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Abstract

In the case presented herein, two three-dimensional rendering software products coexist without competing, though they present similar characteristics and rely on competitive technological architectures. The market configuration for these two software products thus appears largely determined by socio-technical elements, not just the technical characteristics of the software architecture. The socio-technical regime within which the technology is embedded shapes the boundaries of the markets for both software products. Therefore, the concept of path dependency appears insufficient to explain the nature of the competition. To explain the factors that determine the market configuration, the authors introduce the concept of socio-technical regimes.

Keywords: socio-technical regimes, path-dependency, software market configuration

Introduction

In an investigation of the adoption of virtual representation software in a specific industry (i.e., tile), we have observed that two software products with similar functionalities but different technological architectures coexist yet do not compete. On the basis of their technological characteristics and functionalities, path dependency theory would predict that the software product that better exploits economy of scale, network externalities, and interoperability would overtake the other product. However, the socio-technical context within which the two software products function emerges as the main factor shaping the boundaries of the markets. Therefore, in the case that we study and present herein, the socio-technical dimension of *path dependency* appears more important for explaining the nature of the competition and the segmentation of the market. To explain this market configuration, we introduce the concept of socio-technical regimes. Rip (1995) similarly argues that technologies consist not just of technical and organizational aspects but rather are embedded in larger socio-technical configurations or regimes. We find that these larger socio-technical regimes define the boundaries of the markets for the two applications we study; thus, our investigation complements the theory of path dependency with the notion of socio-technical regimes.

We structure the remainder of this paper as follows: first, in the background section, we introduce the concept of path dependency and discuss how this concept might clarify the market segmentation for software products. Second, we present the research method we employ and provide an in-depth description of a case study that includes two focal companies. Third, we analyze and discuss the case. Fourth, we offer some conclusions and implications of our findings.

Background

Information systems literature has addressed the complexity associated with the adoption and diffusion of information systems and information infrastructures (Bagozzi 2007; Bagozzi et al. 1992; Davis 1989; Davis et al. 1989; Hanseth et al. 1997; Star et al. 1996), including investigations of the problem from different angles that focus on either social or technological aspects. In the former case, research mainly considers how social factors determine the adoption and social diffusion of technologies and hence information systems (Bagozzi et al. 1992; Davis 1989; DeSanctis et al.; Roger 1983). The latter stream instead investigates how technological factors, such as standards, may constrain choices in favor of a specific technological adoption (Hanseth 2000; Shapiro et al. 1998). Across these two streams, a third research approach also emerges, rooted in the socio-technical tradition. Path dependency uses the notion of path-dependent sequences to explain the course of adoption and diffusion of particular technological solutions. Path dependent sequences are the result of social and technological dependencies that shape every form of technology (Mahoney 2000). Technologies are therefore both socially constructed—as the products of interpretation, negotiation, contestation, and construction among social groups, interests, and actors—and simultaneously the result of processes of assemblage, standardization, and technological lock-in, such that they exhibit some degree of technological determinism (Callon 1991; Lanzara 2008; Latour 1991).

We propose here to study the market segmentation of specific technological solutions, such as information technologies, by looking at the socio-technical context in which they are deployed. We suggest that software market segmentation is also shaped by the reciprocal interaction among technology and people in the specific context which influences and is influenced by both (Law 1992; Law 1999). By considering this interaction it is possible to better understand the path associated with the adoption and use of an information system and therefore its markets. Path dependency is often referred as a useful approach to study the economic and organizational implications associated to technology adoption and diffusion (Arthur 1994) Path dependency theory helps explain the failure of traditional economic theories to understand why competition among technologies may not be sufficient to explain why one technology gets bigger market shares than another (Liebowitz et al. 1995). The contributions of path dependency theory also reveal that the innovations that tend to prevail are not necessarily the most efficient but perhaps those that are more compatible with preexisting socio-technical networks.

Accordingly, to be successful, a technology should display characteristics that make it “socially optimal” (Liebowitz et al. 1990). This occurs when it fulfills the needs and expectations of the users and is compatible with existing technologies, as well as with users’ routines and practices (David 2007). Therefore, new technological adoptions occur after a certain level of compatibility with preexisting socio-technical networks is reached. In this case we refer to a “path-constrained amelioration” (David, 2007: 16). That is, inherited socio-technical constraints affect the adoption of any technology. We therefore suggest to always situate technology in the contexts where it is used.

Hence the focal concern is with the technologies, agents, and processes that reproduce ‘socio-technical practices’ (Rip et al. 1998). These strongly embedded, self-reinforcing systems are referred to as ‘socio-technical regimes’ (Rip et al. 1998). Socio-technical regimes are here defined as coherent, interrelated and stable structures characterized by prevailing stock of knowledge, user practices, norms, and regulation which emerge around technologies (Geels 2002). Building on the concept of socio-technical regimes (Rip 1995; Rip et al. 1998), we discuss how existing socio-technical relations influence and sometimes shape the path of adoption of specific technologies and therefore their markets. Some socio-technical regimes are associated with institutional support, economic significance, supportive infrastructures, integration with other social practices, so that they define a structured market. In the next section, we detail how socio-technical regimes may be useful to clarify the effects of path dependencies on market configurations for software products.

Path dependency, socio-technical regimes, and market configuration

The economic consequences of path dependencies and the effect they may have on market configurations are critical. Path dependences, or high degrees of interdependences among technologies, may induce network effects in technological adoptions (Shapiro et al. 1998). Thus, the network effects shape the competitive arena and define which technology will survive (Leibowitz et al. 1995; Shapiro et al. 1998). According to path dependency theory, similar technologies generally cannot compete in the same market, becouse path dependencies will segment the market. Technologies that can exploit economies of scale, network externalities, and interoperability gain competitive advantages and therefore overtake others that lack these characteristics (Shapiro et al. 1998). Thus, the coexistence of competing technologies grounded on different standards is difficult; the one that offers the most diffuse and interoperable standard will succeed over the one that relies on the weakest standard.

However, in some markets, similar technologies coexist, even if from a technological standpoint there does not appear to be a clear explanation for why the technology that uses the more open, more widely adopted standard does not overtake the less interoperable technology. A potential explanation derives from the socio-technical dimension of path dependency. As we noted previously, path dependency results from socio-technical interactions, such that the configuration of technological markets is an outcome of not only technical aspects of the technology, such as standards, but also users’ work practices and local arrangements that develop around technologies. As a form of organization (Jessop 1996), technologies do not exist outside the specific spatial and temporal horizons of action pursued by actors during the institutional context of their technological use. That is, the larger socio-technical regime (Rip 1995) determines the characteristics of technological products and therefore their markets (Bijker et al. 1992; Star et al. 1999). We investigate socio-technical regimes as a possible explanation for the market configuration of software products that do not compete, even when they exhibit similar functionalities and build on competitive architectures. For our study, a socio-technical regime is a contextual alignment of technical and social factors that promote, via interactions among the factors, market segmentations. Rip and Kemp (1998) further note that “a technological regime is the rule-set or grammar embedded in a complex of engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artefacts and persons, ways of defining problems—all of them embedded in institutions and infrastructures.” Socio-technical regimes therefore can be considered intermediaries between already defined markets which get shaped by a specific socio-technical landscape.

The case study we provide herein shows that socio-technical regimes not only shape the development path for technological artifacts (Akrich 1992; Bijker et al. 1992) but also segment the market for these products. Market configurations therefore reflect the actions of technology users who possess specific characteristics and skills and conceive of the technology as useful for addressing specific problems that occur in certain institutional contexts, according to the technical characteristics of the artifact. In turn, our case study empirically shows that any assessment of path dependences as variables that affect the configuration of technological markets should include an analysis of socio and technical interdependences.

Methodology

We used an exploratory case study approach (Yin 1993) to research the market configuration of 3D rendering software in the tiles industry. Access has been given to the authors to study the two main competitors in the industry, so that this unit of analysis has, since the beginning, defined the object of the case study (Yin 1994). Following the explanatory case study approach, fieldwork, and data collection have been undertaken to identify the main aspects of the case prior to definition of the research questions and hypotheses. On the base of qualitative data analysis and collection we have been able to formulate our research interest which has resulted to be the explanation of why similar software products do not compete in the same industry. To explain this market setting we have looked at path dependency and its socio-technical dimension as possible explanation. To analyze the socio technical dimension of path dependency we needed to grant a deeper understanding of implicit and explicit business and social processes, as well as of the roles of people and technologies in the shaping the socio-technical relations. Case study research is the most suitable approach to examine a phenomenon in its natural settings (Benbasat 1984) and therefore the ideal vehicle for gaining a deeper understanding of the social, technical and economic factors that shape socio-economical situations (Lee 1999; Stake 2000).

Data collection has been done using open ended interviews, questionnaires (only in the preliminary phase), and analysis of secondary sources material, such as web documents and companies publications. Starting in October 2007, we conducted a five-month field study of two companies (TileSquare and Maticad) and their costumers using qualitative data collection techniques, mainly based on in depth interviews. We first investigated the content of their web portals and made contact with users of the services they provided. We visited several resellers which represented the different typologies of 3D rendering software users in the market. We therefore interviewed users with different business sizes, geographic locations, and market orientations (e.g., high value projects, complex projects, and simple projects).

We used qualitative data collection mechanisms, including in-depth interviews and analyses of existing documentation, to gather evidence about the processes that underlie the adoption and diffusion of 3D modeling software in the tile industry. Observations and documentation serve to confirm the interviews, which provide the main input for our data analysis. Our interviews include the main actors in the industry, such as the CEOs of the two companies, their marketing managers, the CIOs, strategic users in large and medium tile productions companies, and large, medium, and small-sized tile resellers. The in-depth interviews lasted approximately 90–120 minutes. When allowed, we recorded the interviews; when this was not possible, the interviewers took detailed notes. The construct validity of our study is likely because of our use of multiple sources of evidence and because the key informants discussed and reviewed draft case study reports before the data analysis step.

The person interviewed were asked questions on the functions of the solutions developed, on the relations between participants, on the influence on the technological choices on their future development, and on the evolution of the activities carried out by the company for the actors of the supply chain (producers and resellers). In addition we analyzed the printed documentation and the intranet-based documentation archives. We also studied the structure of the website and the procedures used for the development of the main services.
The table below presents a detailed summary of the actors interviewed

Table 1: Interviews

Period	Activity	Timing
October 2007	Web analysis and data collection	
November 2007	Interviews to TileSquare President and TileSquare Vice President. Topic: Description of TileSquare (Strategy and Marketing perspectives). Interview to Maticad General Manager. Topic: Description of Maticad (Strategy and Marketing perspectives)	3 interviews 120 minutes each
Mid November	Interviews to Maticad and TileSquare CIOs. Topic: Technological development of their solutions, constraints and opportunities, main technical issues of their organizations.	4 interviews 90 minutes each
Mid November 2007	Interviews to tile resellers. Topic: use of ICT in the everyday work (TileSquare and Maticad users)	9 interviews 90 minutes each
Late November 2007	Interviews with TileSquare users (Tile producers)	2 interviews 90 minutes each
December 2007	Interviews to TileSquare Marketing Manager and Maticad Marketing Manager.	2 interviews 120 minutes each

	Topic: investigating their approach to the market and competitive strategy	
December 2007	Interview to Maticad General Manager. Topic: technological perspectives	1 interview 90 minutes
January 2008	Interviews to Maticad users (tile producers). Topic: role of ICT in their daily work.	2 interviews 60 minutes each
February 2008	Follow up (interviews by telephone in order to confirm the findings)	10 interviews

Case studies

Maticad: Origins and development

Maticad was established in 1989 as a spin-off of EcoCAD, a software company specializing in the development of vertical solutions in computer-aided design (CAD) environments. Maticad's experience in the ceramic tile sector initiated with its realization of an application to support the design phase of two leading manufacturing companies. The project goal, based on a request from IBM, was to develop a CAD solution that could match the design phases of the ceramics industry while also integrating 3D renderings of the environment in which the ceramics were to be laid. The software was designed to manage all information relative to the arrangement of the tiles and the direction and sequence of decorative patterns, as well as any information necessary for the development and production of such tiles.

The software solution created from this agreement, called Domus3D (D3D), allowed designers to move directly from the designed project to the actual laying of tiles. After the project was completed, the software provided all necessary technical information to execute the client's order and complete the delivery process from the warehouse to the final destination. Moreover, D3D produces, in addition to the graphic design, a detailed list with the number and type of tiles to be used, an indication if the tiles are to be cut in a nonstandard manner, the decorative elements to be produced, and detailed information about tile laying.

Therefore, D3D originally was intended as design software for a very demanding market segment, namely, professional architects and engineers specializing in the realization of complex projects, such as airports, large hotels, or shopping centers. In the ceramic industry though, the software has been adopted by both designers, who use it as an integrated system for defining production orders, and R&D laboratories, which conduct ad hoc projects with it. Domus3D therefore represents a vertical CAD application in the ceramic industry that supports all phases of project design and realization.

Although Maticad's software was created to meet the internal needs of the ceramic manufacturing companies, it has not remained confined to these boundaries but also has become an interface that supports interactions between tile manufacturing companies and designers and architects working on complex projects. Maticad therefore has expanded to meet the needs of highly specialized end users, including designers and planning managers within tile production companies, and to provide an add-on to the existing CAD systems used by architects, engineers, and designer experts in computer-based design techniques who have mastered the knowledge needed to comprehend and analyze the potential inherent in the Maticad software.

The exclusive rights to the use of D3D for the two leading companies that originally requested the software remained valid until 1995. After that point, other companies could buy software licenses, and many manufacturing companies started to use Maticad's software because it is a CAD compliant. During the late 1990s and early 2000s, manufacturers also sensed a growing need to provide resellers with advanced tools for their showrooms, largely due to the global diffusion of Internet. By integrating the Internet into the D3D system, Maticad enabled producer clients and resellers to communicate easily online. This capability has encouraged exchanges of huge amounts of information online, especially transmissions in an electronic format of catalogs of manufacturers to resellers. Therefore, D3D appears increasingly more appreciated for its ability to render "photo-realistic" virtual environments that before existed only on paper.

These capabilities turned D3D increasingly into a marketing tool rather than just a design tool, used by large resellers that could "sell" their ideas to end customers without requiring them to imagine the transformation of a two-dimensional plan into a 3D environment. This marketing activity also receives support from the marketing departments of the tile manufacturers, which employ qualified personnel, such as engineers and architects, who are experts in the use of CAD environments and accelerate the design process by directly assisting resellers to draft large projects. Large resellers often have personnel who specialize in managing complex and sophisticated software. The marketing departments of manufacturing companies enter into collaboration agreements with these specialized experts regarding the use of CAD systems by resellers. These forms of collaboration have allowed for increasingly better articulated and complex projects, supported by agreements with design firms.

The complexity of the projects and increased competitiveness of this industry have caused many manufacturing companies to create internal task forces of five to ten architects and engineers, whose objective is to interface with their largest customers. By developing direct relationships with end customers, these groups can examine their requests carefully and develop articulated design solutions. When customers instead liaise with a reseller, these teams work to support the reseller's sales force with technical support.

When the potential of D3D for improving communication processes and providing useful information about products became clear, the manufacturers began asking for new implementations and more sophisticated services. For example, resellers initially could view the catalogs and price lists of the manufacturers. Starting in 2003, additional services available in D3D also enabled them to offer design services and tile-laying support. The enlargement of the Maticad offer to resellers—which were characterized by high structural and organizational complexity—then enabled the company to increase the number of prospective customers.

However, the relationship between Maticad and tile manufacturers remains privileged compared with its relationship with resellers. Resellers do not enjoy the privilege of access to manufacturers' catalogs; rather, they must make special requests to the manufacturers. Manufacturers can check the identity of the resellers submitting such requests and control the content, catalogs, and products the resellers may download, as well as when and how that downloading may occur. They also have the option to deny access to data that resides within their company servers (Figure 1). The choice to deny such access remains at the discretion of the manufacturers. For example, the reseller submitting a request for data may lack a contractual relationship with the company (i.e., it is not an authorized reseller of the company), or an exclusive relationship may already exist in that specific area with another reseller.

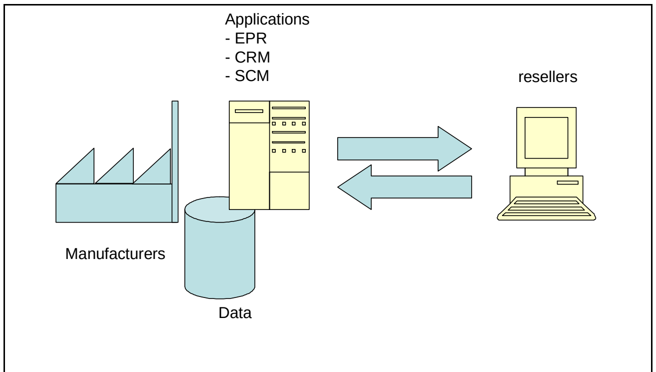

Figure 1: Maticad business model: Manufacturers and resellers

In brief, Maticad's software has become a support service in the manufacturer–reseller relationship. By integrating themselves into the information infrastructure of manufacturers, resellers may speed up their communication with manufacturers. At the same time, manufacturers can dialogue more efficiently with resellers, which constitute the interface with end customers (Figure 2).

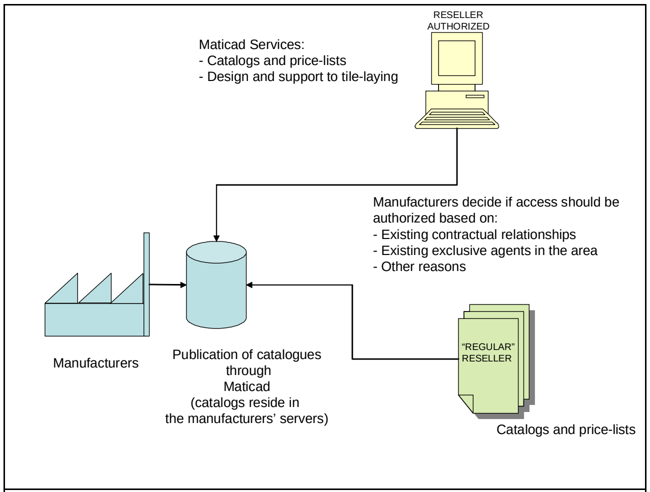

Figure2: Supply Chain Integration

In 2003, D3D became a fully fledged CAD product, with more than 15,000 licenses sold and distributed to resellers all over the world and written in 10 different languages.

TileSquare: Origins and development

TileSquare originally started in Sassuolo (Italy) in 2001, by a team of professionals and specialized company managers in marketing, sales, and communication who possessed a lot of experience in not only the ceramic industry but also in the field of Internet project development. TileSquare originally was conceived as an industry-specific e-marketplace that would provide ceramic manufacturers with a strategic tool to increase their efficiency and cost effectiveness in transactions within the supply chain. The main goal thus was to integrate manufacturers on the supply side (i.e., production machines, extractors, producers of sands and other raw materials). At a later stage, the plan also provided for integration on the market side, particularly with resellers, which represented intermediaries with the end customers (Figure 3).

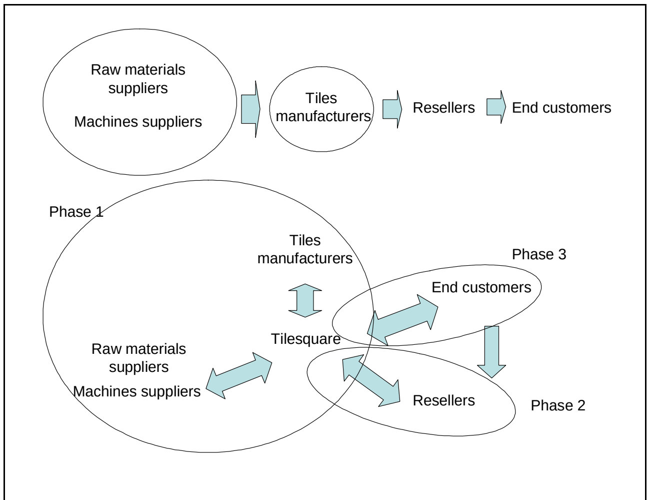

Figure 3: TileSquare business Model

The original project for developing a transactional e-marketplace was not as successful as expected. The end of the Internet boom, the characteristics of the ceramic industry, and preexisting relationships all hampered the development of this e-marketplace.

However, despite minimal interest from large manufacturers, some services offered by the portal attracted the interest of small- and medium-sized manufacturers and many resellers. The availability of industry-specific information, such as updates on regulatory norms, sector-specific fairs, and product or process innovations introduced by the main market leaders, as well as the possibility of enjoying a virtual shop window, were well-appreciated features.

The turning point that allowed TileSquare to increase the number of participants was its offer of a software platform, called Room 3D, that promised to facilitate interior graphic design and 3D rendering of interior design projects. The Room 3D project, written in Java, attempted to optimize user friendliness. No specific skills were needed to use the software, and all the functions were intuitive and very easy to use. Thus, the application was very attractive to small- and medium-sized resellers; from manufacturers' viewpoint, it also offered a valid communication and marketing tool to be used to attract end customers.

The choice of a Web-based technology and the Java platform resulted from the desire to develop a native solution for the Internet environment. The application does not require any specific hardware or software solution. Small resellers can get access to a CAD-like application without large investments in CAD software or the hardware configurations required to use such packages. Moreover, no specific investment in training for the use of the systems is needed.

Room 3D immediately proved to be an effective tool in the hands of those in charge of sales in resellers' showrooms. The main objective of TileSquare therefore has become the implementation and development of advanced software solutions for 3D design and visualization of small environments that can serve a network of resellers and other professionals, such as small architects and designer studios. The Room 3D software consists of an interior design tool, with advanced 3D rendering capabilities, but remains clearly differentiated from competitors' software by its user friendliness, ease of learning the main functions, independence in its technological platform, ergonomic use, and fast project execution. Originally created as a support tool for the business activities of ceramic manufacturers, TileSquare has evolved into a platform for providing services to the whole chain. This shift in focus resulted from the resistance of manufacturers to undertake e-business policies that would allow their information, such as catalogs, price lists, and technical characteristics of products, to reside on sites they did not control directly. Such resistance induced TileSquare's experts to look elsewhere for interested parties, such as resellers that would recognize the services offered by the portal as useful support to their business, mainly through the 3D design/visualization program.

The TileSquare architecture requires that ceramic manufacturers make data about to their products available to a database on a TileSquare server (Figure 4). Manufacturers may select the method for publishing these data, either

- Public, such that any reseller, manufacturer, or architect that logs on to the platform can view the data, or
- Private, such that the manufacturer may define the viewing policies for the data and identify which actors (e.g., resellers, architects) are allowed to access the information. This regulation depends on the contracts in force between manufacturers and the sales network in the relevant territory.

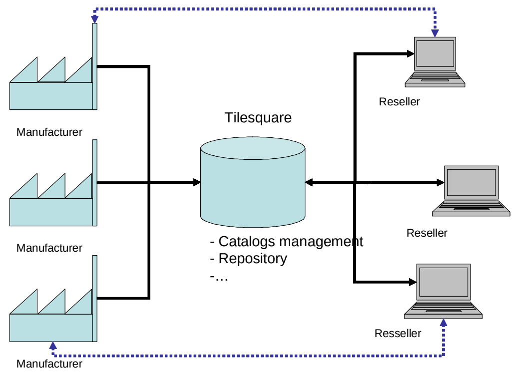

Figure 4: The role of TileSquare as an Intermediary Between Manufacturers and Resellers

Reading the two cases together: Analysis of unexpected issues

Drawing on the results of the case studies, we consider the potential role played by the socio-technical dimension of path dependency in the configuration of the market for 3D rendering software in the tile industry. The concept of path dependence, when confined solely to the analysis of the technological interdependences, appears incapable of explaining the complex set of variables that constrain the development of the market potential for technological adoptions and the configuration of software markets. To be able to grasp this complexity, we need to better analyze the context, and the socio-technical relationships, to identify the key characteristics of the socio-technical regime that affects the market structure.

If we look at our case, it would be difficult from a technical viewpoint, to explain why the two competitors, Maticad and TileSquare, do not compete to gain shares of the others' market. Maticad could develop a new Java version of its system and compete with TileSquare in its market; TileSquare could develop a CAD add-on to compete with Maticad. Alternatively, both might move toward advanced Web-based development and offer different versions that would satisfy the requirements and functionalities needed by both professional and basic users of 3D rendering applications. Considering just the technological installed base and the role played by standards and versioning in traditional software markets (Shapiro et al. 1998), this latter solution seems the most obvious plausible given the existing technologies in the industry.

Yet our findings do not support this scenario. Instead, what emerges, from both the interviews and our analysis of existing documentation, is a market with two companies that do not compete for shares. Manufacturers, which are Maticad's main clients, do not perceive TileSquare as a substitute for Maticad but instead as a provider of an additional product that enables them to gain access to a different market. According to Maticad's sales manager, "Our client remains the manufacturing tile company. We certainly try to reach the resellers, but for historical reasons, we continue to develop our software services, cooperating with the main multinational company in the industry"

Maticad needs a CAD application to run, which traditionally would be described as an installed base for the application, on which the market relies. In this case, this description is only partially true. The CAD-installed base and its technical characteristics originally played a very important role for the diffusion of Maticad, but the key element for this application's success appears to have been its ability to satisfy the needs and requirements of very sophisticated designers who were looking for an advanced 3D rendering application that would enable them to design complex projects and determine the right specifications for the manufacturers that were to produce the material they required. This function remains the main enabler of the market for Maticad 3D rendering software: it provides advanced functionalities to advanced users who seek precise and detailed design functions, as well as complex and accurate definitions of the particulars.

As the Maticad CEO notes, "Our relationships with the R&D departments, engineers, architects, and designers of the main international companies of the tile industry remain one of our value-adding characteristics. We cannot provide new and better releases without cooperating with our clients who became, in these years, our partners in developing new solutions. We must provide more and more realistic rendering software, and this becomes impossible without a strong collaboration with those who produce the tiles we have to manage."

Maticad therefore matches the technology, knowledge, user practices, norms, and regulation which define the socio-technical regime of its client.

In contrast, TileSquare has achieved success by relying on a Java open platform. Smaller resellers do not need advanced computer systems, the computer is normally used for basic accountancy and management of internal stock, or sophisticated design software knowledge. In most cases, these resellers only have one computer connected to the Internet. Thus, according to a reseller that has adopted Room 3D, "our sale attendants are better able to use pencils and sheets than a mouse and keyboard. If you want them to use a PC you must provide a software [that is] quick and smart, like a videogame."

Small and medium retailers' customers receive advice in the form of handmade sketches which are also used to estimate the amount of material needed and the expected cost of the project. After the customer approves a project, the most complex task for the retailers becomes the tile laying plan, which must be very accurate because it becomes the master plan to be followed when the installer lays the tiles at the customer's site. Any error in the master plan creates serious problems, especially when customers choose complex decorative patterns. Poor technical skills and the high costs of 3D rendering software historically have prevented small and medium tile resellers from migrating to more reliable and precise software solutions, such as the one offered by Maticad. TileSquare therefore could enter the market because it met the clear needs of users, their skills, and the technological platform they normally used. The Room 3D solution, according to a TileSquare product manager, "is viewed as a fast, plug and play application for the showroom. The sales attendant has to quickly move in the catalogue and provide different choices to the client in order to reduce his 'decision time.' The client must go out from the reseller's showroom not with a project but with his solution. Otherwise he can be easily captured by another reseller."

Users sought a simple marketing tool to help their customers decide on the best solution for their purchase, as well as a user-friendly rendering software that would enable them to sketch the details of the tile laying plan. They did not need a software solution as advanced or accurate as the one used by architects and designers involved in huge projects, which demand ad hoc tile production or very unusual decorative patterns that require more detailed study before the project can be finalized. Smaller retailers instead need a simple solution to define the amount of material they should order and to improve on the quality of their paper-and-pencil sketches that they previously would give to the tile layers. These smaller retailers do not have the economic resources and skills to invest in software such as Maticad's, nor do they need the level of detail offered by this software or have the skills to use it. Therefore, they do not even consider Maticad an option; it instead satisfies a different socio-technical regime. It is a product that do not satisfies any of their requirement, Only large retailers that engage in complex architectural projects consider Maticad a solution. To use Maticad, they often have to hire someone with enough CAD knowledge to operate the system. This investment can be justified only if these resellers work with customers or projects that demand the level of detail provided by a CAD solution. Not all the actors in this industry work with such a projects and are therefore interested in software solutions that require extra investments in personnel as it is not financial viable for them.

Another reason Maticad may be less appealing for many resellers is its long-term relationship with the production side of the tile industry. That is, "We preferred Room 3D rather than the Iris one," one of the resellers interviewed noted, though Iris is actually one of the leading companies in the tile market that developed many features of D3D, which often is perceived incorrectly as the owner of the software.

According to our interviews, actors in the tile market seem to adopt one or the other solution mostly for knowledge, user practices, social, and political reasons rather than only for technological aspects. The two platforms have become quite similar in terms of the services they provide to resellers. Their complexity thus is not related to their technological origin but rather to the socio-technical regimes in which they get used. Accordingly, the two software providers survive in two different markets, created in response to socio-technical trajectories rather than economic rules. Table 2 summarizes some main differences between Maticad and TileSquare and helps clarify how they have segmented the markets.

Table 2: Maticad and TileSquare at once

	Maticad	TileSquare
Origin	IBM initiative to provide specific manufacturers in the ceramic industry with a CAD solution	An add-on to an electronic marketplace
Longevity	Created in early 1990s, from a consolidated experience in the software market for the design of kitchens and furniture (CAD environment)	Started in 2001 in response to enthusiasm for the new economy. A classic ".com," based on a Java environment
Business goal	To provide advanced 3D rendering software to specialized users	To provide basic 3D rendering software to generic users
Customers	Tile producers, large resellers, designers, and architects involved in complex projects	Tile producers, resellers, and architects involved in simple projects
Market approach	To sell licenses and services to manufacturers and their resellers	To provide services to the chain
Reference technology	CAD, a proprietary environment that imposes restrictions on users and technological compliance	Java, an "open" environment that imposes no restrictions because it is "platform independent" and easy to use
Previous knowledge needed	Architects and designers with expertise in CAD design	Sales reps of showrooms of ceramic resellers, no specific technical knowledge required
Data management	Data remain in the infrastructures of manufacturers	Data reside in the technological platform of TileSquare

Discussion

Maticad and TileSquare both succeed because they are compliant with their markets' technological installed base (Hanseth 1996; Hanseth 2000) and fulfill the needs and expectations of their users by harmonizing with users' routines and practices. The data collected for our case study reveal that the two companies have followed different strategies, justified by the contingent characteristics of the markets in which they operate. As Table 2 shows, Maticad has built its market by relying on a CAD technological platform, and by supporting the knowledge, practices and thereof the socio-technical regime defined by professional advanced design specialists. The application has attempted to ameliorate existing design tools used by professionals in the field by responding to the needs of their socio-technical regime (Smith 2007; von Hippel 1988).

TileSquare built its market by exploiting the socio-technical regime defined by the combination of the open Java platform, and the lack of preexisting knowledge in the use of CAD software among its customers. The application thus may represent an attempted amelioration of the existing design tools (paper-and-pencil sketches) used by professionals in the field and an answer to the further needs of these users.

The ways these two companies have created their market shows that both have successfully exploited the linkages and interdependences with other technological artifacts and infrastructures, which implies that they are technologically situated. This point may seem obvious (Shapiro et al. 1998), but it is not sufficient to explain why the two companies do not compete and threaten each other's markets. We argue here that is the larger socio-technical regime (Rip 1995) which determines the characteristics of technological products (Bijker et al. 1992; Star et al. 1999) and therefore defines their markets.

Even if their technological situatedness does not indicate a clear separation for their future development, they both can decide to migrate to platforms that are compatible with the competitor's application; however, they are not considering this opportunity because the segmentation of their markets is not strictly dictated by their technological situation but rather by their socio-technical situatedness (i.e., knowledge and needs of their users). Socio-technical path dependency is created in the two markets so that the market segmentation is reinforced within the use of the applications. Tilequare users organize their work practices around the functionalities of the system. They have changed the approach to marketing, sales, project sketching, and last but not list tails lay master-plan specification. This has let them to use less specialized tails layer specialist as the plan is now simple to be followed even in complex projects. It has therefore become extremely difficult for them to change the product because it is deeply embedded in the daily practices within which their work is organized around. Maticad users, similarly, relay upon the system to produce their projects, to help the design of the special tiles they want for the unique designed projects, and, for the producers, the systems remains the main marketing tools to maintain and possibly enlarge their existing reselling network. As for Tilesquare, large part of the daily routines, practices, and commercial relationships of the users have been developed around this architecture so that it is now strongly socio-technically embedded making very difficult to move toward a different product.

Therefore, we might conclude that real competition between the two companies, and thus a new configuration for their markets, would happen only if the socio-technical regimes which define their markets will change. Socio-technical regimes are however difficult to be changed because of their imbrication in daily practices and relations. In our case, these changes appear difficult to be predicted as they would require a complete reconfiguration of the industry, market shares of resellers, design practices, marketing strategies, and technological knowledge of the various actors involved

The cases we have discussed exemplify how the socio-technical regime not only shapes the development path for technological artifacts (Akrich 1992; Bijker et al. 1992) but also segments the market for products, reducing competition among products that share the same socio-technical regime (Smith 2007).

We offer empirical evidence of this conclusion; that is, Maticad and TileSquare do not compete because they rely on different socio-technical regimes.

Conclusions

Building on the notion of socio-technical regimes, we note some factors that influence the market structure for software products in the tile industry. Traditional explanations, based solely on the notion of path dependency, are insufficient to explain why two similar software products, used in the same market, do not compete. We instead conclude that socio-technical factors help define the market boundaries for software products. Standards, technological path dependences, and installed bases represent important elements for defining the market configuration of software products, though they are not enough to explain fully why software products that seem so similar coexist in the same market. Our empirical findings further show that users' competences, skills, and needs offer important factors for segmenting the 3D rendering software market in the tile industry. We therefore propose the ongoing use of the notion of socio-technical regimes to explain the social and technical dimensions that shape the market structure for these products.

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