ms. Cristalli (Loccioni's Research and Innovation manager). Ms. Cristalli – who collaborated in the past with Mr. Tabocchini – has decided to not involve him in that meeting judging that the team did not need a consultant for developing such a research project. As a consequence Mr. Tabocchini, who played an important role in establishing the contact with RFI, was dismissed.

Mr. Mirto, in his capacity as production manager of RFI for Umbria region, had involved in the meeting two other persons: Mr. Fratta, man in charge of the territorial production unit of Ancona (Marche Region) and his assistant, Mr. Alate. The three men from RFI shared with Loccioni's people a four pages document containing information about the regulation L94 stipulating which parameters of railway switches were to be controlled and how these should be measured. Neither Mr. Moscatelli nor his colleagues had any expertise about railways tracks, switches and the train transportation systems, so they felt the need to start to "study" and "analyse" the set of standards indicated in the L94 as national regulations. At the end of the meeting Mr. Alate concluded: "Dear Loccioni guys, I see huge potential in what you can do with us but now it's time that you start to study our problem".

Mr. Salvucci and Mr. Concettoni spent most of the three months that followed the Foligno meeting trying to understand which kind of technology could be used for measuring the parameters indicated in the RFI specifications. In the meantime Mr. Moscatelli maintained contacts with Mr. Mirto keeping him updated about progress made in Loccioni. The first output of this phase was the result of a feasibility study that Loccioni called "profilometer". It consisted of an analysis of measures that could be performed on the railway switches. Carrying out this type of study in Loccioni required more time than expected but RFI was not complaining about it. In Loccioni the RFI was seen, in particular by Mr. Salvucci, as a state owned, more or less a bureaucratic company that was not particularly worried about an immediate feedback. The RFI support to the Felix project was practically inexistent. There was no other technical personnel from RFI identified acting as interface which made the situation somewhat delicate. During one of the numerous meetings of the Loccioni team working on the Felix project, Mr. Moscatelli exclaimed: "we need RFI technical support otherwise the project will be difficult to carry out". Anyway, the Loccioni team working on the project with some delay came up towards the end of 2010 with a first prototype of a robot designed to execute the measurements. This prototype came to be called 'Red Felix' (Fig. 1).

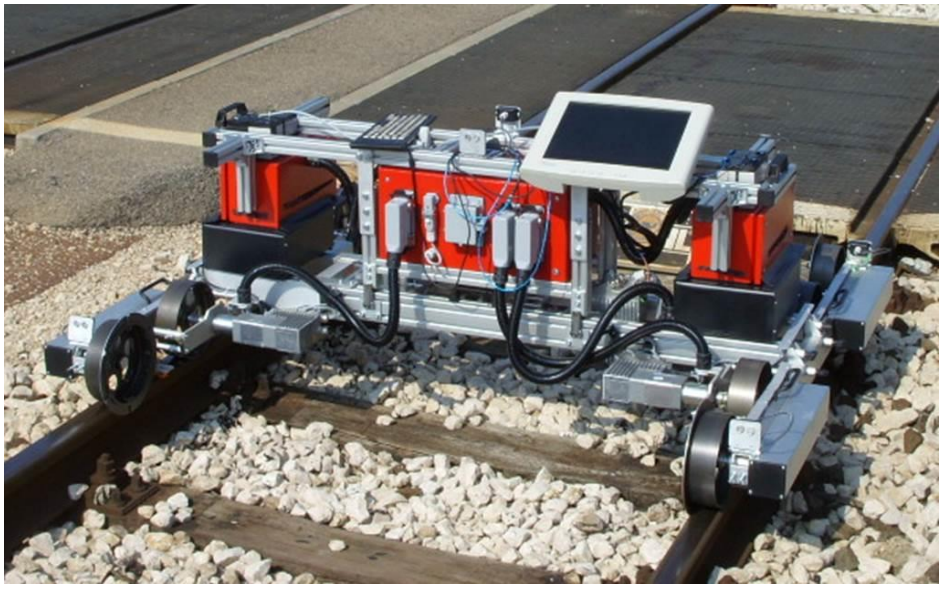

Fig.1. The Red Felix

Towards the end of 2010 Mr. Salvucci and Mr. Moscatelli presented this first version of the robot in a meeting at RFI headquarter in Rome. That meeting was organized by one of RFI's top production managers and boss of Mr. Mirto - Mr. Pavan. During the presentation Mr. Pavan showed a keen interest and encouraged Mr. Salvucci and Mr. Moscatelli to continue working further on the first version of the robot. After the meeting, Mr. Pavan reported the project status to the production manager at RFI - Mr. Enile who after several meetings with Loccioni's president decided to grant more support to the project.

During the meeting Mr. Pavan let Mr. Moscatelli understand that the RFI expected that the maximum weight of the robot for measurement of switches would have to be no more than 50 Kg and the price of the robot was to be kept below €40.000. The weight had to be kept around 50 kg because of a specific "health and safety at work" regulation according to which a single worker should not carry or lift more than 25kg load and two workers were necessary to move the robot. As for the target price, RFI did a comparison with the cost of measuring the switches with callipers and proposed a cost of no more than € 40.000. To Mr. Moscatelli such a price seemed relatively low but he decided to accept it. When the Loccioni team returned home the 'Red Felix' was scheduled for production.

2011 the second act: drafting the requirements

Until the beginning of 2011 Mr. Martinelli was the main responsible for the Felix project in Loccioni sharing the responsibility with Mr. Erelia who in RFI held the position of assistant for technical development of railroad equipment. In the early 2011 Mr. Ali became the new CEO of RFI and started to reorganize the company. In the new organization responsibilities and tasks of most of the internal departments were redefined. Mr. Pavan became man in charge of a new unit department of "Technology and Standards" and brought in Mr. Mirto in a management position in the new department. Mr. Enile replaced Mr. Pavan as the new Production Manager and involved Mr. Leo in the department as responsible for the unit "Railroad equipment".

The re-organization of RFI under the new CEO had consequences for the trajectory of the Felix project. The priority of the new management team at RFI was the adoption of new

technologies and relative investments, but the switch-measurement-problem and Felix project was not among the prioritised projects. Mr. Moscatelli had to adapt to the new organization of RFI realizing that as Mr. Erelia, who was for a long time one of his key contact persons at RFI, moved to the department Railroad equipment, all the decisions concerning Felix in RFI would be from that moment taken in the department *Railroad equipment and infrastructure* headed by Mr. Enile and Mr. Leo.

Later in 2011 when the Felix working group in RFI was formalized, Mr. Enile decided to involve in the project also RFI department unit called *Diagnostic* headed by Mr. Ova. The Felix team in RFI was formally approved when a production manager of RFI headquarters in Rome, Mr. Lippo, became the project leader. The first thing that Mr. Lippo did when he became the head of the RFI Felix team was to ask Loccioni to develop a quite different version of Felix. Mr. Lippo examined the prototype and found it lacking on several features and drafted a request for several different features that were then communicated to Loccioni asking the team to work fast on the new version. Receiving RFI request, Loccioni decided that in order to meet these it was necessary to set up a formal project team to work on the new Felix. The team set up consisted of Mr. Salvucci and Mr. Concettoni who were jointly heading the team that involved two other engineers, one mechanical and one electrical and Mr. Bruni from the department of Robotics. The new version of the Felix was then referred to as ‘yellow’ (Fig. 2) instead of the ‘red’ of the old version.

A few weeks later, in June 2011, Mr. Salvucci was promoted to head of Loccioni’s R&D activities regarding the development of the New Energy business and left his position as one of the two Felix project leaders. In the meantime, RFI came with further technical specification for the new Felix. RFI requested, among other things, that the robot had to measure parameters without touching the rails. The Yellow Felix became now a new-product order in Loccioni with its own job-order number A0 (which denoted an engineered prototype). Mr. Moscatelli decided to define the A0 as “pre-prototype” which was absolutely critical in order to proof that Loccioni was able to satisfy RFI’s requests that now became more and more precise and pressing.

Fig. 2 The Yellow Felix

From an accounting perspective, Felix was for the first two years classified in Loccioni as a research and innovation project. As such it was on the budget of Loccioni’s division of

Research headed by Ms. Cristalli who also assembled the initial Felix team. Over these first two years, the Felix project related costs were growing which became a problem for Ms. Cristalli. She could no longer afford to continue supporting Felix project on her budget and discussed it with Mr. Moscatelli who understood that more financial resources were needed in order to sustain the project and that Ms. Cristalli's unit did not have enough budget in order to "host and feed" the project. Having to find a solution he asked the division Energy, the department in Loccioni that had been doing business with FS and RFI since the 90's, to finance the project. He thought that Energy division was the logical organizational unit to ask for funds. After a short meeting with the head of the Energy division (Mr. Loppi), it was decided that Felix was to be taken up among the projects of the Energy Division. One of Loccioni's project managers in Energy business unit, Mr. Ciciliani, started working with the Felix team on developing the Yellow Felix.

2012-2014 The third act: defining the solution

Early on in 2012 the first Felix A0 has been sold to RFI for about €86.000. The price Loccioni asked was double the original quotation of around €40.000 because Mr. Moscatelli argued that putting the price at €86.000 would make RFI management to apprehend the importance of the project. Delivery and testing of the A0 was important because it signalled that 18 months after the first meeting with RFI there was a solution ready to be tested and evaluated. The test of the Felix A0 by RFI in Turin (Piedmont region, Italy) turned out not to be entirely satisfactory and Felix A0 got only a conditional approval. RFI asked Loccioni to solve several technical issues that emerged in the testing and, this time the new solution was requested in short time.

Getting to know the unsatisfactory outcome of the tests at RFI Mr. Moscatelli became convinced that only involving again Mr. Salvucci could speed up the re-engineering of Felix. He called for a meeting with Mr. Loccioni and asked him to assign Mr. Salvucci to the Felix project in order to speed up the necessary adjustments of the Felix A0 prototype. Mr. Loccioni agreed and Mr. Salvucci was assigned again to his old "project" team and started immediately to work on it. In the meantime, in March 2012, Mr. Moscatelli took the initiative to present Felix A0 at the International Trade Fair "Expo Ferroviaria" in Turin, a venue at which new railway technologies are presented. This was an important event where Loccioni could show its engagement in developing technologies for such particular railway applications.

Something unexpected happened in the spring 2012. Loccioni team had been working on the A0 model until then following the L94 norms, a masterpiece which specified the features of the railway switches which were originally developed in the 1960s. By 2012 the EU Railway Deregulation efforts, initiated some years earlier, were gaining momentum and Italy had now to adapt fast to the emergent Europe-wide norms. These implied separating the actors who managed railway infrastructure (e.g. maintenance activities) from those operating the transport of passengers and goods. Until 2012 RFI and Trenitalia (FS) issued and monitored all the regulations concerning safety, maintenances, and other activities. As the new EU railway deregulation was getting approved the RFI (managing the infrastructure) had to report to an external body that was instituted with the task to monitor the regulations issued by RFI. This new organization named ANSF (Agenzia Nazionale per la Sicurezza delle Ferrovie – the Italian National Agency for Railway Safety) required that RFI would check properly the railway switches and should update the old L94 regulations. The old norm L94 had thus to be revised to satisfy ASF that explicitly asked to improve the controls of railway

switches in order to guarantee safety. The Technical department of RFI responsible for developing and managing the regulations concerning the railway safety had to update the old L94. The new norms were drafted and submitted to ASF which approved all the changes and the old L94 was replaced by the new L94.

This had major impact on Felix journey. While the A0 model was tested according to the old norms L94, Loccioni had now to adapt to the new normative. A new model of the robot, named A1, was to be developed to meet the new L94 requirements. The testing by RFI for approving the A0 was no longer valid and Loccioni had to start from scratch to develop A1 for new testing. They started to work on the new Felix A1 and about a year later, in July 2013, the new Felix A1 was ready to be tested by RFI.

The involvement of the RFI Technical department in developing the new regulation has led to the Felix project gaining more attention and was growing in importance within RFI. Mr. Moscatelli understood that Loccioni team had to deal more closely with the Technical Department whose role was important. The department had to supervise the operating status of all the rail switch points carrying out inspection activities about the functionalities of point switches following the regulations developed in line with the European standards. This had also another consequence. The Technical department asked Loccioni to verify and validate the Felix software and to document that it met the specifications required by RFI. Another issue raised by the Technical department was that Loccioni was asked to provide the 'certification of metrology'. Complying with these new requests became a condition for obtaining the final certification and approval of Felix in RFI. The Technical Department also asked Loccioni to appoint one person as responsible for all the technical aspects related to Felix and this role was assigned to Mr. Salvucci.

A major issue that Mr. Salvucci had to face was to "balance" the new requests from the RFI Technical department with what the Loccioni Felix team could actually achieve on time. The Loccioni team was not always willing to follow the specific procedures asked by RFI in order to improve the Felix. Since the Technical department of RFI was not involved in the Felix project from the very beginning but had to give the final green light for Felix, there was a lot of discussions and interaction on various solution features and the whole certification and approval process was delayed at least six months. The reactions of the Technical department of RFI were perceived in Loccioni as "throwing a spanner in their works" making things difficult for reasons that Loccioni people could not well grasp.

One episode remembered by Mr. Moscatelli illustrates how critical this period was: "At the beginning of 2013 we were called by RFI to their headquarters in Rome. The technical department started complaining about Felix performances and listed many changes that we had to do very quickly on our robot. I was impressed by these requirements and thought that most of them were rather difficult to fix. I stood up against the representative of the Technical department and I claimed that all the modifications required could only be done if RFI issued the order for Felix."

Although the model A1 had still to get the final approval by the RFI Mr. Moscatelli decided that it might be interesting to present the Felix solution to some other potential customers in Europe involving RFI. In spring 2013 RFI presented Felix as 'breakthrough technology' at an important Railway trade fair in London. This was of big push for Loccioni. While Mr. Moscatelli could not participate at the fair, through the RFI he got some contacts in the national railways companies in UK, France and Austria. He was convinced that UK in

particular would be a country where Felix might be sold. He thought that the Network Rail Company, owner and operator of most of the British rail infrastructure, could be considered an important potential customer. The initial approach to Network Rail was facilitated by RFI that provided some key contacts in the company.

Also in approaching potential clients in France RFI has been very important providing some useful first contacts. The managing director of the French SNCF was put in contact with Mr. Moscatelli by RFI when he visited one of the R&D center of RFI in Turin where the approval test of Felix was running. Since SNCF and RFI share responsibility for the maintenance of the railways on the borders between Italy and France, the two companies were at the time discussing how to arrange railway switch controls. These circumstances helped Loccioni introducing the Felix in France.

Epilogue: Felix is sold and ready for delivery

As the project expenditures were accumulating and there was no revenues from RFI, Loccioni's management started to be concerned about how the project would turn out. Moscatelli had created high expectations around Felix in Loccioni, in order to raise money for developing the robot and managing the relationship with RFI. He was promising within the company that RFI would soon become the first customer. But, as time went and the order from RFI was still too far from coming, by mid-2013 Mr. Loccioni started to push Mr. Moscatelli and Mr. Salvucci about the project returns. He was requesting to transform the Felix costs into revenues and made it clear that he expected soon an order from RFI. Mr. Moscatelli recalls that: "The situation of Felix in 2013 was stressful. I almost got sick. Everyone in Loccioni noted that Felix was an ambitious and promising but also expensive project. We were in the eye of the storm. Everyone asked that RFI must order our product as soon as possible, but RFI looked slow and sleepy. So I had to be very persistent".

In parallel with fine-tuning of the robot design, in the late autumn of 2013, the Purchasing office of RFI – which only had the task of executing what RFI Technical department decided – asked Mr. Moscatelli to prepare an offer for 37 Felix model A1 and related after-sales servicing and maintenance. After a nearly four-years long journey, the opportunity to sell Felix and to generate some monetary returns was finally taking form. Towards the end of 2013 Mr. Moscatelli prepared the offer and presented it to RFI's management – including the CEO of the company, the responsible for the production, the chief of Felix team and the head of the Planning and Control department (the department supervising the investment portfolio of the entire RFI, which only played a minor role when came to the decision of whether or not to approve the purchasing)– and arranged a meeting in Rome at RFI headquarters at the beginning of 2014 to decide Felix purchase.

After some internal discussions in RFI in May 2014 the CEO issued an order for 37 Felix robots over the coming 18 months and the related maintenance contract - for a total of about € 6.3 million. That made the RFI suddenly one of the top 20 Loccioni customers in terms of sales. RFI decided to order 37 A1 robots once it was pretty clear that the robot would respect the requirements. However, some of the final technical features were, at the moment of the contract, left open. As part of the signed contract, Loccioni would deliver, by December 2014, three A1 robots to be tested for at least three months at RFI's regional units of Ancona (central Italy), Bologna (central-north Italy) and Turin (North Italy). This tests would allow Loccioni to collect the results of the field testing and to adjust and fine tune the robot in case of malfunctions. This was deemed very important in order to avoid mistakes during the

production of the remaining 34 robots. Summing up the deal with RFI, Loccioni had to deliver three robots for test in December 2014, and the remaining 34 were to be delivered between June 2015 and March 2016 at a pace of about three A1 each month.

An important milestone which allowed Loccioni to close the order for the 37 robots was the creation of the so called "static bench". This bench – conceived, developed and realized by Loccioni – proved that Felix was able to make static measures. It is interesting, however, that the order for the 37 Felix robots has been issued while the testing of the prototypes was still going on and there still was the need to adapt some technical features of the Felix in order to comply with the features as required by RFI. Interestingly, Mr. Moscatelli had some signs that within RFI expectations of adopting the Felix solution was so high that the top management of the company felt "almost obliged" to close the deal. Evidently RFI people trusted the positive outcome of the latest technical adjustments and were confident that Loccioni would not exploit the situation opportunistically.

Moscatelli did a solid work in order to highlight the advantages of Felix for RFI. In order to close the deal, he had to interact with several people and RFI's departments. While in 2010 four people from Loccioni (Mr. Moscatelli, Mr. Bruni, Mr. Salvucci and Mr. Concettoni) were working on the project together with two persons from RFI. By the beginning of 2015 there were 15 people working on Felix in various departments in Loccioni such as marketing, sales, production and R&D and about 30 persons in RFI. The latter did not include the Purchasing department in RFI which seemed to Mr. Moscatelli quite strange. Only later he understood why.

A note about the organization of procurement at RFI

Being a state-owned company, RFI had to follow specific procedures in order to purchase goods from private suppliers. Every purchasing has to be scheduled following a specific procedure; the actor involved are three but with very different responsibilities and decision power. The Technical department (which includes also the railroad Equipment division) drafts a technical specification report that justifies the purchase (*relazione tecnica giustificativa*). The aim of this report is to proof that a technical solution – in our case FELIX- and a provider (Loccioni) have been found 'on the market'. Afterwards, the report goes to the Planning and Control division of RFI that handles the investment portfolio of the company and related expenditures. Once received the report from the technical department, the Planning and Control division opens an account (*conto d'ordine*) which automatically generates a purchase 'code' that is public and indicates that RFI – as a public company – is going to invest money in order to make the purchase.

It is only at that point that the Purchasing office contacts Loccioni with a request for quotation (a bid) on Felix. That explains the limited role of the Purchasing department in choosing the supplier and dealing with the supplier. Purchasing was not involved in negotiations about the order with Loccioni while the other two departments - Railroad equipment and the Technical departments - were central for the negotiations. The main task of the Purchasing has been to verify that all the required documents were provided by the departments within RFI as well as by the potential supplier. Mr. Moscatelli found that the purchasing office has limited power and they have to receive on their desks the following documents: (1) a report justifying the need of purchase (2) a draft of the purchase agreement issued by the Technical departments (3) the estimated cost of purchase based on the tender (being a state-owned company the procurement procedure has to be based on tenders), (4) the

order account which is the confirmation that the department of Planning and Control at RFI has checked the availability of funds to be invested in that purchasing and approved the spending. Mr. Moscatelli recalls that he only met the responsible of the purchasing department when signing the contract and he is convinced that the Purchasing department was more or less totally unaware about what was going on between RFI and Loccioni over the four years preceding the signing of the contract. They appeared only to manage the papers after the deal.

DISCUSSION

With respect to the processes of new solutions development proposed by Tuli et al. (2007) the case covers mainly three processes: Requirement definition, Customization and integration and to some extent Deployment phases. The Post deployment support phase has not yet been reached in the case. The three processes do not appear to be neatly separated and distinct in phases, rather they overlap and go on largely in parallel. The 'Requirement definition', for instance, is not accomplished after four years of development and goes on practically throughout the whole period covered by the case. Similarly, it is difficult to identify a beginning or an end of the 'Customization and integration'. The first Deployment (delivery of the first three robots) is not an end of the Customization and the actual Deployment is extended in time (delivery of the 35 robots in 2015 – 2016 and their maintenance continuing even thereafter). While the four processes evoke liner phases starting with the specification of the need and going on to deployment, in our case they are going on largely in parallel rather than in a sequence.

With respect to the evolution of the *interaction pattern*, our first research question, the case shows a growing complexity of the interaction patterns and of the inter-organizational interface as the new business relationship and technical solutions develop. At first the interaction pattern between the two companies is relatively limited; three technicians and the KAM in Loccioni and the two technicians in the RFI appear central, even if some others have interceded (e.g. the consultant or Loccioni's owner). It is drawing on a history of a tenuous business relationship with the mother company of the customer RFI. The interaction pattern branches out to embrace dozens of persons in different roles on both sides of the relationship as various technical and commercial issues arise and are addressed. The net of relationships among the involved in both organizations mirrors the resources, activities and actors that needed to be mobilized in coping with various issues. From the perspective of KAM, the net of interactions becomes more complex but also gradually more stabilized when other functions (technicians) in the two organizations develop direct contacts. At each stage the solution considered required certain resources, activities and actors, and the features of the solution shaped the "temporary team" that supports development of the new solution and the development of the business relationship. The involved bring in the project their ideas and agendas that in turn shaped the features of the solution under development and the interaction pattern evolves in a rather ad hoc way. It is well illustrated when new actors as Mr. Pavan at first and Mr. Lippo at a later stage, become involved and the focus of the technical development shifts to different features. There are some controversies that could not be avoided, as, for instance, when certain features, and the need to document certain features, are doubted in Loccioni as the Felix team did not think that the requests from RFI were sensible enough to be taken into consideration: they simply did not see customer's rationale. On the whole while there is notable continuity in the 'development team' in the two companies, the composition of the team is fluid and gets only temporarily stabilized just to mutate when circumstances change.

The pattern of interactions between the two companies appears to reflect two different sets of *factors*. On the one hand the involvement of different actors from both the supplier and customer reflects the technical factors and the need to combine and integrate a number of different elements in the technical solution (complex set of technical artefacts – hardware and software). On the other hand the interaction pattern is shaped by 'non-technical' - organisational and commercial factors. Various actors become involved for reasons not strictly related to the technical solutions, such as various management positions in both companies. It is well illustrated also in the 'formal' and sanctioned involvement of the Purchasing and Planning and Control departments in RFI, or the involvement of the company owner, Mr. Loccioni, who represent the 'non-technical' factors shaping the pattern of interactions between the two companies. While the interaction pattern is thus shaped by technical and commercial factors internal to the relationship, there is a notable impact of circumstances and events external to the relationship (and in some cases even external to the two companies – e.g. the need to update the norms to conform with EU-wide standards). These factors have substantial consequences for the characteristics of the technical solution under development and on the interaction pattern between the two companies. The interaction pattern and the solution development mutually conditioned each other. The interplay between the interaction pattern at the interface and the characteristics of the customer solution over time appears mostly ad-hoc reactions to factors emerging beyond the horizon of the various team members. It is well illustrated when customer organization emphasis in the product development shifts to different features or when the president of Loccioni facilitates personal changes in the team.

There is no doubt that Sales have played an active role in both the new solution development (and thus the innovation process) and in development of the commercial relationship with RFI. Mr. Moscatelli (initially KAM for Italian Railways) has been important in actively pursuing the first lead from the, more or less accidental, meeting between Mr. Loccioni and the RFI technician Mr. Mirto. A more or less generic complaint about the need for solution becomes over time a significant opportunity articulated, advocated and formalized by Mr. Moscatelli. Sales (in the person of Mr. Moscatelli) play an important role in shaping the interface and in orchestrating the solution process also by choosing whom to mobilize and connect - for instance when he lobbies Mr. Loccioni to re-assign Mr. Salvucci to the development team or in later phases when he decides to present the Felix to other potential international customers. Even though the technical competences of sales are limited, it has shaped the features of the new solution by connecting individuals with required competences in the own organization and those involved in RFI. Sales mediate when some contrasts emerge and appear to play an active role even though it has only a partial picture of the situation. It takes an active role in adjusting to new circumstances and in 'navigating', but also in actively shaping the 'narrative' of the project both in the own and customer organization. The latter is illustrated when Mr. Moscatelli turns the company internal 'research project' into a "job-order" for a client, legitimizing thus further investment, or when he anticipated the deal with RFI for the 37 robots without final definition of the specifications in order to ensure further support for the project in both organizations. Sales, in the person of Mr. Moscatelli, have also been important for understanding and adjusting to the customer organizations, such as dealing with the Purchasing and Planning and Control departments in RFI.

CONCLUSIONS

Our study suggests that if we are to understand, and to cope effectively with the new solutions development in existing business relationships, we can benefit from a focus on interaction processes and from approaching the new solution development in business relationships as a set of "interrelated processes" (Tuli et al., 2007). The case illustrates that new solution and business relationship development involve different interaction processes and interface architecture that in turn impact on the innovation process outcomes. The three research question that we formulated can be answered as follows.

First, the pattern of inter-functional collaboration tends to be complex mirroring the need to involve heterogeneous competences and to combine different resources on both sides of the relationship ensuring some coordination in the activities. The interaction pattern at the interface in terms of organizational units and actors involved tends to become occasionally stabilized and 'structured' but remains fluid. It has no given beginning nor ending. The development of the 'pattern of interactions' is anything but linear; rather it is subject to frequent changes for reasons internal to the relationship or external to it. Furthermore, any 'mapping' of the interaction pattern related to the new solution and business relationship development is likely to remain fuzzy and relative as it reflects the limited horizon of various actors (or issues) involved. The different pictures can be aggregated but the aggregation becomes always relative and anchored to a certain perspective. This aspect is clearly present in our case but it certainly deserves more attention in future research.

Second, the interaction pattern and the solution sought are transformed over time in a way that cannot be anticipated reflecting factors related to the technical content of the solutions and commercial and organizational aspects internal to the project and external to the relationship. Both the technical and non-technical and endogenous and exogenous factors call for adjustments in the set of actors involved as circumstances change. The solution as well as the set of actors who actually shape the task are subject to substantial transformation as various issues arise. This tends to happen in a way that can never be fully anticipated and requires continuous adjustments.

The sales function plays an important role mediating various impact factors and often contrasting forces, within and across the two organizations. It has a role in shaping the opportunities perceived. Mediating and linking various units and actors involved, sales actually shape the interface and influence the new solution development process. Sales appear also to have an important role in constructing the narrative that motivates and mobilizes the various actors on both sides of the relationships. That makes sales to a function that is critical for the outcomes of the innovation process even though it has limited technical and organizational competences. Our study also suggests that quite distinct capabilities of relating are required if sales are to cope effectively with such a task.

Our study adds to prior research on new solution development bringing some insights on the role of interaction processes and of the organizational architecture of the interface between the two organizations, which opens for the critical role of boundary functions that take part in orchestrating the interface activities (La Rocca & Snehota, 2014b). While 'capabilities to relate' have been identified as critical in turning innovation in a new business venture (La Rocca & Snehota, 2014a), this study suggests that such capabilities are equally, if not more critical, when established companies with well-equipped functions engage in product-service innovation.

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