

Applications of the REST Framework to Test Technology Activation in Different ICT Domains

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Abstract: As innovations based on technology multiply, research on technology diffusion evolves both downstream – i.e. covering adoption and use – and upstream – i.e. focusing on the antecedents of diffusion. In the latter domain, the study from Ghezzi et al. (2013) proposed to revisit traditional technology diffusion theory to include the concept of “technology activation”, which investigates the external determinants influencing the introduction of technology-based innovations. Such determinants are included in the Regulation, Environment, Strategy, Technology (REST) framework. This study aims at proposing an application of the REST framework to the Mobile Video Calls and the MiniDisc industries. This application is meant to further validate the framework and test the validity of the concept of technology activation in different ICT domains.

1 INTRODUCTION

Technology diffusion as a process is inherently multifaceted, and develops both horizontally along time, and vertically along a number of diffusion determinants affecting each of its steps (Abernathy and Utterback, 1978; Antoniou and Ansoff, 2004).

While several studies (e.g. see Lanzolla and Suarez, 2007) have focused on the analysis and investigation of what occurs after technology is adopted, discussing the determinants of technology use, a literature gap is found with reference to what comes before diffusion. Indeed, few studies have focused on the preliminary determinants leading technology-based innovations' uptake (Loch and Huberman, 1999).

The seminal work from Moore (1991) goes in this direction, by modifying the traditional technology adoption lifecycle to underscore a “stage and gate” approach in the process of technology diffusion: “crossing the chasm” from early adopter to mass market requires a number of determinants to be positively met. Recently, the work from Ghezzi et al. (2013) puts forward the proposal that the traditional technology diffusion theory should be revisited, to explicitly include the concept of “technology activation”, which investigates the external, non-user determinants influencing the

introduction of technology-based innovations. Such determinants are included in the Regulation, Environment, Strategy, Technology (REST) framework (Ghezzi et al. 2013), which is proposed as a theoretical tool to integrate the benefits from both diffusion theory and strategy analysis model (Okazaki, 2005), and which is later applied to the Mobile Location Based Services market to assess the market's activation status.

This study hence aims at proposing an application of the REST framework to the Mobile Video Calls and the MiniDisc industries. This application is meant to further validate the framework and test the validity of the concept of technology activation in different ICT domains.

2 THE REGULATION-ENVIRONMENT-STRATEGY-TECHNOLOGY (REST) MODEL

The REST model proposed in Ghezzi et al. (2013a) assumes that market activation and technology activation are influenced by four macro-determinants: *Regulation*, *Environment*, *Strategy*, and *Technology* (Figure 1).

In the following paragraphs the four building blocks of the R-E-S-T Model and their set of constitutive core determinants are described.

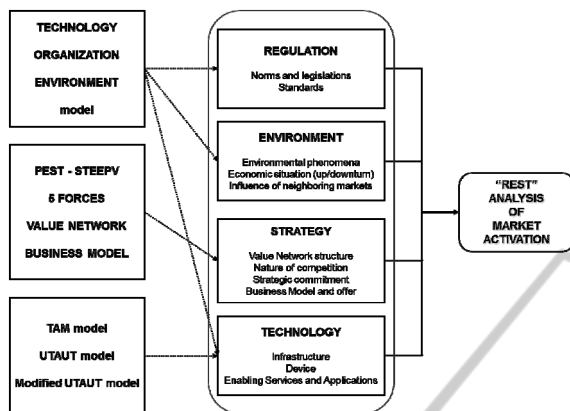


Figure 1: The Regulation-Environment-Strategy-Technology conceptual model.

2.1 Regulations

The Regulation macro-determinant deals with the overarching framework of laws, policies, recommendations, licenses (R1) and standards (R2) (Farrell and Saloner, 1985; West, 2004) governing the evolution of technology on an industry or geographical basis. It affects the sphere of influence and strategic choices regarding technologies made by players both on the supply side, – i.e. firms supplying the new technology – and the demand side – i.e. consumer or business adopters of the new technology.

2.2 Environment

The Environment macro-determinant consists of the external, largely exogenous social, political, economic and financial environment influencing the new technology's native business area. It includes the following determinants.

Environmental phenomena (E1): the exogenous phenomena and trends that impact market conditions – e.g. the convergence of the IT, Telecommunications and Media industries (Peppard and Rylander, 2006). This factor can influence the market structure, the players involved, and the “technology pool” of products, services and solutions that can be bundled, transformed or developed to bring about a technology innovation.

Economic situation (E2): the overall economic climate related to the new technology market. It affects suppliers' ability and intention to innovate and launch a new technology, influencing cash flow,

R&D spending, advertising spending, etc., as well as affecting users' purchasing resources.

Influence of neighbouring markets (E3): the impact of neighbouring – complementary or substitutive – market trends on the new technology's market. A business area is influenced and cross-fertilized by the conditions that characterise related markets, which in turn can affect technology activation status.

2.3 Strategy

Based on the widely-held assumption that strategy design is intimately related to technology and technological innovation (Brandenburger and Nalebeuf, 1996), the Strategy macro-determinant implies the Strategic landscape and structure that characterise the market in which the technology-based innovation is offered, and the Strategic choices made by providers of the new technology's products or services. It is further divided into four determinants.

Value Network structure (S1): the structure of the industry, assessed in terms of a set of “static” variables (i.e. network focal firm; critical network influences; structural equivalence; structural holes; revenue streams) and “dynamic” phenomena (lock-in and lock-out effects; and learning races) (Gulati et al., 2000; Dell'Era et al., 2013). It affects the way value-creating activities related to technology activation are allocated to different providers, responsible for organising and linking them in an efficient and effective configuration.

Nature of competition (S2): the technology innovation providers' strategic attitude towards other parties operating in the business area, which ranges from aggressive contrast (Porter, 1980) to a hybrid interaction process combining competition and cooperation – or “co-opetition” (Shapiro and Varian, 1999). It influences the overall approach towards technology innovation, whether it is consortium-led or single entity-driven, and whether it enables or inhibits technology activation.

Strategic Commitment (S3): the interest of incumbent or challenger technology innovation providers towards investing in the new technology's development and building a market – i.e. whether or not innovation is perceived as a strategic priority. It is a supply-side determinant that affects the pace of technology evolution and commercialization.

Business Model and offer (S4): the way the business configured around the new technology is organised to create value for customers, and to capture a share of such value, in terms of: the

efficiency and appeal of the technology and its related services, and both direct and indirect associated costs (Timmers, 1998; Teece, 2010; Ghezzi, 2013). It is a further supply-side activation determinant that in turn affects several modifiers of technology diffusion as identified by TAM-derived models (e.g. new technology's price/performance ratio, user and firm expected benefits, and user experience).

2.4 Technology

The Technology macro-determinant addresses the technology landscape in which the innovative technology is embedded and derived, consisting of the past and present technological choices made by the players involved, and represented in the following determinants.

Infrastructure (T1): the underlying enabling technology infrastructure – e.g. traffic networks in ICTs, Energy or Transport industries – and its core functionalities and characteristics – e.g. capacity or bandwidth, availability, reliability, localization (Ghezzi *et al.*, 2010).

Device (T2): the tools and instruments employed by individual or business users to exploit the new technology, and their key features – e.g. cost, compatibility, interoperability, performance, user experience.

Enabling services and applications (T3): the constellation of systems, services and applications – e.g. creation, integration and publishing tools, management and delivery platforms, storage systems – built on the infrastructure and enabling the new technology's stages of development, translation into a set of services, and commercialization.

3 EMPIRICAL ASSESSMENT

The empirical assessment method chosen for this study is historical analysis, i.e. the process of assembling, critically examining, and summarizing the records of the past (Gottschalk, 1969). Information gathered from published sources about the commercialization of the technological innovations related to Mobile Video Calls was analyzed and employed to test the importance of a technology activation and market activation analysis through the REST model.

In the first years of the 21st century, Mobile Network Operators were looking for new revenue generating value added services to make up for market saturation and shrinking margins. Mobile

video calls soon became a paramount innovative service among those tentatively launched by Operators: some players, like H3G Italy, even made this the core of their offer and market penetration strategy. However, as the customer base and revenues never took off, it became apparent that such service and the related innovation had inherent criticalities. Such criticalities could not have been spotted by traditional models on technology adoption, as they did not only refer to user characteristics: they largely depended on the supply-side surrounding ecosystem.

At the strategic level, the mobile value network was neither structured nor ready to support the service, since the key players (e.g. device manufacturers and content providers) lacked the necessary commitment, as Operators provided them with no incentive to craft a surrounding offer that could have boosted the service demand; in addition to this, the business model and revenue model built around the service was too expensive or simply unappealing. At the same time, technology determinants were not activated: the network infrastructure would have needed an expansion to support the increased data traffic, but no player was willing to overinvest in an innovation whose uptake was far from being certain; the share of customers owning a smartphone was too little at that time, and even such devices of devices enabling video calls had neither the characteristics nor the performance to ensure a satisfactory customer experience. In addition, no complementary application or service were bundled to video-calls.

This report clearly shows that the market for video calls was not activated when Operators first launched their services: a lack of technology activation hence determined the resounding market failure they experienced.

A technology activation analysis employing the REST model would have probably highlighted the supply-side hurdles and pitfalls, thus sparing Operators expensive investments.

Similar considerations and conclusions could be drawn for other failed innovation such as MiniDisc format, where a lack of market activation at multiple sides covered by and unified in the REST model (including: strategic agreements; value network; business model; network of complementary technology and products; ancillary services and applications) prevented the rise of this potentially interesting technology. At the strategic level, in fact, there was no strategic agreement between two of the main competitors (Sony and Philips). While Sony introduced the MiniDisc technology, Philips focused

on the digital compact cassette. Such choice created marketing confusion. Moreover, MiniDisc had to face the competition from substitutive products. Initially when recordable compact disc (CD-R) became more affordable to consumers, but later the biggest competition for MiniDisc came from the emergence of MP3 players.

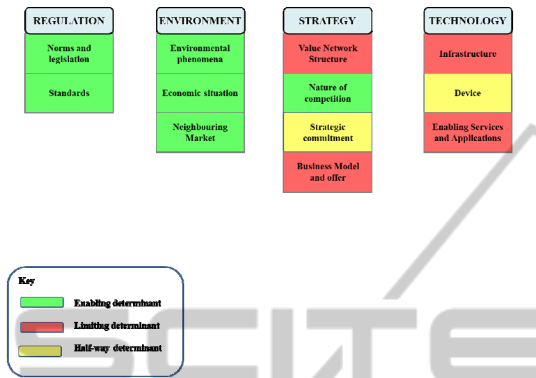


Figure 2: Application of the REST framework to the Mobile Video Calls industry.

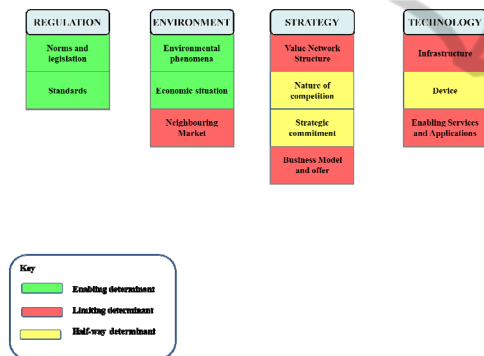


Figure 3: Application of the REST framework to the Minidisc industry.

Table 1 summarizes the distribution of determinants. As can be easily seen, more than a half of determinants in both industries caused a lack of market activation.

Table 1: The distribution of determinants in the two industries.

	Enabling	Half-way	Limiting
Mobile Video Calls	5	2	4
Minidisc	4	3	4

4 CONCLUSIONS

Innovation diffusion theory may significantly benefit from an extension which explicitly considers uphill determinants acting as a prerequisite or trigger of adoption. Indeed, this extension would underscore the inherent relationship existing between the technological domain and the strategic, regulatory and environmental ecosystems, where the latter may severely influence the former's performance. Research on technology diffusion should hence be more tightly connected to that on strategy: in turn, this would create mutual opportunities for both literature streams.

In parallel, revisiting the technology diffusion process to include the activation phase has insightful implications for entrepreneurs or managers dealing with technology-based innovations.

Managers could employ the REST framework to assess a number of issues possibly affecting the successful launch of their innovation, ranging from regulation, to external environment, external and internal strategy analysis, and technological infrastructure and applications. Thanks to the analysis of resounding market failures like that of Mobile Video Calls and the MiniDisc format, this study shows how a detailed analysis of those market's activation status would have spared significant amounts of resources to the companies involved. Their poorly planned and short-sighted eagerness to rush towards a fascinating innovation led several managers and their companies to commercial disasters.

This study's contribution is to provide further evidence of the REST framework's validity in additional ICT industries, thus confirming the REST framework's descriptive and normative power.

The study's limitations mostly lead back to the methodological approach taken to perform the empirical analysis, where historical analysis might show shortcomings in both the recollection and in the gathering and interpretation of past events.

Future research opportunities lies in the validation of the framework under scrutiny with quantitative methodologies, by means of a proper operationalization of each of its constituting variables.

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