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## **How do firms enact absorptive capacity? A routine based approach**

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### **Abstract**

Our research aims to open the black box of routines that shape potential ACAP and of its enacting by studying the emergence of recurring patterns of recognition and assimilation, through a case study

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## Abstract

*In spite of an increasing amount of research on absorptive capacity (AC) and its relationship with the innovative performance of a firm, more recently the theoretical debate has drawn attention to the dynamic nature of this construct. There are still a few studies on the organizational routines that make-up absorptive capacity, particularly on those that are at the basis of “potential” AC, which encompass the recognition and the assimilation of external valuable knowledge. According to this claim our research aims to open the black box of routines that shape “potential” AC contributing to this recent debate in two ways: by studying the emergence of recurring patterns of recognition and assimilation of external knowledge in innovative organizations and by investigating how do firms enact absorptive capacity through the formation of its successful routines. Through an inductive research based on a multiple case study, we provide a grounded categorization of the key organizational practices that shape the routines of recognition and the assimilation of external knowledge absorption and we offer preliminary insights on their enactment process.*

**Keywords:** absorptive capacity, recognition, assimilation, routine, enacting

## 1. Introduction

How do firms enact absorptive capacity (AC)?

Since AC definition of Cohen and Levinthal (1990) as an organizational capacity to leverage on External Knowledge (EK) for innovation purposes, the issue of the development of this capacity has been only partially addressed. Its formation has been investigated by research on cognitive foundations of Absorptive Capacity (AC), that conceptualized it as a by product of a firm's past knowledge. Studies proved that when a firm invests on prior knowledge measured by R&D proxies a capacity of absorbing external knowledge is enabled and this affects innovative performances.

These studies contributed to show AC existence and its relevant impact on a firm's innovative performance. However they shed light on the static dimension (knowledge stock) of AC (Lane et al. 2006) and left underexplored its dynamic nature, related to organizational routines (Easterby-Smith et al. 2008; Lewin et al. 2010).

Acknowledging this theoretical and empirical gap we argue that there still a lack of research on how *routines* of external knowledge recognition, assimilation and exploitation are developed by an organization. According to literature on routines and organizational capabilities (Cohen et al. 1996; Grant 1996; Winter 2003) we maintain that AC enactment not only depends on investments on the knowledge stock of the firm but also on the development of *systematic* and *continuous practices* of external knowledge absorption (Volberda et al. 2010). Accordingly we suggest the need of research on constitutive elements at the basis of this capacity (Lane et al. 2006; Lichtenthaler 2009; Lewin et al. 2010; Volberda et al. 2010). Yet we need to open the black box of routines that shape AC (Lewin et al. 2010:1) and to unravel how they are enacted by a firm.

Our research studies AC as an organizational capability based on patterns of interdependent actions that are repetitive, recognizable and carried out by multiple actors

(Nelson and Winter 1982; Cohen and Bacdayan 1994; Feldman and Pentland 2003; Becker 2004). Literature on AC of the last decade has identified two orders of routines: routines dealing with external generated knowledge (recognition/acquisition and assimilation routines) widely defined as *potential absorptive capacity* (PAC) and routines that combine new and existing knowledge (transformation and exploitation) defined as *realized absorptive capacity* (RAC) (Zahra and George 2002; Flatten et al. 2011).

Our research concentrates on *potential* AC and its enactment. Recognition and assimilation routines deserve an in depth analysis for two reasons. First these routines are still under investigated if compared with RAC. Indeed the understanding of transformation and exploitation routines has been provided by a large and established body of literature on new product development processes and projects (Ceppeda-Carrion et al 2010). Second as research on open innovation has highlighted (Chesbrough 2003; Gassman 2006; Huston and Sakkab 2006), firms only recently are moving from sporadic and spontaneous individual efforts of search for external knowledge (already documented by research on creativity or R&D gatekeepers) to an organizational and more systematic endeavor. Therefore the potential dimension of AC has only recently become an issue and an aim for innovative firms and consequently emerging routines that mold it are a promising line of research.

We contribute to fill this research gap addressing the following research question: how does a firm enact the organizational routines of potential AC?

In this paper we will study the ongoing enactment of potential AC as a interrelationship between the individual and the collective level (Narduzzo et al. 2000: 48). Our contribution to the debate on the routine-based nature of AC would help to further theoretically and empirically the research on its dynamic dimension, also advancing the knowledge on practices at the basis of these routines. Secondly we maintain that research on ACAP could enrich the empirical evidence on the formation of organizational routines.

According to our theoretical approach and our explorative research aim, we adopt a qualitative method through an in depth analysis of three cases studies. The field research helped to get closer to the potential AC by detecting organizational practices of recognition and assimilation of external knowledge and analyzing routines enactment.

The paper is structured as follows. First, we review routine-base literature on AC and address research gaps. Second we present the research design and the qualitative approach adopted coherently to the research problem, which is followed by the case studies analysis. Findings are presented and discussed by identifying the enactment of organizational routines of recognition and assimilation and categorizing the practices that mold the two routines. In the final section conclusions and future line of research are developed.

## **2. Theoretical background**

Since the conceptualization by Cohen and Levinthal (1990) of AC as a capacity to exploit external knowledge for innovation purposes, there have been a few attempts at studying its development process despite the relevance of this research issue.

A significant amount of quantitative research has been specifically devoted to the analysis of the cognitive foundations of absorptive capacity conceived as a by product of R&D investments. Assuming that prior knowledge empowers a firm to recognize external ideas by analogy, to assimilate it by leveraging on accumulated expertise and finally to exploit it by combining external and internal knowledge (Cohen and Levinthal 1989; 1990), scholars indirectly proved the enactment of AC by showing a relationship between investment on prior knowledge and firm's innovative performances.

Notwithstanding the relevance of the individual and organizational prior knowledge in AC enactment, it has been recently highlighted (Lichtenthaler 2009; Volberda et al. 2010) that research tends to neglect the process-based nature of AC, underestimating its dynamics

compared to the static dimension. Therefore this perspective does not address two main research gaps recently identified (Volberda et. al 2010): *how AC is performed as process* (Zahra and George 2002; Todorova and Durisin 2007) and *how the organizational level of AC arises*, or in other words *how it is enacted*. Coherently with this concern, research on organizational routines helps open this “black box” (Lewin et al. 2010) and understand how this capacity is developed as an organizational systematic and continuous pattern of actions, that positively impacts on a firm’s innovative performance.

Literature on AC of the last decades has identified two orders of routines: those dealing with external generated knowledge (routines of recognition/acquisition and assimilation) widely defined as *potential AC* (PAC) and routines that combine new and existing knowledge (transformation and exploitation) defined as *realized AC* (RAC) (Zahra and George 2002). A recent effort toward the development of a multidimensional measure of AC confirms these four routines as main elements that make-up AC (Flatten et al. 2011).

*Realized AC* has already been investigated by the large body of literature on NDP processes, that studied how RAC is implemented as a system of rules, procedures and problems solving routines (Cepeda-Carrion et al., 2010:4) usually adopted to improve the effectiveness and efficiency of product development projects. By contrast PAC has received less attention, since processes of recognition and assimilation of external new ideas are widely recognized as the effect of creative individuals and of their personality traits (high valuation of aesthetic qualities in experience, attraction to complexity, independence of judgment, intuition, self-confidence, ability to resolve antinomies) (Barron and Harrington, 1981). For this reason studying recognition and assimilation practices and their encoding into organizational routines is theoretically sound.

Furthermore empirical evidence shows that PAC has only recently become a critical issue and a core aim for innovative firms which are implementing the open innovation paradigm

(Chesbrough 2003; Gassman 2006; Huston and Sakkab 2006). Firms which aspire to enhance their innovation performance tend to substitute spontaneous individual efforts of search for external knowledge with organizational and more systematic processes, as for instance demonstrated by the P&G change from R&D to Connect&Develop (Huston and Sakkab 2006). Despite this empirical evidence and the recent contributions that highlight the fruitfulness of investigating the patterns of actions and knowledge flows underlying recognition and assimilation, research provides still limited insights on how firms access useful EK and effectively communicates throughout the organization. The work of Lewin et al. (2010) proposes some examples of practiced AC routines, based on a review of a large and heterogeneous sample of articles. We follow their suggestion for future empirical research on AC routines “in practice” (Lewin et al. 2010: 15). Through an explorative empirical research we address the following research question: how does a firm enact the organizational routines of potential AC?

According to this research question we would contribute to the extant literature of AC and routines in two ways. First with our research we add to the debate on the dynamic (process-based) nature of AC providing evidence on its ongoing enactment through the development of organizational routines. With this contribution we would extend the conceptual framework on AC by analyzing the organizational practices by which recognition and assimilation routines are performed. Accordingly we contribute to the conceptualization of the two organizational routines of PAC (recognition and assimilation) by a grounded categorization of practices that make-up them analyzing the aspects that are organizational or individual.

Secondly with our study we would shed light on the interrelationship of the individual level and the collective one that ends up with the enactment of organizational AC (Narduzzo et al. 2000) by identifying the generative mechanisms of routines.

### **3. Research design**

#### *3.1 Research method*

We adopted a qualitative approach in order to get closer to the recurring patterns of action by which *potential* AC is implemented at organizational level, since our aim is to study the practices that enable a company to scan external environment for valuable ideas (recognition) as well as to spread this new knowledge inside the organizational boundaries (assimilation). Considering the problem of validity of the concept of absorptive capacity raised by different scholars (Lane et al. 2006; Lewin et al. 2010) our research entailed a comparative case study, in order to overcome the known limits of generalizability and potential biases of a single case study and to ground a more fine-grained conceptualization on rich and varied evidence (Yin 1994; Eisenhardt 1989; Siggelkow 2007).

We theoretically sampled three innovative Italian firms which are similar in their effort toward fostering the innovative performance. Since 2000 all the three firms, in order to cope with the new challenges that global competition entails, have also undertaken a reorganization of their innovation processes to improve their ability to get access to external knowledge and exploit it. Thus the three firms theoretically sampled let us to investigate the emergence of new organizational routines of knowledge absorption in medium sized enterprises previously focused mostly on the exploitation of internal knowledge.

#### *3.2 Cases overview*

The first company, Alpha, is one of the main European leaders in the construction of mechanical products and the electronic systems to work and control them, and, since 2002, has been a holding of a European group (Alpha Group) which in turn is part of a larger US group. Since 2000 turnover, 82% of which is realized in the European market, has increased



from € 127 million to € 193 million in 2007. Alpha is characterized by an innovation of a technical type, both of the product and process, which it draws from fields spanning from mechanics, to hydraulics, electronics and IT.

The second company, Beta, is one of the main European leaders in the fashion industry, and is composed of 20 companies, 9 of which are situated in Italy and 11 abroad. Thanks to a strategy which has led the company to diversify the product and trademark portfolio in complementary business areas, Beta has achieved a significant increase in turnover which has leapt from €38 million in 2000 to €230 million in 2007 (38% abroad). On the other hand, Beta is principally characterized by design innovation and therefore it acts not so much on the tangible aspects as on the languages and meanings of the product.

The third company, Gamma, is one of the key players at international level in the home automation industry. Since 2000, the company has undertaken a process of acquisition of European and US firms in the same and complementary businesses in order to offer a complete range of integrated indoor and outdoor automation systems for any kind of residential and industrial uses. Due to this strategy the consolidated turnover, 80% of which is realized in the European market, has increased from € 45 million in 2000 to € 165 million in 2007. In its sector, Gamma has distinguished itself from the other players thanks to its unique combination of cutting edge technological solutions and innovative design. For its investment in the aesthetic of materials and colours of its products, Gamma has received national and international prestigious design awards.

All companies have undertaken during the last decade a strategic and organizational change to enhance their innovative performance. The changes implemented are characterised in the three companies by different pace and path as well as level of managerial intentionality. However in all cases these changes promoted the emergence of new pattern of actions undertaken by individuals in charge of the innovation process. In our attempt to provide new

insights on PAC's routines formation, these cases provide the appropriate setting to investigate how from individual-level actions and interactions the new patterns of actions became repetitive, recognizable and collective (Feldman and Pentland 2003).

In 2000 the top management of Alpha has intentionally started a change program to strength the R&D department's capacity for exploration which led the company in 2004 to re-organize the unit. The problems that restructuring has sought to reduce were linked to the specialization of the units by market segment. This entailed a strong market-driven orientation, with the consequent centrality of projects with an orientation to the short-term and incremental innovation based on the recombination of existing knowledge. The aim of the firm was to foster its capacity to leverage on advanced technological know-how by enhancing also its ability to identify and acquire new EK. Unlike the previous structure specialized by market segment, a new R&D unit, with a staff of 35 employees who hold different technical backgrounds, was structured around 7 Centers of Excellence (CoE). Five CoEs are specialized by product range, one is in charge of customizing the product and of launching market-driven incremental innovations, and one centre (Advanced Engineering) is responsible for applied technological research. The Advanced Engineering CoE is also in charge of monitoring the external environment in order to grasp the evolutions in terms of availability of production technologies and new advanced design tools in order to make them available to the other six CoEs. The R&D manager who promoted the change explained that the organizational change required an investment in new qualified human capital to introduce advanced computational technologies and new work methodologies *“There was an old generation of technicians who used the drafting machines and it took long time for everything. I realized that we had to do things in a different way, so we renewed our competences hiring young graduates with a computational background. The professional experience of the senior personal combined with the tools and the methodologies introduced by junior technicians enabled us to improve the*

*way we work*". Therefore this change promoted and legitimated different patterns of actions to search and use EK as AE Manager said *"Every time we launch a new project, we do not start relying on the solutions embodied in previous projects but we look for something new that has come in meanwhile"*.

Until the end of 2008, Beta depended solely on a network of external designers, both national and international, for the generation of the creative brief. The product manager had the task of coordinating this external network of designers and selecting their new product ideas in order to propose them to the CEO, who in turn carried out the idea screening activity. Occasionally repetitions and overlaps emerged between the proposals made by different designers for the different collections. Moreover the external designers' cognitive distance (different meanings, languages, purposes...) from Beta's needs generated reworkings of the initial creative brief. In order to strengthen the design competences, and furthermore to guarantee greater coherence between the collections and the firm's brand, the style process has been wholly internalized within the firm's organizational boundaries, with the hiring of a style manager and two specialized collaborators. The assignment of the new style manager has been that of developing and consolidating a "Beta style" which would be recognizable on the market. The external knowledge that fuels the brief is in tacit form and is spread across different socio-cultural contexts. Designers had been entrusted with the activity not only of monitoring the sources of external knowledge but also understanding, interpreting and re-combining the tacit knowledge into a creative proposal. To further strengthen coordination and reduce time-to-market the role of merchandising planner has been created within the firm. One of his tasks is to give directions to the Style office's creative search by analyzing the internal and external commercial data. The strategic change and the set up of the internal style department and the merchandising planner role triggered new pattern of action performed by

the new staff and developed expectations about how these actors will act in accessing external knowledge for the formulation of the stylistic proposal.

Starting from 2000, Gamma implemented a high degree of growth, through international acquisition processes, aimed at offering the consumer a complete range of integrated automated systems and expanding its presence in new geographical markets. The expansion of the markets served and the range of products offered, together with an orientation towards a more explorative innovation, required that Gamma strengthen the channels of external knowledge collection, whether technological or market knowledge, and the opportunities for sharing the same knowledge internally. Gamma has an R&D department with a staff of 47 employees which is made up of two areas: the mechanical and the electronic units. Internal advanced testing laboratories and technological tools enable the company to guarantee a high quality standard of the innovation process. As far as the design, marketing and communication activities Gamma relies on an independent Design Company physically located inside Gamma's headquarter. Originally the Design Company offered its services to other firms in different businesses such as furnishings and electrical appliance but at present, due to the increasing importance of the design in the Gamma's products, the Design Company exclusively works for Gamma. The employees specifically devoted to the design activities are two product designers and the Head designer who is the owner of the Design Company. Monitoring of the technological evolution in the sector and market trends has always been the responsibility of the individual mechanical and electronic technicians of the R&D department and the designers working for the Design Company. The change of strategy has led Gamma to foster the ability of being aware of the outside advancements in a systematic and continuous way.

Moreover new activities and roles have been established in the company to strengthen the capacity to acquire EK. Considering the business Gamma operates in, the installer of its

automated systems represents the principal interlocutor with the final consumer and therefore an important source of ideas. Over recent years the After Sales unit has increased the codification of the collection of telephone calls from installers, which are classified and tagged by product and depending on the specific problem, by means of a continual sophistication of a database. In 2008 a new professional position was introduced, the Technical Trainer, whose tasks include that of analyzing and comparing Gamma's products with those of the competition. Although in this company the sharing of EK takes place via verbal exchange between R&D technicians and designers, Gamma has implemented tools aimed at codifying EK in order to encourage a more easy access of it.

### *3.3 Data Collection*

Data on these three retrospective cases were collected by participant observation and in-depth semi-structured interviews. Ethnographic observation was conducted in different periods and with a different time span in the three sites, from 2008 to 2010. The data were also collected drawing on archival sources in order to triangulate facts and make inferences.

The primary source of data collection was a semi-structured interview with open-ended questions administered face-to-face and by phone contacts. To limit bias, we used numerous and highly knowledgeable informants who view the phenomenon under investigation from diverse perspective. Table 1 provides for each case the total number of interviews and hours as well as the interviewees organization role.

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Insert table 1 here

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The number of semi-structured in-depth interviews held was 32 over a period of 15 months, each lasting from one to three hours. The interviews were taped and transcribed, and validation was received through feedback from the respondents. The semi-structured interviews were conducted using the behavioural event interview technique (Boyatzis 1998) in order to collect critical incidents about behaviours that respondents performed as members of innovative project teams. We tried to ensure the proximity in time to the events recall by interviewees as to guard from biases related to retrospective reporting (Miller et al. 1997).

As highlighted by Boyatzis (1998) and Coffrey and Atkinson (1996) the critical incident interview as a form of storytelling it is a valuable source of qualitative information.

In order to ensure coherence and consistency between the case studies, an interview guide composed of three main sections was developed (Yin 1984). After a preliminary analysis of the company catalogue and projects database, we asked the interviewees to recall events about those projects which successfully reached the commercialization phase, introduced a discontinuity within the sector of each company (in accordance to technical and/or stylistic criteria) and finally required an effort of recognising and assimilating external knowledge. For each event we interviewed several respondents in order to avoid single-respondent bias.

### *3.4. Case analysis*

The case analysis has been developed according to our research problems in two main stages.

Firstly, in analyzing the data we devoted attention to how actors in each company described and made sense of the activities they engaged in to recognize and assimilate external knowledge for innovation purposes. We organized data collected in order to understand in each particular case the recurring and collective patterns of actions undertaken

by organizational actors before proceeding to cross-case analysis and coding (Eisenhardt 1989; Miles and Huberman 1994),

In each case we broke down and reconceptualized the data by means of an open coding of the activities, capturing the concept at a higher level of abstraction and drawing on existing literature on PAC which defines the two dimensions of recognition and assimilation, thus within-case configuration is preserved (Miles and Huberman 1994). The data generated a repertoires of recurring and collective patterns of actions undertaken by organizational actors.

After this first step, data analysis entailed an in-depth cross-case analysis. Through discussion, the two authors debated interpretations of the data and the final coding of the patterns of actions and categorizes routines. We analyzed the entire sample making contrasts and comparisons and testing findings. The coding process was aimed to categorize the generative mechanisms through which individual PAC practices are institutionalized at organizational level.

#### **4. Findings**

The results of the systematic and interactive comparisons of the interview data are presented in following sub-sections. We describe the empirical evidence that allowed us to identify the collective, repetitive and recognizable pattern of actions that emerged in the three cases as a consequence of the strategic and organization change undertaken by companies in order to foster innovation performance.

##### *4.1 Recognition in practice*

The awareness that EK could be a valuable resource, both for individual creativity and for organizational innovation emerged from our interviews as a challenging novelty in the way respondents perform their jobs. In contrast to the efficiency behaviors required by the past

cost-oriented strategy of firms analyzed, a collective practice of EK search implied the setting of a new priority: i.e. producing ideas, insights, solutions, consequently the efficient reallocation of individuals' working time among activities devoted to incremental knowledge refining and new activities of EK search . In the case of Alpha:

*In the context in which a perspective of continual market adaptation is predominant, it is evident that all the innovation efforts were concentrated on the internal possibilities of incrementally improving the products already developed in order to reduce the costs and serve the market before the competition (Alpha – member of former Product Market Unit).*

*There was neither the time nor the predisposition to explore technological solutions of an innovative type, which would have taken time and resources from the further development of the products of that time (Alpha – Advanced Engineering manager).*

A first step toward activating the routine of recognition of external opportunities was to explicitly create a new role and hire a person motivated and competent to operate at the boundaries of the organization on the basis of his background at the frontier of the field:

*I was employed in 2000. Alpha came to the university looking for a mechanical engineer with a background in numerical fluid dynamics because they wanted to introduce this technology which was considered cutting edge, and until that moment not employed in the sector .... In 2006 the R&D manager said to me: “you will deal with the Advanced Engineering CoE, we have to be more at the forefront”, and I took on the position (Alpha – Advanced Engineering manager)*

The engineer once socialized identified among its tasks the one of monitoring external sources of knowledge. The center is composed of 13 technicians in addition to the leader and they were engaged to monitor the external technological advancements on a continuous basis:

*In order to accomplish this task we monitor external technological advancements, which perhaps may not yet have application by competitors.... You cannot do it only when you need it, you have to be continually focused, analyze the outside, follow the technology if you want to be on the cutting edge (Alpha – Advanced Engineering manager)*

Before the setting up of the internal Style unit, in Beta the creative brief for the seasonal collections were provided from external designers. The Product Office was in charge of contacting the designers and bringing their proposals to the Product Committee. After 2008



Beta's concept development stage has been entrusted to the new Style manager and her staff made up of two designers. The aim of the Style department encompassed a new task of systematically explore the external environment in search of new idea, previously performed only by the external consultants. Indeed the external search for ideas for the new collection, the “creative brief”, became a recognized and collective behavior by which they define themselves:

*We are mercenaries of inspiration, in the sense that anything can be an inspiration, seeing colored posters in papier-mâché, the opening of an exhibition (Beta – Head designer)*

The implementation of this practice was not only recognised by the Style staff that carried out it but also but other units involved in the innovation process such the merchandising newly set up by Beta. The merchandising planner defined his and the Style unit activities as two distinct “searches” with different but complementary purposes. Therefore he expected from designers insights every time a new collection is to be launched.

In Gamma sporadic initiative of individuals characterized the way in which the R&D staff performed in the past their external search for new technological advancements. In 2000 the company started a strategy of diversification through a process of acquisition in related business that let it to get access to complementary technological know-how. Due to the entrance in new markets and technological fields the company became aware of the importance to spur a systematically and continuous effort of EK search both in the R&D and Design unit:

*[the monitoring of external environment] has always been part of my job, but this activity has recently increased due to the larger size of the company and the hiring of two new young designers. Our search is continuous and it becomes more intense during the new product development phase (Gamma – Head Designer)*

Contrary to Alpha and Beta in which formal roles, tasks and interpersonal expectations have been established, in Gamma the “recognition routine” seems to emerge informally from a common awareness of its relevance for the innovation performance of the company. Thus, in the absence of a formal specialization individuals have to handle both their previous consolidated tasks related to technical design activities as well as the new activity of searching outside. This implies a trade off between the amount of resources, time and attention devoted to the different activities generating tensions:

*I devoted from 2 to 3 hours per week to the collection and screening of external information, less than I would like, but much more than my boss would like (Gamma – Senior Electronic Designer).*

According to Pentland et al. (2010:919) who claim that “behavioral manifestation are the best basis for empirical research on routines”, from the field notes and the interview transcripts we constructed a representation of how recognition routine is performed in the three companies.

A first actual action that emerge from the across-case comparison is that recognition routine entails the monitoring of sources and channels far from the boundaries of the specific technological or semantic domains in order to identify relevant opportunities for non incremental innovation. All companies are leader in their market segment and respondents maintain that only near search is not fruitful for inspiring breakthrough ideas:

*Instead of merely scanning competitors’ ideas, we generate our innovative products drawing on completely different industries...solutions that already exist but that are applied in other settings (Gamma - Technical Director)*

*Visiting specialist trade fairs of another sector, or that of sheet metal working, we have seen that companies in other sectors employ laser welding and we thought that it could be introduced here (Alpha – R&D manager)*

Beta and Gamma operate in a B2C market and experience technological and meaning convergence, and search not only for new technologies and functions but also for new product

meanings. Therefore their R&D technicians do not limit their external search to similar products but take a broader perspective and draw from several inspirations coming from the observation of people's lifestyle:

*Consulting magazines, doing trips and living in the fashion world we are able to identify and interpret future trends in terms of colours and materials like stones and pearls (Beta – Product manager)*

*The approach is to visit trade fairs, even those which are not just specific to our sector rather than consulting magazines, amateur ones that can be found in newsagents, or sector-specific technological journals where suppliers present their solutions. For example, one of our designers recently visited a trade fair on LED illumination and brought back some information to the company on how that specific market is going. (Gamma – Technical Director)*

This search beyond the local domains entails the activation and recurrent use of different channels. A first channel to get access to information is the web in which online resources like blogs, journals, magazines or data set are publicly available. Searching by internet enhances not only the number of channels available within a firm's technological field, but also allows a search process across fields, whenever the informative potential of industry specific channels is exhausted. Interviewees take advantage of this opportunity to extend the scope of their search beyond firm's and industry's knowledge domain.

In Alpha surfing conventional and unconventional knowledge sources became part of the job of the Advanced Engineering team:

*I carry out on-call research for each project developed by other units by surfing the internet and seeing whether something has been discovered. When I have time (I'm in charge of supporting other units project development activities), I consult the internet sites of software houses rather than the internet sites of the technical magazines or university research projects (Alpha – Advanced Engineering manager)*

Also in Beta and in Gamma, selected blogs and portals are regularly consulted, and these behaviors are enacted more frequently by newly hired technicians and project members:

*There are blogs that I have been consulting a lot, an American blog which presents new designs, new ideas, in the absence of trips to Paris, New York, or visit expositions, museum, trend settings internet is the primary sources. (Beta – Head designer)*

*Above all we visit internet sites and portals dedicated to design which show a collection of the best on the subject. (Gamma – Head Designer)*

The online channels are often complemented by searching onsite in order to leverage on two types of advantage: visualizing artifacts and interacting face-to-face with potential sources of information. Walking around fairs, shows or shopping centres, actors in charge of monitoring external environment might collect objects, pictures and other artifacts that provide a visual support to capture emergent meanings, physical architectures and product functionalities. Furthermore searching onsite allows the establishment of new ties with sources of ideas. This emerged especially in the case of Beta and Gamma, more design-driven in comparison to Alpha, since EK about socio-cultural trends is often tacit being embedded in artifacts instead in product brochures:

*The three people of internal Style Office, set up at the end of 2008, deal with the research of new meanings by going to the fashion shows, doing scouting trips to New York, London etc to search for possible future trends in shops or markets. (Beta – Product manager)*

*Also by walking around shopping centres, I see how products evolve, above all low-cost products in which today the role of design has become popular. (Gamma – Technical Director)*

A third channel used by companies in order to span technological and semantic domains is the creation of bridges with external experts, to whom they delegate the search process. This allows the acquisition of non-redundant knowledge in an efficient and timely way, because it is filtered and organized by competent nodes according to the requirements of the receivers. These benefits that are explicitly pursued by people who try to exploit this channel.

In the case of Alpha cutting edge technologies are sought interacting with academic departments:

*The thing that I have tried to do after joining Alpha in 2000 is to maintain contact with the Department of Mechanical Engineering and with the Department of Electrical Engineering of the university I graduated from .... Thanks to this collaboration we have developed a simulation thermal model for the heating of submersible engines that has helped us considerably in modifying the design of the product (Alpha – Advanced Engineering CoE manager)*

Being part of a open community of experts improves the ability to quickly get access to privileged and reliable knowledge in Beta. Since products' meanings are not industry-specific, the opportunity to interact with other designers on different categories of products allows the transfer of meanings from one sector to another. The Style unit staff's interacted with a distributed network of external designers and consultants to catch insightful inspirations:

*We maintain contacts with the best designers for future collaboration relationships ... The Head Designer collaborates with a person who writes for fashion magazines and attends fashion shows in Milan, Paris and New York. Thus our present approach is not longer to give to external designers inputs to direct their search but to alert external consultants to have regular feedback on fashion trend (Beta - Product manager)*

In Gamma after a preliminary selection of the information contained in the newsletters sent by suppliers to the R&D staff and the Purchasing office, periodic meetings are organized to collect data on components and technologies used in different industries:

*We have many meetings with the suppliers of technologies even in sectors other than our own. An idea taken from another sector could stimulate something in ours, so some ideas come to mind quite often and easily from interviews with these people and naturally I write down. .... They present an idea which is far from our sector but which could be useful for a future product. Or they say "look this supplier has introduced this product, and I think it could be useful, they use it here for example on a microwave oven but I think if you use it to do that thing I know you are working on it could be useful. (Gamma – Senior Electronic Designer)*

Searching through multiple channels generates a large amount of information, some insights can be redundant, some other not immediately valuable. Recognition routine is successfully performed only when actors assess the usefulness of EK. The interviewees were asked to describe in details critical events in which the EK explored has been assessed as valuable in addressing NPD problems. Findings show that in all three cases R&D technicians built analogies which involve the recognition of similarities between a problem (target) a firm need to solve and a new domain (base or source) from which a potential solution could be mapped. Once similarities (superficial or structural) have been detected, actors established

correspondences between the source and the target domain, and transfer by analogy chunks of knowledge of the source to the target domain. Among the critical incidents collected through the interviews, for each company we describe in detail an event in which the mapping practice has been collectively implemented.

In Alpha the interviewees narrated that they were already inside the development of the new product and they arrived at a point in which an unforeseen need arises. They needed to reduce the prototyping times, and therefore to find a speedy prototyping tool which would be sufficiently reliable. By means of specialized magazines, technicians identified a widespread technology, the stereolithography, applied in other sectors like electrical appliances industry:

*This technology was used in other sectors until that moment only for cosmetic/design purposes and not to realize prototypes. To apply this technology we had to resolve the problem of the structural strength of the material because the material obtained with this technique does not have the necessary mechanical resistance to be subjected to testing. (Alpha – Advanced Engineering CoE manager)*

The searching practice enabled the technicians in Alpha to be aware of the range of possible solutions available to solve the problem of prototyping. The mapping practice took place during a meeting in which the detection of similarities between the target – prototyping and the solution provided by stereo-lithography emerged. Through the mapping practice actors assessed the strength of the match between solutions applied in other settings and the internal problem, and therefore the innovation opportunities as well as the possible constraints (the material obtained for cosmetic purposes lacked the adequate structural resistance).

In Beta the Head Designer explained how an input from the history of art formulated by a consultant, member of the community of experts, became a new product collection:

*The consultant suggested that the style to which our product portfolio is related is that of the cultural movement of Renaissance. We then prompted an internal research on Renaissance and its aesthetic values such harmony of forms or beauty of nature. We brought a bible of 14th century, and we analysed the floral drawings and paintings. The art embodied in that bible, the painting of its thousand pages, were inspiring for us, even if this wasn't clear at first sight. We applied those drawings in some components of our products. By this*

*innovation we have reinterpreted one main feature of that style as our specific and modern approach in designing the new collection of product. (Beta – Head designer)*

The external input selected triggered the correspondences between the source (the aesthetic values of Renaissance embodied in the bible) and the target problem (the value of harmony of forms to embody in Beta's collection).

In Gamma the idea of introducing in its products a touch screen solution similar to that applied in a blackberry emerged during the scouting trips to fairs of different sectors. One of Gamma's main supplier, knowing that the company was working on this idea, addressed this problem during one of the period meetings:

*The supplier suggested to us a new methodology he developed to detect the position and the pressure of the hands. When we met, the supplier brought us a metallic slab on which a keyboard was designed. In the meeting the supplier left us a demo of this keyboard and, since I thought it was interesting I showed it to the director. (Screen Electronics Senior Designer)*

The face-to-face interaction with the supplier and the visualization of the keyboard was the trigger of an analogy between the solution provided by inductive sensor embodied in the metallic slab (source) and the target problem of protecting Gamma's product from damages caused by water infiltrations. Before the meeting with the supplier, Gamma's technicians thought to address this using mechanical bottoms:

*Besides the application of the metallic slam to a touch screen, the solution illustrated generated an idea for improving the reliability of another product. The metallic slam, if sealed up and put outside, would have solved the problem of the breaking of selectors due to water infiltrations... the inductive slam would have reduced costs, increased reliability and allowed to integrate further functionalities. (Screen Electronics Senior Designer)*

These examples of mapping practices confirmed that a recognition process is not fully performed until similarities are detected and an external domain is identified as a carrier of a valuable and feasible solutions.

## 4.2 Assimilation in practice

All external knowledge recognized as useful for addressing internal needs could not be easily comprehended and available by the actors who are expected to benefit from it. Indeed, the collective nature of AC, as an organizational capabilities, implies that actions are undertaken by multiple actors and in different moments, thus those who recognize EK might be not the same of those in the position to apply it. Therefore EK needs to be translated and moved among different actors and periods of time

Representation of new knowledge by means of codification of the external ideas and their embodiment emerged in our field research as a recurring activity of the assimilation routine. Representation practice resorts to the creation of a shared language or code that can be understood by the potential users of external knowledge. In Alpha the creation of an “idea banking”, continuously nurtured by members who can post ideas (for technical solutions, new materials...) and inquiry it every time they need a new insight, required the definition of a template that specifies how to fill the form in order to allow the consultation of the database by anyone :

*We have a bank of idea in which we store technological solutions that might be useful for future new product or technical problems ....We use a template that allows all members of R&D to adopt the same language for the data entry, we cannot open a word file and describe the new idea as we want, we all have to fill the same form in which benefits and risks of the technological solutions are described. (Alpha – Advanced Engineering CoE manager)*

Another recurring pattern of representation through artifacts is rendering information legible to receivers by summarizing it through tangible and quickly readable reports or summaries like in the case of Gamma:

*After Sales gives R&D the summary of the problems related to our products as revealed by the market. From all the telephone calls that they receive, approximately 200 a week, they prepare a report that is discussed weekly with the general management and the R&D manager. (Gamma – Technical Director)*

*When visiting the trade fairs a written report is prepared (Gamma – Senior Electronic Designer).*



Another useful pattern to render effectively the value of a new idea is the use of visualization of new products or ideas features by sketches. In the case of Beta, the Style staff needed to interpret the clues got from the interaction with external consultants and convert them in Beta's product forms and meanings. Translation implies the modification of the language by which the external knowledge has been delivered to the internal receivers in order to increase the attractiveness of the external ideas and to reduce possible misunderstanding, when they are moved towards other actors of the organizational network:

*Our product is very commercial, and not a niche product, and so making too much reference for example to a painter or any other niche thing that have given inspiration for a new collection may not be understood by the Brief committee. For this reason occasionally I don't believe it is appropriate to divulge the stylistic weight of the collection outside of my office, otherwise I prefer to embody the new idea in sketches (Beta – Head designer)*

Assimilation implies an investment in communication channels which allow the sharing within the organization of the recognized external knowledge. From the empirical analysis, we distinguish between two main communication channels: diachronic and synchronic. The first kind allows the knowledge to be stored and retrieved easily in every moment by the receivers, this is the case of knowledge repositories such as the idea banking of Alpha and Gamma:

*Normally I, the process owner, or one of the product managers, can insert the idea inside the Idea Banking, which is accessible online to all personnel. The idea can be from the market or even technology and therefore it can be proposed by the marketing, technical or production offices. One of the product managers or the process owner decides to bring the idea before the screening committee, in the initial Stage-Gate phase, the committee analyzes the various aspects (strategy, finance and feasibility studies) and decides whether this idea can become a project. (Alpha – R&D manager)*

*There is also a database with the new ideas. The database contains all the proposals and requests that are made by clients, sales people, external branches or directly by designers regarding alterations or creations of new products. (Gamma – Senior Electronic Designer)*

*I believe that an idea caught in another sector might stimulate something in our.. during the meetings with suppliers I generate some ideas that I write down and disseminate... I upload to the server technical materials I collected and elaborated, in this way they are*

*available to everyone. By e-mail I alert my colleagues about something valuable... I expect that my colleagues do the same with me. (Gamma - Radio Frequency Senior Designer)*

Another practice is the creation of *yellow pages* computer-based which contain specialists' names and areas of expertise in an easily accessible form. The use of this IT tool increases the awareness of the existence and the location of knowledge held by individuals within the organization and even beyond its boundaries. In the case of Alpha, every employee can get directly in touch with another specialist who works in a different company of the group:

*At group level we are developing a global system for sharing knowledge among all the companies. Each company can access the common database and browse freely in the search for information on products, materials and trials. The important thing is that we know exactly what the other companies in the group know how to do, therefore if I have a problem that belongs to a specific area which is the field of a company I know who to turn to. (Alpha – R&D manager)*

The synchronic communication channels implies the contextual interaction between the senders and the receivers, examples are meetings for external knowledge updating (Alpha) and daily or weekly interpersonal discussions (Beta and Gamma):

*In our company the activities of product design and development remain the exclusive responsibility of the CoEs of the R&D department, but weekly staff meetings are scheduled by the Advanced Engineering unit to encourage exchange, so that everyone is updated. (Alpha – R&D manager)*

*It is always the Brief Committee, composed of the CEO, Merchandising Planner, Sales director, Marketing manager, Style office staff and possible some external designers, who choose what to keep or not. From a preliminary proposal from the designer originating from an external idea, sketches were made and out of 10 for example 8 were rejected, the remaining 2 were to be developed in mono-colour or bi-colour, and then some modifications to the sizes were made. Thus a screening is carried out at the table between 5, 6 or 7 people, with a deadline once a month. (Beta - Product manager)*

*I collect several information, by my relationships with suppliers...Knowing which are the projects my colleagues are working on, I try to keep them updated. This activity is spread among us. (Gamma - Radio Frequency Senior Designer)*

In summary findings seems to confirm that the assimilation routine is performed by practices of knowledge transfer according to what has been shown by prior literature. By

contrast to main research, our field work contributes to point the relevance of knowledge embodiment. This highlights the role of artefacts as means of assimilation routine.

## 5. Discussion

By a qualitative field research we aimed at contributing to the micro-foundation of ACAP by analysing its routine dimension and its ongoing enactment. First we provide a conceptual model of organizational routines that make up Potential AC: recognition and assimilation, analysing the organizational practices by which they are performed and represented. Second we identify the generative mechanisms by which PAC organizational routines are reproduced.

We aim to enrich understanding of the interplay between individual cognitive processes and the collective actions bridging two complementary but not yet fully integrated streams of research: organizational routines literature and the emerging contributions on analogical thinking in problem solving and innovation (Gassmann and Zeschky 2008).

### *PAC organizational routines*

#### Recognition in practice

Due to an increasing tension towards launching non-incremental product innovation a first effort of all organizations analyzed was to broaden the scope of their search of insightful new domains they can draw on for new ideas. This contrast with past approaches aimed at quickly activating either internal or industry specific well known sources.

A new common pattern of actions performed by interviewees is thus consolidated, that is *searching* for new ideas, trends or discoveries beyond organizational and even industry boundaries. People are aware that distant domains carry out solutions that are potentially more innovative than those available in already exploited and local domains, but they need

legitimacy to accomplish a systematic scanning with some frequency, beyond the typical activities required. Legitimizing these actions of crossing the specific boundaries of a person's technical background is still an ongoing process in firms under analysis.

A relatively common understanding about the value of both onsite search (like fairs or meetings with visitors, customers, etc.) and online sources like blogs or online industry magazines is shared among R&D employees of the three firms investigated. Each person chooses creatively the most appropriate public source of new ideas across industry or technological boundaries. While there is a spread agreement on the potential positive impact of *searching* outside public sources, less consensus is shared on the right amount of time and efforts that should be devoted to this practice. Above a certain threshold *searching* may be considered a waste of time at the expense of other most institutionalized routines such testing or technical design. The following quote exemplifies the potential trade-off between routines which explore external source and those aiming to exploit existing internal knowledge, which is more legitimated in firms under investigation, due their experience of in-house research.

*I devoted from 2 to 3 hours per week to the collection and screening of external information, less than I would like, but much more than my boss would like” (Gamma – Senior Electronic Designer).*

We distinguish between *searching by pulling* when technicians take the initiative to looking outside for ideas and *searching by pushing* when outside “knowledge partners” are identified and an organization takes the advantage to leverage mainly on their expertise and time for searching new ideas. *Searching by pushing* is a recurring and collective pattern of exploiting a privileged and trustworthy external source, coherent with the organizational role and competence background of each person. This exploitative approach differs from previous practices by which a partner was asked to find out a “local” solution for a specific problem. Rather this demand of a “push” approach by partners is aimed to gather regularly updates even in absence of a precise requirement. For instance project members started to deal with

suppliers asking them reports on innovations about components, materials or machineries. Designers deal with customers or trend setters to catch seasonal insights on aesthetic evolutions.

The effectiveness of recognition is based on the a mapping process (Gentner 1983; Holyoak and Thagard 1989) of the most useful ideas among the large amount of information that are gathered by searching (*by pulling or pushing*). Mapping is a process by which technicians once accessed a new domain, by similarities recognition, select the aspects of the source relevant for the solution of their target domain, that is a new product concept or a technical problem occurred during a project. This analogical process driven by similarities between prior knowledge and external domains, results in the identification of relevant chunks of knowledge to be assimilated. By *mapping* employees defines a set of inferences about components of the target domain based upon correspondences with elements of the source domain (Holyoak and Thagard 1989).

This practice is rarely a recurrent and collective action, rather it is based on different individual intuitions associated to knowledge accumulation and previous experience.

The development of a better organization capability to look beyond firm's boundaries and benefit from knowledge generated outside in the three cases study is an ongoing process by which recognition routine whose outcome is an effective generation of new inferences is gaining increasing legitimacy even sometimes not the same resources are devoted this process and to efficient and standardised project driven routines, the latter being more consolidated and spread.

#### *Enacting the assimilation routine*

Our findings suggest that the process of assimilation implies practices of knowledge *representing* and *disseminating* within the organization. Case analysis shows that given the

cognitive and cultural distance between external sources and internal recipients, new practices of interpretation, translation and codification of external knowledge are implemented in order to effectively communicate it within the organization. This is a shared practice due to the fact that people might act in some cases as senders of external valuable ideas, while in others as recipients. *Representation* is performed by preparing either readily reports or using visual supports such as sketches that may better capture the attention of recipients on the usefulness of the new knowledge embodied.

Knowledge *disseminating* practice put in place in organizations studied relies on synchronic communication mechanisms, like meetings, knowledge sharing via interpersonal and informal relationships. These practices are chosen as a direct and timely channel from outside sources to inside users. People-to-people knowledge sharing is complemented by diachronic means. These tools are used as an organizational memory, that complements the individual one, that was until then essential for information retrieval of in-house past ideas and solutions. Digital repositories such as the bank of ideas of yellow pages provide a common knowledge integrating external ideas storage and retrieval. The formalization process of storing and retrieving through codified forms support the institutionalization process of this practice.

#### *PAC enactment: generative mechanisms of organizational routines*

The analysis of the enactment process of the two AC routines showed the interaction of different generative mechanisms.

First AC enacting is allowed by a progressive enrichment of the R&D routines. First local quest for solutions is enriched by distant search in unusual public sources. Second recognition practices that are problem driven (pull approach) usually activated in a specific project stage (search of technical solution in the prototype stage or the search for a new idea in the concept

development stage) are enriched by the practice of asking for a systematic updating (push approach) by external reliable sources that periodically report on external innovations.

Second the expansion of routines is progressively consolidated by some development mechanisms (Schults 2008; Narduzzo et. al 2000). Enactment is allowed by a labelling process, by which new tags or metaphors (bank of ideas; mercenary of inspiration) are used to name and legitimise the new routine. The empirical evidence shows the interviewees' awareness of the new, recurrent and collective pattern of EK search outside firm's boundaries. Indeed they define it either by entitling its performance (e.g. monitoring), or those who iteratively do that (e.g. mercenaries of inspiration).

Formalization is used for encoding new roles such as gatekeepers and activities such as meetings. Both internal and external actors are engaged and recognition allows "reciprocal typification" (Schultz 2008) that in our cases occur for instance when actors develop expectations of receiving periodical reports from their privileged source or when a translation process is expected by the internal provider of external knowledge. Finally is worth to cite the role of artefacts shared by actors such as sketches as visual tools or the repositories software used to codify novelty carried by valuable pieces of external knowledge.

Third we suggest that AC enacting through routines formation is also supported by complementarities among recognition and assimilation. Preliminary findings seem to show that interviewees are aware that the routine of recognition is complemented by the assimilation one, "outward looking" is supported and fostered by "in-ward looking" (Foss et al. 2010). Nurturing the organization inbound flows of *valuable* external knowledge is necessary, but not enough. In order to absorb external knowledge, inbound knowledge flows should reach recipients for whom external ideas could be useful.

Moreover the practice to establish and use knowledge repositories indirectly encourages a continuous and not strictly finalized search for external knowledge, allowing new ideas to find a place where to be stored even if they do not match with a present problem or project.

While literature on absorptive capacity assumes that there is a sequential interdependence among processes. According to our findings we suggest that there is not just a sequential temporal interdependence (Foss et al. 2010) among routines which deal with external knowledge, so that recognition triggers assimilation, but there is also a backward relationship from assimilation to recognition. We suggest that there are at least two factors that explain this backward relation.

A first factor is related to cognitive processes. Assimilation may act as a trigger of recognition in that once a piece of knowledge has been delivered to an actor of the organizational internal network, the node/receiver may ask for clarifications, further investigations, new elements from the same external source, triggering an iterative cycle among the two routines of recognition and assimilation.

Second when actors receive new external knowledge and perceive its usefulness, they may engage on search themselves or ask for a more systematic quest. Thus we posit that assimilation routine, allowing people to acquire even a few insight from outside, may be a trigger for further activities of recognition, igniting the engagement of the organization on knowledge absorption. Consequently the legitimacy of one routine, not only comes from its own repetition and the acknowledgement of its results, but also is reinforced by the repetition of the other, due to their complementarities.

Finally in organizations studied while some internal fit among routines seems to emerge, also an external fit between routines and R&D strategy appears as a support in the enactment process. As presented in the research design section, the three firms undertook a redesign of their innovation processes to attain better innovative performance. This strategic reorientation



from incremental to radical innovation projects enhanced the relevance of all explorative activities and gave them recognition, allowing their repetition.

## **6. Conclusions**

This research contributes to the recent theoretical debate on the dynamic nature of absorptive capacity. The paper adds to this stream of literature in several ways.

First we contribute to the theoretical debate on AC from a routine-based perspective. We provide preliminary findings on how the potential absorptive capacity is enacted by firms. Findings suggest that enactment is only partially deliberately planned at organizational level, being the outcome of an ongoing accomplishment of recognition and assimilation and an iterative relationship between performance and representation of routines. In this paper we show that absorptive capacity is based on the way individual actions become recurrent, recognizable and collective. We suggest that in this enacting process different mechanisms are in place.

Second we provide evidence on practices that make up a dimension of AC, namely potential AC, that has not been investigated yet. Through the data analysis we identified a repertoire of three organization practices that when engaged by the companies' actors can be seen to make up the recognition routine: search and selecting. We also identified a repertoire of two organization actions that enact the assimilation routine: representing and disseminating.

Third we provide a first preliminary contribution to bridge two streams of literature, organizational routines and analogical thinking, whose integration is potentially rich of theoretical and empirical implications. We also provides first explorative evidence on PAC routines as based on a cognitive individual processes such analogy, that interacting at organizational level, are fragmented and enacted by different actors and in different time and

spaces. We show that enacting absorptive capacity means managing this interaction between individual level and organizational one.

Finally we provided preliminary findings on AC as a bundles of complementary routines. Findings show that interdependence among practices is not only a sequential and unidirectional one, as previously assumed by the literature. We highlight how external fit between R&D strategy and new organizational routines of recognition and assimilation and their internal fit support AC enacting.

Furthermore we would highlight that the dynamic interaction between individual and collective levels of routines and their performance and recognition through different mechanisms support an incremental and legitimated shift of firms studied, from in-house and incremental innovation toward a more innovative and open approach to product innovation.

Further research is needed to support our preliminary findings and future research may also further study complementarities among routines of each dimension of AC, potential and realized, but also among the two. Another direction for future research lies in applying a longitudinal study in order to deep the understanding on how to enact absorptive capacity

Our preliminary findings require more investigation by means of a broader qualitative research in order to have theoretical replication (Eisenhardt and Graebner 2007).

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**APPENDIX**

**Table 1: Interviews and respondents**

<b>Case</b>	<b>Number of interviews and hours</b>	<b>Interviewees</b>
Alpha	10 (15 hours)	R&D manager Four CoE leaders specialized per product range Advanced Engineering CoE manager Human Resources manager
Beta	7 (12 hours)	Head designer Designer Product manager Merchandising Planner Human Resources manager
Gamma	15 (15 hours)	Technical director Two Electronic designers senior RF designer senior Screen Electronics senior designer Project manager Head designer Product designer Technical Support manager Technical Trainer After Sales Manager Commercial director Human Resources manager