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MASTER OF SCIENCE IN ENGINEERING AND MANAGEMENT

MASTER's DEGREE THESIS

# A STUDY OF R&D IN MEDIA: A QUALITATIVE CASE STUDY OF BBC R&D AND CRITS


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Education has planted eternal seeds in my heart and mind, I dedicate this thesis to every teacher and professor, who have helped me reach this path; To my first teacher who taught me how to use a pen; to my internship supervisor, Sabino Metta; and to my academic supervisor Marco Cantamessa. I would also like to thank my family and friends, I would have never been able to reach this point in my life if it was not for your support and care.

**“Open books, Open minds”**

…

# ABSTRACT

*R&D was once done in extensive research laboratories, under the hands of brilliant scientists and engineers. Not anymore. The costs of creating and developing technologies have risen, while profits have declined and innovation life-cycle are shortened. Media companies are now innovating in technology clusters with a joint-effort from lead users. This thesis provides a brief synopsis on the impact of convergence to market scenarios and innovation conditions. It finds that, as media converges, R&D in media will remain important, but must adapt to networked-based innovations. Further on, the thesis empirically studies BBC's R&D and CRITS (Rai) activity and analyses their respective managerial, operational and organisational practices before and after convergence. The case study finds that BBC R&D transitioned its innovation approach towards open innovation, while CRITS is locked in its own competencies due to strong path dependency. The last chapter of the thesis uses design thinking methodology to innovate the current business model of CRITs and sets a competency roadmap for its transition.*

*Keywords: Media Convergence, Innovation, Business Model, Design Thinking, R&D, BBC, RAI*

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# PREFACE

The area of topic of this thesis originally stems from my combined passion for media and management. As the world moves further into the digital age, it was of my interest to understand how the management of innovation has changed within the context of media firms. The final-outcome is a fruit of hard-work and many long nights, and I am very content of the results. This thesis was done during my internship in Rai in Turin, Italy. However, it is also an expansion of my previous developed mini-thesis on the topic of "Design Thinking", in the school of information systems, Queensland University of Technology, Brisbane, Australia. The mini-thesis was well integrated within the context of Chapter 6. Thus, I also express by grief gratitude to my academic supervisor at QUT, Dr. Syed Rehan Abbas Zaidi, for his continuous support and great assistance.

# CHAPTER 1

## INTRODUCTION

Research and development owes its developments to the 20th century, originally deriving from industrial labs. Traditional R&D assumes a linear model of conducting innovation. Its goal is to improve current technologies or create new ones for future implementation. In general, R&D is organised around basic research, applied research and projects and product development. Corporate R&D works in a very similar way, where specialists collaborate among themselves or on industry level on a task-by-task basis to achieve a pre-defined goal under predefined timeframe. Regardless of the type of industry, most work of R&D is predominantly applied on technology research.

Schumpeter's (1934) defined innovation as a novel combination of production actors with their economic exploitation. The characteristic of "Novelty" is an essential condition of innovation. Furthermore, it is important to understand innovation from a perspective beyond of organisational boundaries but rather as a collective scenario of different actors.

According to the evolutionary theory of the firm, Companies tend to self-evolve in reply to their industry surrounding (Nelson & Winter, 1982). Media firms, like any other firm, are also dynamically changing in a response of discontinuous revolutions followed by new market scenarios. Speaking of not a long time ago, the last big revolution in media is the internet. It has not only shaken up media industry, but also newspaper and music. The last big revolution that happened before the internet revolution, was almost 100 years ago when the world transitioned from radio to broadcasting. Today, there is not a single person on the planet that can imagine the world without TV, nor radio and newspaper (at least digital newspaper).

For a long period of time, the newspaper was an important platform for mass media. The public relied on it to know the latest news in current events. Centuries later, in the 1890s, the radio was invented. The radio would soon replace the newspaper and become the new appropriate source for mass media. Families would gather around the radio and listen to their favourite radio programs, or hear the latest news regarding politics, global issue, and entertainment. After around 20 years of the introduction of radio, Technological Innovation in media started by the early 1920s. Innovation became been part of the DNA of Media Industry. Later, when the television was invented. It immediately set aside the radio and became the most prominent platform for public reach. With Television, the demand of technological innovation was strengthened more, and R&D became of significant necessary for Broadcast Technology innovation. R&D first role in media was to test new technologies on transmission and delivery technologies.

Today, the internet is the most relevant form of mass media. Since the evolution of the internet, the public is now able to access news s in an instant, instead of having to wait for scheduled programs on Broadcast television. In the beginning of 90s, Internet pushed media industry towards digitalisation, disrupting an entire market environment. 30 years has passed since the beginning of the digital era and now is the right time to have a moment of reflection after the dust has settled down. All media have got used to this change and to the fact there are new things coming out. Now, every media company's objective is aiming to become a fully digital one soon; if not, then the company really has no clear understanding of the near future. This is a correct time to reflect on R&D activity in media and predict where its heading to.

It is unlikely though, that the current market environment will face again any disruptive change in at least the next 10 years. But, it is very much likely that new small media firms and tech companies will continue to emerge soon. This is not of any strange since the media industry has currently entered the post-disruption phase. For example, all the

big television companies, including BBC and RAI were created during the post-disruptive phase of broadcast revolution. Similarly, after the internet revolution, so many new media companies have emerged to compete against the same television companies that erased previous radio channels and newspaper. In case it hasn't been clear yet, Netflix, Amazon, Facebook, Twitter and YouTube are also considered as the new media companies.

History have taught us there is no such thing as a static market. RAI and BBC were established as publicly owned **monopolies** in the 1920s and 1930s and existed as such for the next half century, very often in their own isolated habitats, with their own managerial thinking, innovation approaches and operational. during the last two decades of the 20th century, the media market was **opened to commercial competition** and the hitherto monopolies were faced with new competition against private media companies. Since the market was subject to new entrants, public broadcasters rapidly lost part of their market share. This was gradually followed up with successfully-adjusted policies, and new schedules and programme formats to meet the new scene of market competition. Regarding R&D, the technology basis necessary to innovate remained to be broadly stable since the days of monopoly.

However, in the beginning of the 21st century, with the **introduction of external revolutionary technologies**, BBC and RAI were forced to do a major rethinking of their *managerial, organisational, and operational practices*. Media innovation has become intertwined with other market industries such as Information Technology and Telecommunications. Media firms became involuntary dependent to external developments. The barriers between content creation and technology have broken down and the two fields have started to merge. The technical staff and engineers in R&D who were once a support function are now pushed to be at the heart of creative processes. R&D is moving from a world of long-term innovation that was primarily located in research labs and academia, to a converged open innovation source that is

vastly distributed among networks of “lead-users”. Content and Creative capabilities are fast becoming as strategically significant as technological capabilities. Furthermore, cross-border competition and low barriers of entry has significantly declined profit margins of media firms, making R&D for the first time since its day’s establishment in a negative criticism due to its extremely costly investments and uncertain positive outcomes. The internet revolution has amalgamated the role of R&D in media- a new transition that R&D managers need to recognise if they wish to keep their jobs safe.

# CHAPTER 2

## RESEARCH METHODOLOGY

### Motivation

The study of R&D activity in media is still an undiscovered topic in research and literature. Besides few articles and publications in corporate reports, there is no evidence of any previous research on R&D activity in the context of media industry. Even so, there is also a clear gap of empirical case studies and media research work. There is a need of research that covers real-existing media firms and tackle their concerns and dilemmas. Tangibly, this means that more of media research needs to be out in the field, investigating on case studies and coming with fruitful insights. Better late than never, this thesis comes at an opportune time to contribute in filling in this gap.

This thesis should be of importance to at least two viewpoints: “academic” & “corporate management”. From an academic aspect, the thesis anthropologically dissects media from the lens of innovation management and not from the general social and artistic aspect. Thus, business case-studies could also be taught from outside the context-norm of financial corporations and multinational manufacturing/tech firms and include public-service-media firms. Secondly, this thesis is an opportunity for managerial decision-makers to understand the new scene of innovation in media and foster actions on R&D management and innovation policies.

### Objectives

This research paper has one core objective to be reached; to study how R&D activity

has adapted with the digital revolution and media convergence.

To ensure a concise and planned research, the following sub-objectives were defined:

1. To study the media market scenario after disruption,
2. To highlight what new conditions were created for R&D,

Once there is a theoretical understanding of innovation in media, the next objective is study on-ground practices of media innovation, Thus, the case study has three clear objectives:

3. To understand how CRITS and BBC R&D are doing innovation,
4. Analyse their R&D strategy in correspondence to their corporate strategy,
5. Compare CRITS and BBC's R&D practices with what theoretical findings say firms should do,
6. In case of unparalleled practices, try to innovate a new business model for the firms that's need it.

### Research Questions

The entire thesis is structured around one core theoretical hypothesis:

*"After media digitalisation, Research and Development, in a way or another, remains useful for and is applied in Media Companies."*

*- If no, has technological 9path-dependency strained Media R&D into a competency trap?*

To answer the above objectives, four main research questions are defined:

1. *What are the new trends in media innovation?*
2. *How is R&D currently being practiced?*
3. *What is the new role of R&D in media?*
4. *How R&D can continue to generate value to media firms?*

## Research Methodology

To execute the research in a structured and methodical manner, the case study was organised according to the research methodology of Dul & Hak (2008).
The research is a multi-phased process divided as the following:

1) Starting point is defining the problems;
2) Translation of problems to defined objectives;
3) data collection;
4) Interpretation and visualisation of data;
5) Analysis and comparison of findings;
6) Conclusion drawing and recommendations formulation based on the results found.

The theoretical part of the thesis is based on a methodical search strategy. Specific keywords were decided prior to research on to help formulate the knowledge base. The chosen keywords were: Media, Convergence, R&D, Innovation, Open Innovation, BBC, Rai. Once the key word was defined, a selection of databases was chosen to strengthen on the quality of extracted literature. The domain of interest was distributed among three disciplinary areas: Media journals, Management and Economics journals, Innovation journals. It was also decided to include articles, journal papers, and book chapters. Google scholar and QUT Library search engine were chosen as the main source of research. Scholarly databases were also selected such as ELSEVIER, Taylor Francis Group, Science Direct, EBU Publications, etc.

# CHAPTER 3

## THEORETICAL FINDINGS & KEY CONCEPTS

### What is Innovation

Although Leonardo da Vinci invented and made drawings of the helicopter in the 1400s, it was not until almost 500 years later that helicopters flew with people inside. Just by reflecting on this, multiple definitions of innovation could be interpreted. Innovation is usually viewed as a synonym of invention or an outcome of the activity called technology. In innovation management literature, Technology is a subset of the broader construct of innovation (Mierzjewska & Georgia, 2006) and innovation is defined as the "economic exploitation of an invention" (Roberts, 1987). The study of innovation as an economic phenomenon goes back to Joseph Schumpeter (1883-1993) who is considered the founder of economics of innovation. Schumpeter defines innovation as a "*gale of creative destruction*" that impacts past economic entities and establish new ones (Schumpeter, 1942).

### Key Drivers of Innovation

One of the main contributions by Schumpeter (in the theory of economic development, 1911) lies in the study of *actors driving innovation*, Schumpeter identifies two main contributors "Innovators-entrepreneurs" and "Large firms".

Since innovation is generally funded by equity (Cantamessa & Montagna, 2016). Large firms were mostly responsible for the act of innovating, however only the cost of innovation so is lower than the added value that can be expect to be appropriated (Schumpeter, 1942). Due to their large labour and capital, large firms could invest in internal departments with the only duty is to innovate. In the mid-twentieth century,

the term “research and development” entered the vocabulary of innovation, and R&D was respectively monopolised by large firms since they have the financial capabilities to invest in se. The role of R&D was to create new technologies and create new market opportunities that can increase in revenues streams (Cave & Frinking, 2007).

### Types of Innovation

According to Merriam-Webster Dictionary, Innovation is “the act or process of introducing new ideas, devices, or methods”. The term “*new*” brings up a further debate on what is the degree of novelty of something to be considered innovation. For instance, innovation is more than a new film or a TV program. It must have an additional impact, whether economically or socially, to be called an innovation. In the Schumpeterian tradition, innovation is classified in a dichotomy; *incremental versus disruptive innovation*. Incremental innovation refers to gradual improvements where innovations are builds on another. Disruptive innovation, on the other hand, radical innovations that changes the economy through creative destruction (Schumpeter 1942). Like every industry, Innovation in media is mainly incremental and done by large media firms, but almost every disruptive innovation in the media industry have always taken place outside the space of media industry itself. For example, internet graduated from ICT industries. This makes media firms, regardless of their size, involuntary dependent to external industries and hence unable to control their evolution.

### Traditional model of Innovation:

In Literature, researchers have focused largely on research and development (R&D) as the main source of firm-level innovations (Kline 1985; Nelson & Rosenberg 1993; Freeman 1994; Kleinknecht 1996; Love & Roper 1999; Hirsch-Kreinsen et al. 2005; Marsili & Salter 2006). In practice, R&D became the mainstream of innovation and competency development (Cantamessa & Montagna, 2016). R&D practice is traditionally carried out in a closed linear process that would start with “basic research,

followed with applied research, and finished up with development and commercial novelty" (Thompson, 1967).

Empirical literature identifies two basic advantages of traditional R&D activity: *to protect existing organisational competencies and routines*, and *to develop absorptive capacity within the firm itself*.

Resources working in the same firm often share a common code of communication and organisational routines for discussing tacit knowledge and developing new capabilities (Arrow, 1974; Nelson and Winter, 1982). Thus, organisational tacit knowledge can be better interpreted by internal resources working in the same organisational environment (Nelson, 1959; Cohen and Levinthal, 1990; Argyres, 1996, Nagarajan &; Cyert & March 1963; Nelson & Winter, 1982).

In the meantime, when innovation conditions changes, it often destroys organisational capabilities and creates new competencies that could be external to the firm itself (Christensen & Bower, 1996). Firm will have to adapt quickly its routines and possibly its pool of resources to regain a satisfactory level of performance (Cantamessa & Montagna, 2016). Otherwise, internal resources can be subject to organizational inertia and imprisoned to their own strength (Lee & Van den Steen, 2010). In the context of technology disruption, firms that continue to rely on closed innovation approach will tend to make small steps in innovation and eventually run in trouble. Many findings have emphasized the importance of accessing external knowledge and collaboration since post-disruption technologies cannot be deployed in the context of the company's capabilities (Rosenberg, 1982; Cohen & Levinthal, 1990; von Hippel, 1988; Chesbrough, 2003).

Nonetheless, if firms only outsource innovation without any internal contribution, firms are only able to get codified results of knowledge, and not the accumulated person-embodied skills (Narula, 2001). The notion of "absorptive capacity" introduced

by Cohen and Levinthal (1989) stresses the importance of a prior knowledge capacity to effectively absorb external spill-overs, consecutively it creates an incentive to invest in internal innovation (Mowery and Rosenberg, 1989; Veuglers, 1997).
Technology is easily copied and rapidly surpassed (Morris, 2009). Closed R&D secures appropriable patent protection, which results in positive economic benefits (Brockhoff,2003). However, one of the reasons attributed to the favour of non-internal R&D activity has been the decline in transaction costs for external relationships with relative to complete internalisation (Narula, 2001). Moreover, external R&D activity have the advantage of being a 'reversible' form of investment, and the risks of capital lost are substantially reduced (Gambardella & Torrisi, 1998).

### Media Industry:

In Europe, the media industry is composed around separate broadcasting markets aligned to major language communities. The European broadcasting market is traditional in the sense that it is catered through a duality: public media services-private media services. The Media Industry is a source of economic growth and jobs, contributing to around 4.5% of EU GDP (European commission, 2016), employing directly or indirectly more than 7 million Europeans, generating benefit to both local and European communities (Ernst & Young, 204).
Media industry, just like every industry, it changes over time as it evolves (Porter, 1980). In general, it is difficult to define industry borders (Hamel & Scholes, 1997). In fact, the Media Industry is: one industry with many sectors (Oliver & Lowe, 2018). The media industry is a conglomeration of different markets that have content creation as a common activity (Kung, 2017). The market opportunities of media comprehend broadcasting, print, film, entertainment, theme parks, gaming, and performing arts; all of those, make the media industry a delicious feast for new market entries.

### Media Market Scenarios after digitalisation

After the digitalisation of media; the traditional linear model of innovation has converged (Doyle, 2010); market share and value chain have fragmented (Zotto & Kranenburg, 2008); international boundaries have diminished and market competition has opened its door to firms from external industries (Storsul & Krumsvik, 2015). Consecutively, new tech giants have invaded the media industry, demolishing the traditional norms of innovation and shifting consumer behaviour towards their side (Mays & Ferrier, 2018). Moreover, creativity and content capabilities are becoming as strategically significant as technological skills (Osman & Gerzic, 2017). Digital content must be delivered on growing number of platforms, such as mobile phones and tablet devices, instead of one primary medium Furthermore, now, both public and private media companies operate in an increasingly open innovation scene where the new drivers of innovation include some of the world's biggest and best funded tech firms as well as small media start-up (Storsul & Krumsvik, 2015).
Three major market trends are essential to be distinguished and highlighted on for further understanding of market innovation and upcoming discussion.

*1. A major shift in consumer behaviour*

The reinvention of the public service media has become more urgent, the profound changes in the global media landscape are accelerating. Media technology continues to advance rapidly. Audience behaviour is changing in response to these drivers at an ever-faster rate, particularly among younger audiences. The uptake of new disruptive technologies has been particularly marked among younger audience's consumer behaviour. The pace of change among this age group is widely remarkable. Young audience spend most of their screen time on social media, they listen to music through streaming, and when it comes to news, the internet is their primary source. These ways of using media have being taken up at scale among older audiences too and not solely to younger generations. Once someone is a habitual over new services such as video-on-demand for example, the age of the consumer becomes less relevant in predicting

their behaviour with respect to habitual behaviour. The current challenge of public service media is to reinvent themselves for a new generation. The attention on young consumer behaviour shifts have increased both in importance and in urgency.

*2. Content is now being consumed anywhere, anytime and on any device*

The changes in consumer behaviour have been profound. So, too, has been the way content is generated on behalf of online services alongside traditional broadcast channels. Online video services like Netflix and Amazon Prime have grown rapidly. Changes in content delivery means content can be consumed anywhere, anytime on any device. More than half of us now watch TV or films while in bed, read the news while in bathroom, consume media while commuting. These are trends that would have been unheard of a decade ago. But the last ten years have seen a huge boom thanks to new devices which would allow us to consume content almost anywhere. Consumer have been provided with cheaper and faster broadband and data plans of content delivery, making it cheaper and easier for us to stream content.

*3. A fundamental change in the competitive market*

Ten years ago, when the App Store first launched, none of the five major tech giants (Facebook, Amazon, Apple, Netflix and Google) were among the top 30 most valuable companies in the world. Fast forward ten years later, that group of five has not only increased in value, but all are now ranked in the global top 10, and it is not a coincidence that each of these companies has significantly expanded their market opportunities to include media industry too.

These global tech giants have created new definitions of market scale, and as a result we have seen some of the biggest media mergers among private media giants too, looking to consolidate with the high spending power of the tech giants. Numerous

Merger & Acquisition transactions have redefined private media boundaries, triggering public service media like BBC and Rai and redrawing the national and worldwide competition context.

As Apple continues to shift its focus from hardware to services, it has recently revealed a revamped TV app and new subscription video-on-demand service, Apple TV+, set to invested in premium content. Apple will launch a subscription news and magazine service, News+, as well as Arcade, a new subscription gaming service in addition to its already existing Apple music and podcast service. Netflix dominates the global subscription video on demand market (SVoD), and has a stronger shifting focus from acquisitions to original content curation. Amazon continues to invest heavily in original TV content on Amazon Prime Video services. It has also begun to break the broadcast stranglehold on live Premier League coverage, by winning streaming-only rights package. Live streaming will be available too for all users who have an account on the social network. Facebook, alongside its existing services "News Feed" and "Instagram", has launched an ad-funded VoD platforms, Facebook Watch and IGTV. Meanwhile, Google continues to invest in YouTube, adding recently a subscription music offer and original long-form TV programmes.

NBCUniversal is now preparing to launch a global ad-funded VoD service through tis owned subsidiary Comcast, which will be available for free to Sky customers. Disney has completed its acquisition of 21st Century Fox's entertainment assets paving the way for the launch of Disney+, a new streaming service bringing together a wealth of popular intellectual property from across the Disney, Star Wars, Pixar, Marvel and National Geographic brands. Walt Disney further partnered with the e-commerce giant Alibaba on the distribution of films and TV series, major sagas and cartoons on the Chinese video streaming platform "Youku Tudou". Spotify has led the shift in the global audio market, recently committing to podcasting, with acquisitions of podcast heavyweights Gimlet, Anchor and Parcast.

None the less, the explosion of TVoD (TV on Demand) and SVod (Subscription Video on Demand) services did not lead to a cut in the consumption of traditional TV, but rather an overlapping of offers. Public media firms still have time to be fully prepared for a digital only period, however it must be done quickly. In the present, more and more users are abandoning costly subscriptions to on-demand TV or at least reduce the type of subscription and eliminate contents packages, and there is no evidence that this shift will stop any time soon.

It seems only a few short years ago that the public broadcasting companies were thought of as the monopolies of European media industry. But in fact, public media firms are getting smaller and smaller in the world of Apple, Amazon and Netflix. Today, competition is getting fiercer every day. And innovation, regardless if done through corporate R&D or outsourced innovation, needs to adapt media companies to the changing needs of their audiences.

### The new drivers of Innovation:

An influential and expanding stream of research argues that in the face of increasing global competition, rising R&D costs and shortening innovation life cycles, companies can no longer only rely on their traditional R&D.

Following the Schumpeterian theory of economic development, Literature remarked two additional but important actors to innovation; "Networks of firms (ecosystems)" and "Customer co-creation". Researchers started to pay strong interest to the new scene of innovation and debated in favour of networked innovation management (Roman et al., 2018; Narula, 2001; Daidj & Jung, 2011; Buckley & Chapman, 1998).

In the wake of this, Kline (1985) and Edgerton (2004) showed that innovation process is not linear and exhibits many relationships of iterative nature. Empirical studies have

also demonstrated a growing evidence of benefits from experimenting with external knowledge bases (Dodgson et al., 2006; Huston and Sakkab, 2006; Ramaswamy & Gouillart, 2010; Aitamurto & Lewis, 2012). This is clear from the appearance of various means of collaborative contractual agreements (Arora & Gambardella, 1990; von Hippel, 2005). In fact, recent trends in information and network technologies have led to a decreased costs of knowledge dissemination and communication, which made it easier for companies to find and access external knowledge (Lakhani, Assaf & Tushman, 2012). Companies are no longer restricting themselves to markets that they serve directly, but rather are using partners to find new markets and business models for their technologies (Enkel, Gassman, & Chesbrough, 2009).

### The changing innovation conditions in media

In the context of media, the needs of innovation have become increasingly complex (Aitamurto & Lewis, 2012), and thus, there has been a significant lack of investments in R&D. One of the reasons of poor investments may be linked to the capitalisation of tech giants to skills and financial resources compared to media firms. Furthermore, being a public service media, may limit a firm's investment paths by constraining its behaviour within accepted activities and arenas (Scott, 1987).

Moreover, due to the liberalisation of markets, and the reduction of transaction and transportation costs of media services. This has led to a decline in the profit margins of many media firms due to increased cross-border competition and low barriers to entry (Bukley and Casson, 1998). For example, major new entrants such as Amazon and Netflix have meant that the global media profit is increasingly dominated by a small number of US-based media giants with extraordinary creative and financial firepower. The last few years have seen high super-inflation in content production areas such as Originals (Netflix) and user-generated content (YouTube), moreover the cost of sports

broadcasting rights has skyrocketed while, overall, the cost of ideas and talent has risen fast

In this context, Public service media had an urgent challenge to cut on additional unnecessary costs. At the same time, Media firms were struggling with their license-fee revenue models, leaving them with waning resources (Kung, 2007). Large media firms have reduced costs in many areas: such as management layers, divisions and boards, property fee. For example, Rai had a significant decrease in revenue primarily due to the reduction of the total annual licence fee from 100 Euro to 90 Euro (Rai, 2017). Also, Rai recently suffered from a decrease in advertising revenues due to negative performance in the reference market.

These challenges of R&D are not unique to the media industry, as firms in several other industries struggle with a similar tension between two key factors that are changing the economics of innovation: the increasing costs of R&D and the shortening of innovation lifecycle (Chesbrough, 2003). These factors create many conundrums for R&D management to look on new approaches of driving innovation. Today's business reality is based on companies that invest simultaneously in internal as well as external innovation activities (Enkel, Gassman, & Chesbrough, 2009).

### Open Innovation in Theory:

In response to the new scene of innovation, Chesbrough (2003) defines the concept of "open innovation". The open model of innovation permits access to competencies from outside and inside the boundaries of the firms.

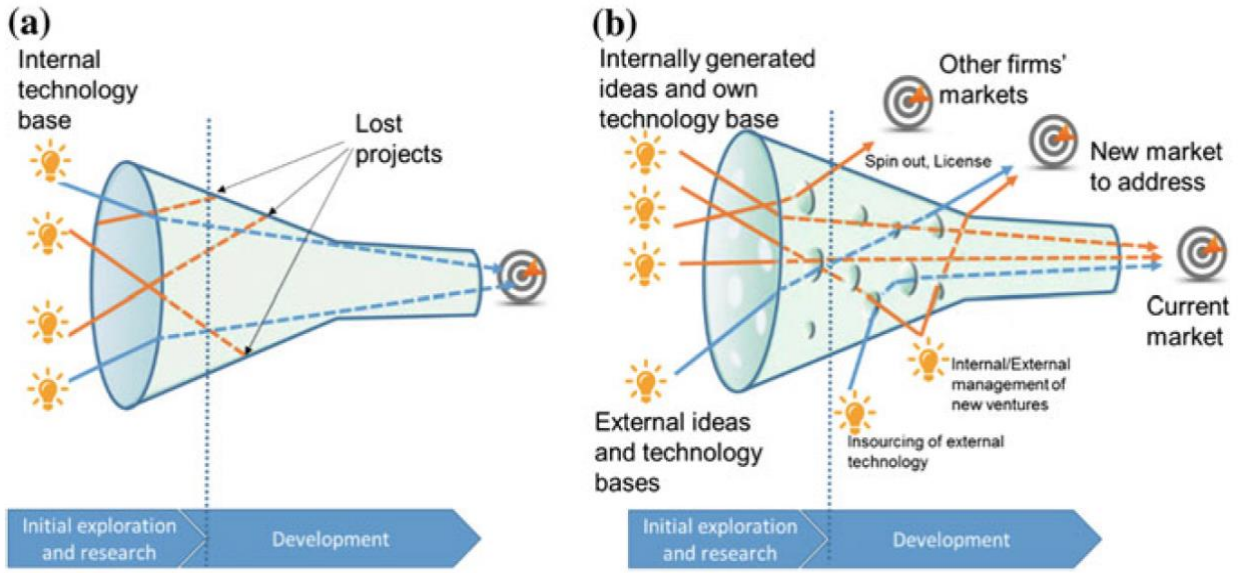



*Figure 1 The traditional (closed funnel) approach to innovation, compared to the Open Innovation (open funnel) approach. Source: Management of Innovation and Product Development; Cantamessa & Montagna, 2015.*

As seen in the above figure, the traditional linear process of innovation can be transformed to a coupled process one (outside-in and inside-out); that combines internally generated ideas with external ones, which leads to access to new markets and market spill-overs.

In the ***outside-in*** **process**, firms enhance their knowledge base by tapping into the external knowledge of the customers and industry partners. This leverages the discoveries of others, and organizations become less dependent on their organisational routines (Chesbrough and Crowther, 2006). Meanwhile, in the ***Inside-out*** **process,** firms externalize their internal organisational knowledge through spill-overs and intellectual property (IP), as well as by reaching new markets through spin-offs and partnerships − thus increasing overall revenue while at the same time saving costs (Chesbrough, 2003). The ideal type in the open innovation process is a ***coupled process***, that combine both the outside-in and inside-out processes (Enkel et al., 2009).

Companies can carry out open innovation by establishing R&D collaborations, alliances, partnerships, joint ventures activity, acquisition of start-ups and founding of

innovation incubators. The most efficient way to achieve open innovation is through innovation incubators that act as external R&D labs. Although this notion did not exist in the traditional concept of innovation, it has recently gained a lot of attention in literature and practice (Lakhani et al., 2008; Hienerth, 2006; Lettl et al., 2006; Franke et al., 2006; Perkmann & Walsh, 2007; Enkel & Gassmann, 2009).

On the one hand, research has identified several advantages of the coupled process model, such as leveraging external knowledge inputs to accelerate internal innovations and expand the markets for external use of innovation (e.g., Chesbrough, 2003; Enkel & Gassman, 2009; Prahalad & Ramaswary, 2004; West & Gallagher, 2006; Dahlander & Gann, 2010). On the other hand, empirical evidence indicates that the returns from open innovation decrease at the margin as the costs of openness exceed the benefits (Laursen & Salter, 2006).

Because of open innovation, companies started to engage in what is called a "network-based innovation strategy" (Saebi & Foss, 2017). The company becomes part of a larger innovation ecosystem consisting of individuals, communities and other organizations (Keinz et al., 2012). While adopting this strategy, the company creates value by reducing transaction and coordination costs, and by offering user-oriented value propositions.

### Open Innovation in Media Industry:

In Chesbrough's seminal work (2003), open innovation was identified an emerging practice by several large corporations, among which Procter and Gamble, SAP, Siemens, and Philips transitioned towards open innovation environment. Procter & Gamble increased its R&D productivity by 60 percent by employing open innovation, and more than one-third of the company's new products originated from outside the company (Dodgson et al., 2006; Huston and Sakkab, 2006).

Just as large firms switched interest towards open innovation, small- and medium-sized enterprises (SMEs) has also demonstrated special interest (Edwards, Delbridge, & Munday, 2005; Chesbrough, 2003). In fact, SMEs have fewer resources to develop and manage the whole innovation process internally (Edwards et al., 2005). SMEs are more likely to lack sufficient capabilities in manufacturing, distribution, marketing, and extended R&D (Lee, Park, Yoon, & Park, 2010). Thus, as for the service SMEs, collaboration is also a particularly important factor to improve their own R&D performance.

Benghozi and Salvador (2013) realised that many firms in the creative sector prefer to appropriate R&D results coming from external resources instead of investing directly in internal R&D projects. They found that open Innovation have served to stimulate creative firm both within and beyond the firm, especially in quickening the pace of outside-in knowledge transfer.

Many media firms have established innovations labs that carries out innovation organically through collaboration and participation. Furthermore, through those labs, media firms can discover what skills and knowledge are currently needed in digital media, As well as, public media firms can establish a brand leverage of its performance among the public opinion.

For example, The New York Times, The Guardian, USA Today and NPR have established external R&D labs to foster collaboration between technology and editorial teams (Aitamurto & Lewis, 2012). Radio France began to get serious on open innovation and is shifting from a media frim to a tech firm. It established with Rai Canada an Idea Accelerator and created its own Open API facilitating spontaneous innovation from developers (EBU, 2019).

The national public broadcaster of Flemish region in Belgium, has already three innovation hubs: VRT Sanbox, VRT Innovatie, and VRT Start-Up (EBU, 2018).

*VRT Innovatie* is tech driven innovation that focuses on big international development projects. Even though technology is a core competency, a core strategy has been put to a stronger emphasis on investing in people and places (VRT Innovation, 2019). *VRT Sandbox* is market driven innovation, created to match media technology start-ups with real VRT productions. The start-ups are given an opportunity to work together with a specific VRT programme or product and with the Sandbox team. While there is no money changes in hands as part of the process, the development opportunity and increased visibility are valuable for the start-up and VRT itself. VRT's brands and programmes get opportunities to keep up with the latest developments in digital platforms and services, helping them to remain relevant as audience needs change.
*VRT Sandbox* has extended its brief to harness ideas that come from within the organization through an "intrapreneurship" programme. In such cases, the staff members who come up with the ideas initially work on them in their own time, eventually employees that come up with potential ideas may receive investment from a VRT production for further development. (VRT Sandbox, 2019).
*VRT Start-up* is consumer driven innovation that act as an internal start-up for digital development. Its purpose is to link media trends to audience needs, aiming to bring VRT's brands into closer contact with each user. They translate new insights into formats, media products and working methods; but they also go further, building and testing prototypes in co-creation with users and creative talent.

At MDR (Mitteldeutscher Rundfunk), the public broadcaster for the federal states of Thuringia, Saxony and Saxony-Anhalt in Germany, a new accelerator for innovation will be launched by year 2020 (EBU, 2018). NRK, the Norwegian public broadcaster has created NRKbeta, an incubator that exists specifically to explore, test and support the implementation of new ideas (EBU, 2017).

The British Broadcasting Corporation (BBC) is the pioneer of media innovation on behalf of wider public media industry. In practice, this is by a cause of BBC's financial

scale, technical capability, audience reach and independence. Theoretically, this difference in performance could be rationalised from the essence of the evolutionary theory of firm (Nelson & Winter, 1982) and the correlation of competitive advantage with firm's different history (Cantamessa & Montagna, 2015);

In response to open innovation, BBC has founded BBC News Lab, a partnership between BBC R&D, BBC News and BBC News Product and Systems. Its purpose is to explore innovation opportunities in technology, journalism and Big Data (EBU, 2016). Furthermore, BBC Backstage, was R&D's first effort to engage with third party innovators at scale, including companies such as Yahoo and Google (About BBC Backstage, 2019). BBC connected studio is part of BBC R&D, it manages workshops and creative sessions to guide innovators through the idea-generation process (About BBC Connected Studio, 2019). BBC taster, is an audience facing platform that invites BBC's audience to try, test and rate BBC's latest innovations (About BBC Taster, 2019). Qualitative and economic assessment carried out on behalf of BBC R&D suggest that the pros of open innovation in media outweighed the cons (Review of the BBC's Research & Development Activity, 2018).

### Business Model Innovation:

The choice of open innovation requires that the companies must define new ways to create, deliver and capture value in conjunction with external partners (Vanhaverbeke, 2006). In fact, the ability to continuously innovate requires a company to evolve, adapt, and constantly improve to survive and thrive. History proves that successful innovations often stem from excellent business models as much as they do from superior innovation strategies (Shelton and Davila, 2005). Furthermore, empirical research strongly stimulates companies to re-organize their business models as to

accommodate with their new open innovation strategies and subsequently enhance innovative performance (Foss, Laursen & Pedersen, 2011).

The concept of "business model" is relatively recent but already existed before the concept of open innovation. The term came in use only at the beginning of the twenty first century, when Internet companies started to emerge (Mahadevan 2000). Given the importance of business models and of business model innovation, researchers started working on precise definitions and on methods for supporting their study and on the relationships between business models and strategy (Magretta 2002). As highlighted by Teece (2010), a business model represents a "conceptual, rather than financial, model of a business" and is therefore aimed at representing the constituent elements of a business and their coherence, rather than its profitability. Industry leaders now look to business model innovation as a principle source of differentiation and competitive advantage (Brown, 2009). In fact, ambidextrous organization is the firm that can maintain efficiency in the current business models while always being adapted for the future (Tushman & O'Reilly, 1996). In the sense of that, Hienerth et al. (2011) finds that, organisations must consider users as key resources.

# CHAPTER 4

## CASE STUDY

BBC and Rai are two well-known public-media giants on the European and global market, both practice innovation on a continuous basis and have a long-history in established R&D department. While the two are key players on media innovation, BBC R&D and CRITS have reacted differently post the digital revolution. In the sense, BBC R&D has managed to transition from its traditional R&D model towards open innovation based on external collaboration through innovation incubators and partnerships. Meanwhile, CRITS continues to operate on its traditional model of innovation, based on basic research, applied research and then technological development.

*BBC*

The **British Broadcasting Corporation** (**BBC**) is the public service broadcaster of the United Kingdom, it produces programmes and services for audiences throughout the UK and across the globe. The BBC's mission was set nearly a century ago by its founding father, Lord Reith. It is "to inform, to educate and to entertain" ("About BBC", 2019). **BBC Research** was first launched in Clapham April 1930. BBC Research and BBC Design merged in 1993 to become known as **BBC Research & Development**.

*Rai*

**Radiotelevisione Italiana (RAI)** is the national public broadcasting company of Italy, owned by the Ministry of Economy and Finance. Rai's mission is committed towards expanding and diversifying its television, radio and multimedia offering ("About Rai",

2019). **Rai Centre Research, Technological Innovation and Experimentation (CRITS)** was founded in Turin in 1930 originally called "Laboratorio e Officine". In 1961, its name became "Research Laboratory". In 1999, it assumed the name of "Research and Technology Innovation Centre" and, from 2018, the centre of research holds the name **CRITS**, translated from Italian as Centre Research Innovation Technology and Experimentation.

The BBC R&D department compromises of just over 200 highly specialist of research engineers, scientists, creative directors, journalists, ethnographers, designers, producers and innovation professionals working on every aspect of the broadcast chain, from audiences, production and distribution ("About BBC R&D", 2019). CRITS is part of the Rai technological area and while it used to compromise around 50 employees, distributed between researchers, electronic engineers, telecommunication engineers and few computer engineers.

BBC's R&D and CRITS have contrasting resources pool, this is already an evidence of how the two are practicing innovation differently. In fact, this is not an unusual result, since CRITS' traditional model of R&D looks at innovation from the lens SET (Science-Engineering and Technology), while BBC's R&D open innovation model requires a set of diverse complementary resources. But the key-point is, although engineering and scientific knowledges monopolised the competencies of both BBC R&D and CRITS before convergence. BBC R&D alternated its resources pool while CRITS continues to preserve a the same traditional one.

Scaling up from R&D strategy to corporate strategy, BBC has placed external collaboration, participation and partnership at the core of its corporate strategy; It has set a corporate scope on: Reinventing its service for younger audiences; Revive its education mission; Grow worldwide (BBC's Annual Plan, 2019/2020). Meanwhile Rai considers technology consolidated in its core corporate strategy (Rai Annual Report,

2017); It has also placed the experimentation and implementation of new technological platforms aimed at broadcasting, telecommunications, television production and accessibility support are at the heart of Rai's research and development strategies (Rai Annual Report, 2018).

These differences in R&D and corporate strategy are a matter of investigation in the following section of the case study. Since a firm can be viewed by a static and dynamic view (Nelson & Winter, 1982). The next aim is to deduct evolutionary trends of CRITS and BBC R&D, and eventually test *the cast-study hypothesis that "*Path-dependency has strained CRITS into a competency trap" or in other words;

*"What CRITS' is today, is a function of its history and will be the state its tomorrow*."

## Collecting data

The initial and most time-consuming stage of the case study was collecting relevant data on current and past R&D activity. This step was brought with well-paid attention and importance to avoid any subjectivity or incorrect data. Therefore, data was collected exclusively from BBC R&D and CRITS official websites, information was found on their online digital archives and publications sections. BBC's R&D and CRITS' each have well organised digital archives with a cloud keyword tagging, this fastened the data scamming phase and identification of interrelations in data. Unfortunately, their online archives are limited to activities starting only from the 90s. Thus, to find data on the prior period, information was extracted from official paper work or unarchived catalogues found in CRITS book library in Rai headquarters in Turin. Once a clear set of data was compiled, projects were ordered according to their position in the media value chain (see figure. 2). This was not of very difficult, since certain projects are self-explanatory and there is unique keyword tag associated with each value chain section on both digital archives' websites.

Appendices A and B show respectively the complete historicising of CRITS and BBC R&D projects with their value chain positions. Projects are ordered chronologically with respect to a decade-range, starting from 1990 to 2000, then from 2000 to 2010, until 2010 to 2020. Each table represents one section of the media value chain.

## R&D trends based on value chain


*Figure 2 Media Value Chain*

The second stage of the study is identifying the trends in R&D activity along the distribution of the value chain. Since, BBC and Rai have two different innovation model, it is interesting to see how the open model of BBC and the closed model of Rai is reflected on the value chain of media.

Chapter 3, identified that Content is now the primary focus of media companies. This is intriguing to investigate how R&D responded to this new aspect of market scenario. How did BBC R&D and CRITS juggle the two-cultural dichotomies of creativity and technology? CRITS is path dependent to its engineering competencies, meanwhile content innovation is dependent on non-scientific and creative competencies. The hypothesis to be tested is that CRITS' won't be able to perform adequately in comparison to BBC's open R&D model.

A Thematic data analysis is used for identifying, analysing and reporting patterns (themes) within data on R&D activity. The number of R&D projects in each value chain section was quantified from Appendices A and B. The percentage of the total was then calculated, enabling us to visualise the trend in R&D activity. The results can be seen in table 1 and table 2 that correspond to CRITS and BBC respectively. The values in the table are then transformed to two bar charts. The x-axis separated R&D activity on three charters, the Y axis represents the percentage of each value chain section from the total R&D projects that were developed during that specific period.

*Table 1 Data Summary of Appendix A (RAI)*

| | | 1990-2000 | 2000-2010 | 2010-2019 |
|---|---|---|---|---|
| Percentage (%) | Content | 25% | 20% | 16% |
| | Production | 25% | 47% | 37% |
| | Distribution | 50% | 33% | 47% |
| Num. Projects | Content | 2 | 3 | 9 |
| | Production | 2 | 7 | 21 |
| | Distribution | 4 | 5 | 27 |

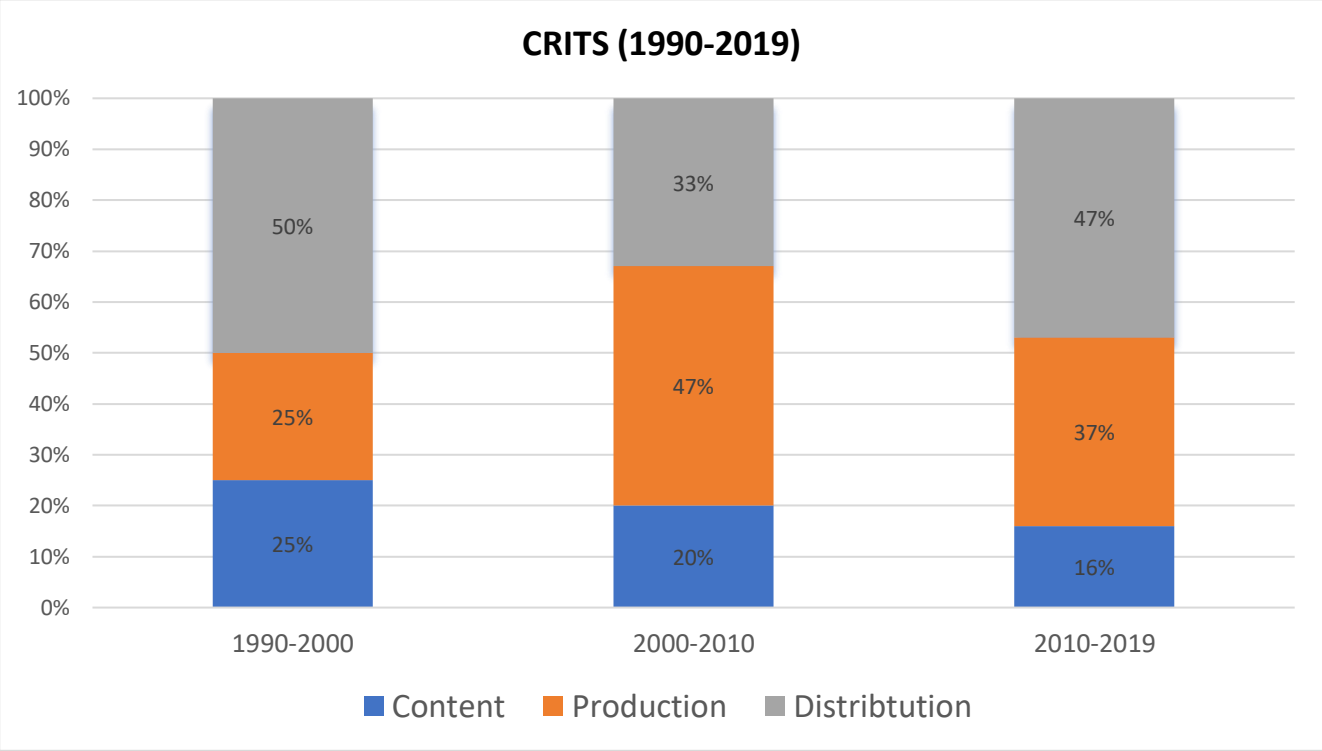



*Figure 3 Bar graph of R&D trends in Rai based on value chain*

*Table 2 Data Summary of Appendix B (BBC)*

| | | 1990-2000 | 2000-2010 | 2010-2019 |
|---|---|---|---|---|
| Percentage (%) | Content | 0% | 16% | 50% |
| | Production | 33% | 36% | 29% |
| | Distribution | 67% | 48% | 21% |
| Num. Projects | Content | 0 | 4 | 43 |
| | Production | 4 | 9 | 25 |
| | Distribution | 8 | 12 | 18 |

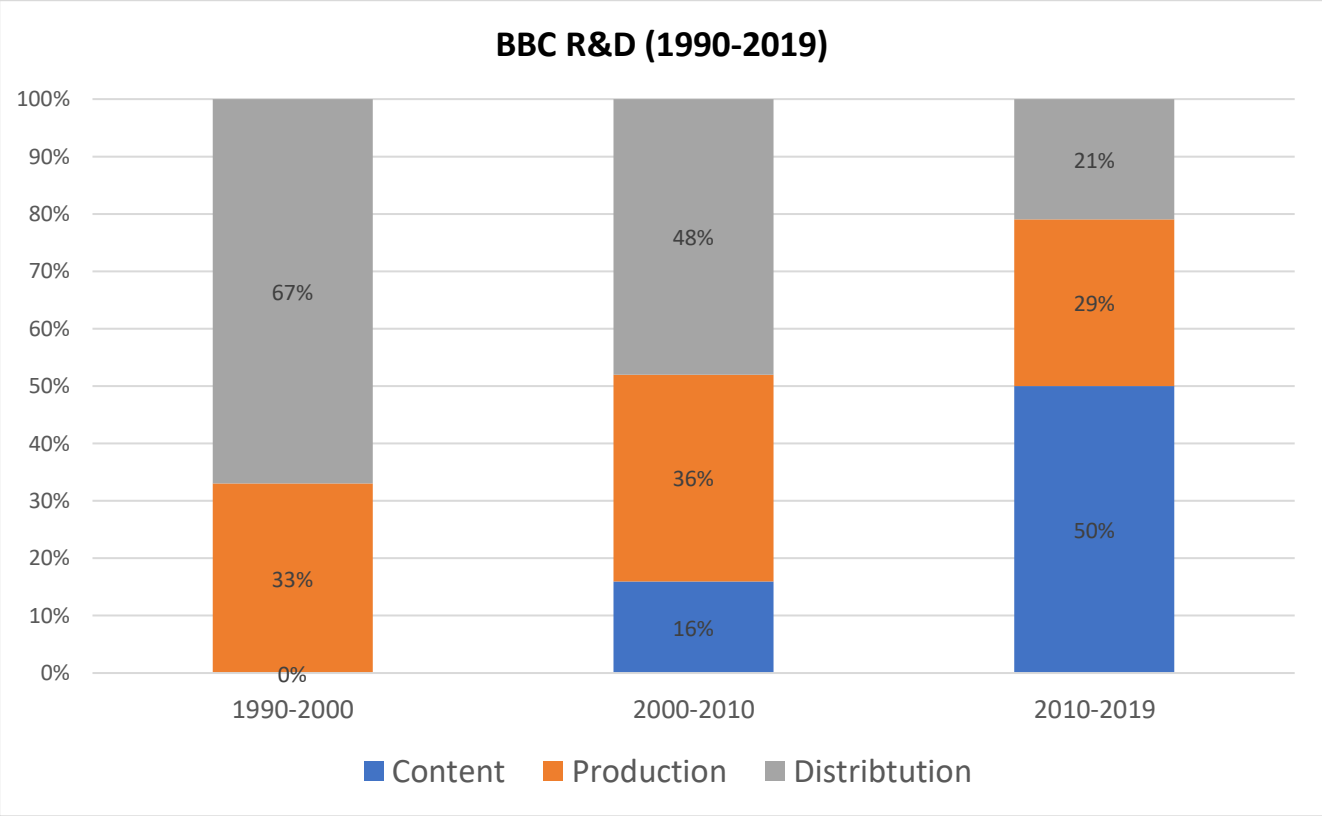



*Figure 4 Bar graph of R&D trends in BBC based on value chain*

*Content (represented in Blue)*

Rai: Even though the number of projects related to content innovation increased, the percentage of content innovation in Rai maintained almost the same path with a slight decrease. The total concentration of R&D projects has decreased from 25% to 20% in year 2000, then to 16% in 2010.

BBC: this is of completely different with respect to BBC. The concentration of BBC R&D on content boomed in the last decade, with a jump from 16% to 50%.

*Production (represented in Orange)*

Rai: the focus of CRITS on production changed over the three decades. Production accounted for 25% of share in 1990, In 2000 the percentage increased to 47%, then decreased again to 37% in 2010.

BBC: the focus of BBC R&D on production almost remained the same over the three decades. Production accounted for 33% of share in 1990, In 2000 the percentage increased slightly to 36%, then decreased to 29% in 2010.

*Distribution (represented in grey)*

Rai: Just like production and content, the focus of innovation on distribution almost remained the same over the three decades. Distribution accounted for 50% of innovation share in 1990, In 2000, the percentage decreased to 33%, then increased again to 47% in 2010.

BBC: even though, 67% of concentration was on distribution in 1990, this value continuously decreased to 48% in 2000, and significantly to 21% in 2010.

*It can be briefly summarised, that BBC steadily focused on production innovation with a new dominated focus on content, while distribution is not a matter of focus as before. Meanwhile, Rai hasn't show any difference in approach over the last three decades, it*

*continues to heavily focus on distribution and production and a limited contribution to content innovation (digital archiving, recommendation).*

The results are of great importance since it confirms the hypothesis that CRITS is not able to evolve from its path dependency and didn't switch its focus on distribution and production in the favour of content innovation. Meanwhile, BBC has shown dynamicity in shifting responsibilities in correspondence to shifting market scenarios.

### R&D trends based on innovation determinants

- Technology Push
- Demand Pull

There are two contrasting determinants of innovations in the economic literature. Theories of technical change have generally been classified into "market demand-pull" and "technology-push" theories. The distinction is self-explanatory and relates to the degree of autonomy of the innovative activity (Dosi, 1982). Demand Pull innovation is when market or consumers forces the innovation activity. Conversely, Technology Push innovation is when technology is an autonomous or quasi-autonomous factor for innovation, innovation is generated independently from a specific market need, thus matching a latent demand.

1. After collecting data on R&D projects. A timeline was created to summarise all the R&D projects developed since year 1930 till 2019. Consecutively, every project was stripped from its technical background. Projects that share similar technical layers were grouped together under the same umbrella.

For example, CRITS projects on "halfRF HD/UHD radio-camera", "HDTV Eureka 256", "Beyond HDTV", "HDR", and "4K, the evolution of television" are classified under the same umbrella named "Image Quality"

2. After that, each grouped family was further classified under a binary condition:
   0: the project was either a as a response to market and audience necessities or,
   1: an introduction of new technologies to the market or as response to later demand.

For example, CRITS' developed two project named "*mitigating techniques of the interference generated in TV Distribution by 4G/5G signals in the 700 and 800 MHz ban*ds" and "*Long term perspectives of DTT Convergence towards 5G: Application of 3GPP Rel-14 to Italian Scenarios"*. These two projects have been grouped to the same technical family "4G/5G". Consecutively, according to market scenarios and theoretical understandings, the technical layer "4G/5G" is a new technology that media firms are pushing to be integrated in the context of media distribution and delivery. Therefore, "4G/5G" is classified to be under the technology-push condition.
Which makes each project in the "4G/5G" family a technology-push innovation. Demand pull projects are per-se user oriented (personalisation, participation, etc.) thus R&D projects that are user oriented were easily attributed to be demand pull, such as BBC's R&D recent proving on "improving subtitles quality".

3. The final mapping was followed up with Iterative feedbacks from various R&D engineers and technology experts that work in Rai. For example, several interviews have been done with three experts in CRITS who helped in confirming and identifying various innovation determinant of their R&D projects. Appendix C and D contain respectively, the final classified data with the exact number of R&D projects and their respective innovation determinants for each BBC and Rai.

Depending on data presented in appendices C and D, it was possible to create two Figures that represent the dynamic view of both BBC R&D and Rai R&D with respect

to innovation determinants. The Y axis represents the total number of projects developed, while the X axis represents time. The bar graphs show an extensive review of R&D activity since its foundation in 1930s till today. The result are two distinctive trajectories in R&D activity in BBC and Rai.

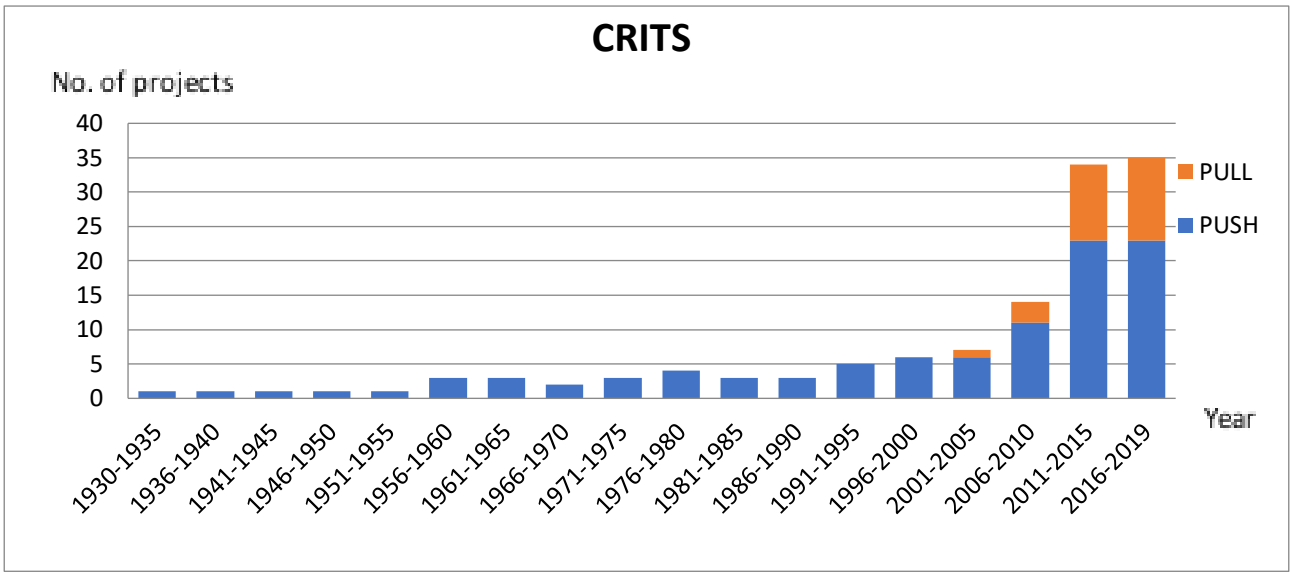



*Figure 5 Distribution of R&D activity according to their technological paradigm Rai*

Figure 2 is bar graph that shows the distribution of CRITS project according to two innovation determinants. The technology-push approach dominates CRITS since its year of foundation till today (2019). Even after the convergence of media in the early 90s, it was only until the beginning of 2000s, that CRITS started to show some work pulled by market demands. This shows that CRITS was a late mover in changing innovation scenarios after convergence. Nonetheless, market demand innovations in CRITS didn't overpass technological pushed innovations. In fact, there is still a significant gap between the two approaches. Thus, just like it has always been, today, technology based innovations dominate the scene of CRITS' innovation.

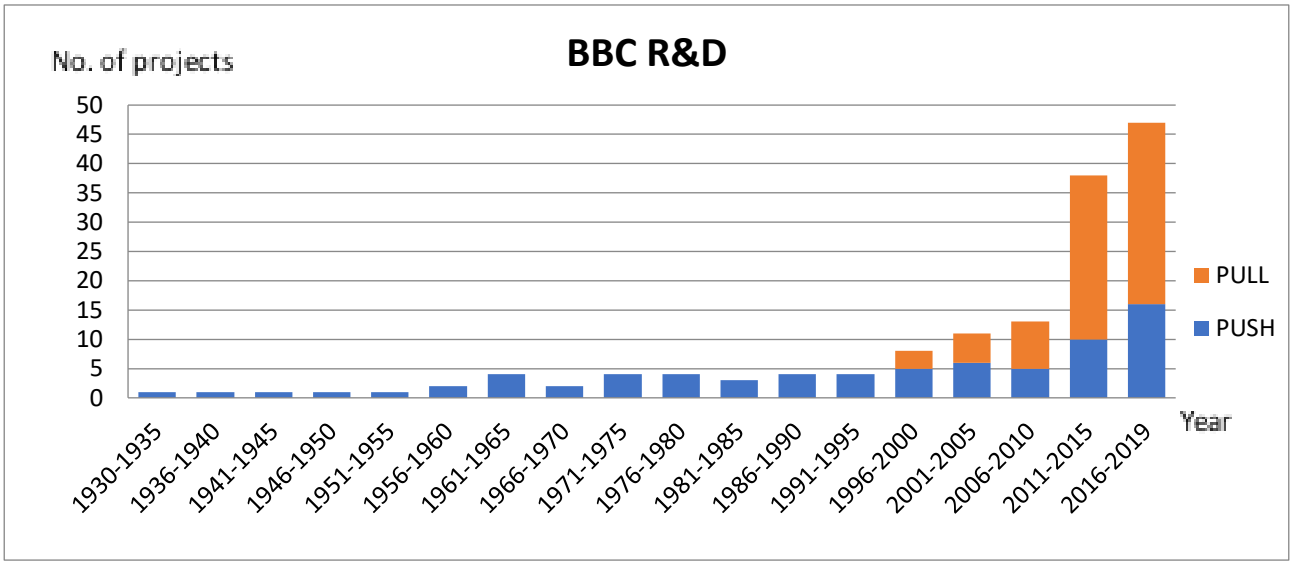



*Figure 6 Distribution of R&D activity according to their technological paradigm BBC*

Figure 3 represents BBC's R&D trends in innovation. BBC R&D, likewise CRITS, had a consistent technological push emphasis over a long period of time. However, BBC R&D managed to pull its strategy towards market demands and started to do market oriented innovations since 1996. Since convergence of media started in the early 90s, BBC immediately predicted market trends and change its innovation strategies since 1996. This shows that BBC has the organisational capabilities to be an industry "early mover", meanwhile, the norm of most media firms is "late adapters". Regardless of that, in 2006, BBC R&D took a major turn in trajectory towards a totally dominated demand pull innovations. This turn in strategy is significant with BBC's adoption of open innovation instead of traditional linear innovation.

Figure 4 and 5 displays the evolution of innovation trajectory along of time. It is clear here how CRITS' and BBC R&D differ in respective innovation trends. Today, BBC

R&D focuses on market pull innovation, CRITS still emphasis its Science and Engineering background and focus on technology push innovation.

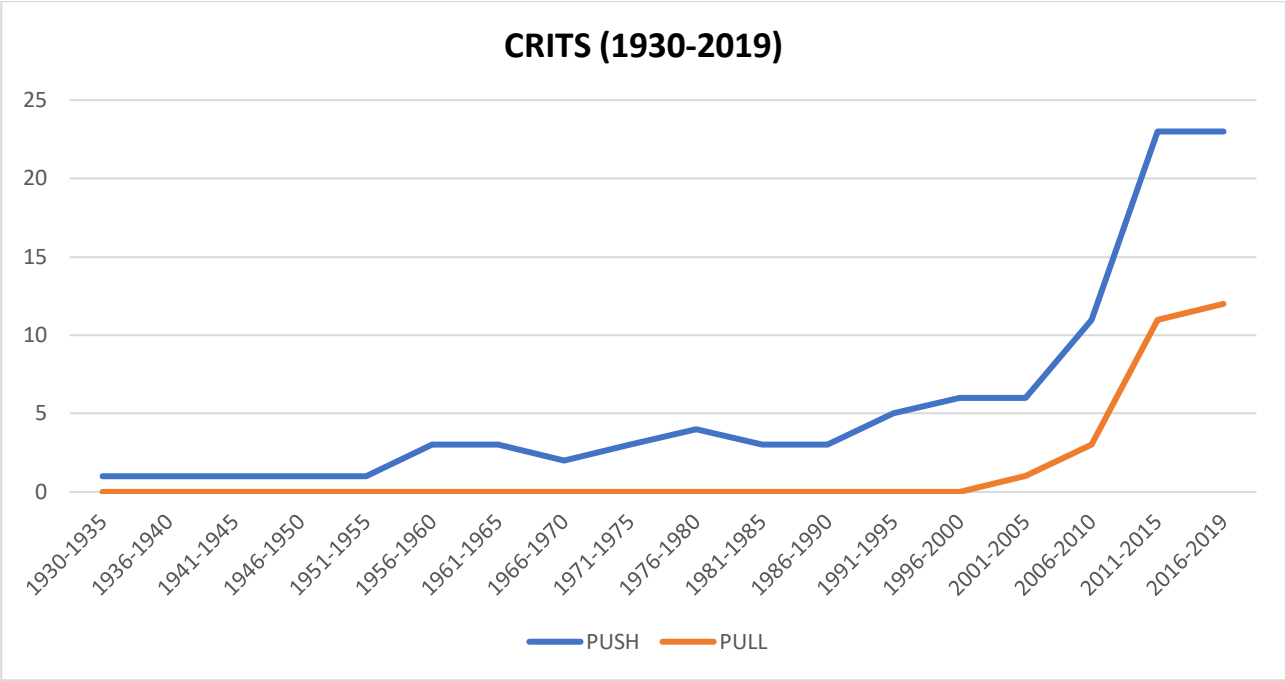



*Figure 7 Evolution of Technological paradigms RAI CRITS*

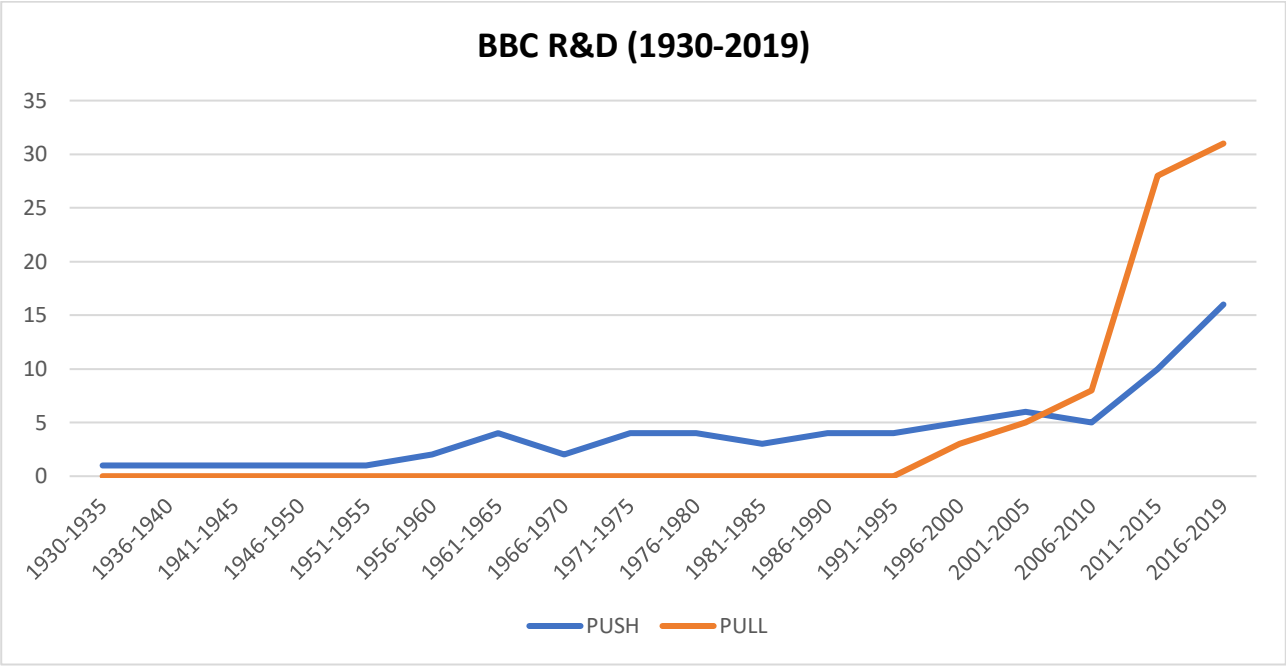



*Figure 8 Evolution of Technological paradigms of BBC R&D*

Thirty years have passed since BBC R&D started to identify itself with demand pull innovation. This time gap is of great meaning, meanwhile, while all market scenarios

hinders media companies to change innovation approaches, CRITS' still function in its traditional R&D concept from the lens of technological innovation. This should already ring a bell that CRITS' suffer from path dependency while BBC was successful in avoiding dependency through alternating its organisational resources and routines over times. The organisational and managerial aspect will be discussed in the next chapter, for now, the main take away that BBC's demand-pull trajectory is well accommodated with open innovation, while CRITS' technology-push trajectory is sustained from CRITS traditional model of innovation.

### R&D trends based on organisational competencies

BBC R&D took a new outlook to organisational competencies after executing an open innovation strategy. BBC merged its research and design department into one; both departments have complementary resources that accommodate with the new market scenarios, such as: engineers, designers, journalists, creative directors, project managers. Moreover, BBC opened new organisational positions such as data experts, software engineers, cloud engineers, collaboration managers, etc. Furthermore, BBC crossed innovation along its organisational departments and now ICT and digital departments hold together with R&D responsibility for innovation development. To sum things up, post convergence, BBC R&D became a source of innovation, and not the source of innovation. Meanwhile, this management pattern of innovation is slightly different compared to Rai. Till today, CRITS continues to assume technology and scientific research as the complete source of innovation and looks at open innovation as if it is a "nice-to-know" and not "must-have". After convergence, CRITS stopped contracting with technicians and electricians since their role became unavailing; however, it kept its knowledge base unchanged. In fact, according to the theory of the production of knowledge (Gurukkal, 2018), the Linear model of R&D neglects any non-scientific origins of innovation. This is very supported in current CRITS's

traditional model that diverts attention from creative and social determinants of innovation

# CHAPTER 5

## ANALYSIS OF FINDINGS

Chapter 1 spilled some tea that media companies needs to take a different approach to innovation since the scenarios of the market has changed, Chapter 3 found that after media convergence, most media companies transitioned towards open innovation, while few remained attached to their traditional R&D models. The previous chapter concluded that CRITS is a subject of path dependency and BBC managed to escape it. In this chapter, I try to make an analysis behind the reasons CRITS' path dependency from an operational, managerial and organisational aspect.

### Operational Aspect

Although the technological weight of innovation existed since the foundation of CRITS, it didn't feel the burn of path dependency until the last two decades. In fact, what the internet has disrupted, and telegraph, radio and television didn't, is that it made the cultural dichotomy between technology and creativity a more evident one. Creativity has always been critical to media, in the sense of filmmaking, cinematography and journalism, but never in the context of innovation. The current spate of technological changes has enlarged the need to include creativity within innovation conditions. For example, creativity in media Innovation can be regarded from the lens of interactivity, personalisation, user-generated-content, virtual reality, machine learning, mobile applications, etc.

The traditional model of innovations neglects any non-scientific origins of technological developments. In fact, CRITS fell a victim of the "not-invented here syndrome". In the sense, it finds it much easier to continue with technological innovation rather than going for non-technological fields of innovation such as content creation and machine learning. Moreover, Christensen (1997) posits what he calls the innovator's dilemma", which is when a company's very strengths now become barriers

to change and the cause of a company's potential decline. Unless there is a clear mandate with strong incentives to pursue non-scientific innovation, CRITS will continue to fall back with the old technological competencies and path-dependency will become stronger.

While CRITS' continues to divert attention to any creative and social determinants of media innovation. BBC considers users and society in large as an inherent part of the R&D development (BBC Taster, BBC News Lab, BBC Connected Studios); moreover, creativity became a core competency in innovation (BBC Reality Lab, Story Explorer, Your Story, Culture UK). CRITS lacks initiatives that provide it with a genuine connection with individual users and the creative community, this progressively led to its competency trap which imprisoned its own strength to technological innovation, thus, it finds it difficult to pursue exploration projects.

### Managerial Aspect

If we look on Rai's recent annual reports and financial statements, not speaking about those published twenty years ago, but literally on the most recent published ones, like the one of the annual year 2018. Rai considers technology has a complete control over its innovation. This corporate assumption has confined Rai to a technical innovation strategies that respectively bounded CRITS to technology. Nonetheless, this corporate practice of managing technological innovation is in fact homogenous with the exogenous notion of the neoclassical economics. The theory pressures governments to invest in scientific and research development toward innovation (Solow & Swan, 1956). In the sense, Governments expect from Rai to invest in science and technology policies, which may constrain CRITS to look for non-technological innovation.

Although this should also be the case for other European media firms, in the sense that too have a public responsibility to innovate. BBC, Deutsche Welle, VRT, NRK and many other European broadcasters have managed to gradually transition their innovation policies from technological towards market oriented. While, in-spite of many years since entering in the digital era, Rai's innovation policy is still organised

and managed in a way that is close to the model from the age of monopoly and market competition.

Furthermore, CRITS' organisational resources are subject to their cognitive and action inertia. In the sense, CRITS still look at technological innovation as a source of competitive advantage which have always granted them success in the past and continues to do. For example, CRITS has recently participated in an open competition on the European level and eventually won funding for its proposed project. This has been brought up to Rai's top-management on a plate of gold as a proof of satisfactory performance. Moreover, this has also been interpreted among CRITS' employees with a high confidence in their ability to innovate adequately performance and generate revenues in the future. This could be indeed true, but with a cost of trade-off between direct benefits to public in the favour of direct benefits to Rai.

### Organisational Aspect

R&D activity impersonates organisational routines and resources (Cantamesa & Montagna, 2016). During the era of Radio, resources who used to be responsible for innovation were originally engineers that came from the telegraph services; When television was introduced in the 1950s and 1960s, the transition from Radio to television was brought with an organisational downgrading of the whole technical staff. The competences found in Telegraph, Radio and TV were simultaneously similar. In the sense, organisational resources were asked to make a duplication of technologies but the context of innovation remained the same. Resources in R&D remained for a long time in the scientific context (Godin 2006). In the early 2000s, when media transitioned to online, Internet required complementary resource that are found in fields such as information technology, design, creative industries and telecommunications all together. Even though a long time has passed since the digitalisation of media, the organisational structure of CRITS is still based accordingly to the era of radio and television and did not evolve to accommodate the scene of digital

media. This is another main reason that led CRITS to its path dependency and consecutively competency trap.

Meanwhile, the merge of BBC Design and BBC Research came in response to digital media with a correct timing. Since design is a non-linear process (Brown 2008), it offered BBC R&D with the needed resources and routines to help its transition from linear to open innovation. Indeed, design is "a different way of thinking, doing things and tackling problems from outside the box" (Bucolo & Matthews 2011). As a result, BBC had a unique capability for investing in new business value propositions by using the designer's sensibility and user-centred methods with engineer's rationality and scientific knowledges. The merge of BBC design did not only alternate R&D resources, but also changed its routines. For example, R&D engineers were accustomed with long term scientific innovation; meanwhile, Design is a subset of creativity, which is per se of short-termed type and characterised with a continuous need for newness (Turow, 1992). Moreover, designers interact directly with users and stakeholders and thus possess the ability to see a 'humanised' version of each proposal, constantly and powerfully returning the proposal to a user-centred value proposition (Verganti & Dell'Era, 2009). Therefore, this has given BBC, feasibility and breadth in switching innovation models.

# CHAPTER 6

# BUSINESS MODEL INNOVATION OF CRITS

This chapter is devoted to help CRITS create, deliver and capture new values. All the findings from the previous chapters, advocate that CRITS should transition from its traditional model of innovation to open innovation. therefore, this is the focus and goal to be reached by the end of this chapter.

## Designing an innovation strategy for the new business model:

The first step in innovating the business model, is to define an innovation strategy for CRITS, which the "to-be" business model shall be based on. Shaping strategy usually starts with the definition of a "vision" for value creation. In the context of open innovation**,** value can be created if R&D taps on external resources that are complementary to its traditional model. Based on literature, this can be achieved through collaborative agreements with external partners; such as lead- users (Von Hippel, 2005), universities and research institutes (Perkmann & Walsh, 2007) or small media firms and start-ups (Calatone & Droge 2006; van de Vrande et al., 2006). To this context, it is interpreted the best for CRITS to adapt a "*networked-based innovation strategy*" (Saebi & Foss, 2015). This will make CRITS part of a larger innovation ecosystem consisting of lead-user, communities and other organisations (Keinz et al., 2012)

## Choosing a methodology for business model innovation:

Martin (2009) have advocated making use of creativity instead of simple analytical skills in business problem solving. One of the methodologies that emerged from design science, is the use of a methodology named "Design Thinking" (Brown, 2009; Cross,2011). The idea of design thinking has become very popular after its introduction by tech giants such as IBM in their innovation practices (Kolko, 2015). Furthermore, Design Thinking is an iterative process that uses user-centred techniques to solve

wicked problems (Brown & Wyatt, 2010; Cross, 2001). It is unique because it is identified with a great degree of flexibility in the types of methods it uses (Souza & Silva, 2015), moreover its adoption has improved idea generations and concept selection (Seidel & Fixson, 2013). On top of that, Design thinking is moving beyond its original implementation from design science and has been successfully applied in an ever-wider spectrum of areas, such as the development of strategies, business models, and organisational structures.

Although there is no generally optimal method for business model innovation, all the previous theoretical indications, suggest that Design Thinking is a suitable method for innovating the current business model of CRITS. Therefore, it has been selected to be used in the context of this chapter (see. Figure 10)

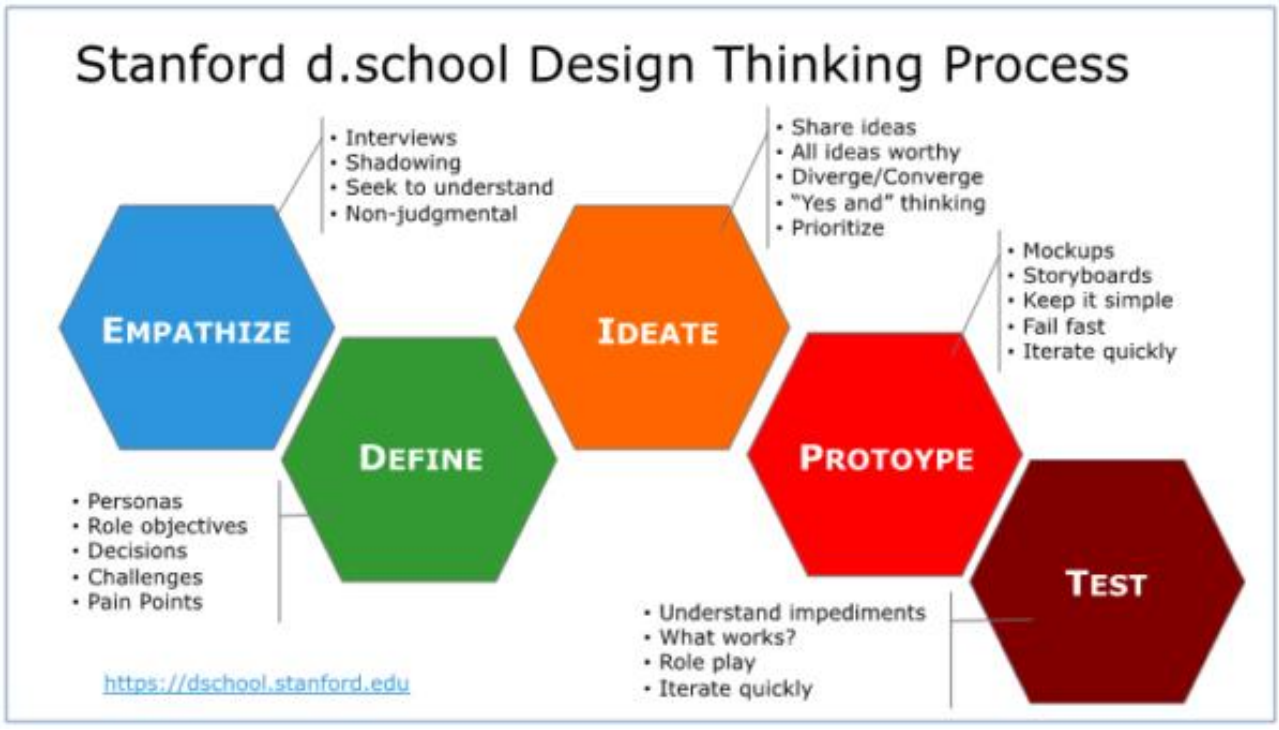



*Figure 9 Design Thinking methodology, source: Stanford design school*

## Design thinking process:

The following section explains in details the various steps of design thinking that led towards the development of a "To-be" business model of CRITS (see table. 4). The process was iterative and based on various user-centred techniques; one questionnaire, two brainstorming sessions; one empathy map; two interviews with experts; one presentation; and two feedback sessions with one R&D specialist in CRITS, and two innovation experts in the German public-broadcasting company: Deutsche Welle (DW), Germany.

### Step 1 Empathy:

This first step in design thinking is understanding the current problem situation and empathising with the user (Stephens & Boland, 2014). It provides a great opportunity to reevaluate the existing conditions in CRITS and discover nascent opportunities for the next phases of business model innovation.

A questionnaire of open and exploratory questions was sent to a couple of selected CRITS' employees. A format of the survey is found in Appendix E at the end of the thesis.

Participants were asked on three main concepts:

1. what do you think innovation in media is?
2. why do you innovate?
3. And most importantly, according to your observations, what has changed in the context of media innovation after digitalisation.

The answers helped in conceptualising the current understanding of CRITS' employees to innovation conditions and various market scenarios. All the answers showed a clear comprehension to the importance of innovation in media, in the sense, most have mentioned that innovation generates benefits to end-users through: new types of content, higher picture quality, better accessibility, enhanced coverage of national events; benefits for the creative community such as providing a know-how knowledge

for the launch of new technologies, online archive and new experiences in news. Participants also mentioned direct benefits to Rai from patent appropriation, commercial exploitation, and experimentation in new affordable technologies**.**
Some answers mentioned benefits to the external Media industry from cross-collaboration and on-campus events such as Rai Porte-Aperte.

Most answers showed an interpretation that innovation cannot be separated from the context of IT. Nonetheless, none of the answers showed an understanding of non-technological aspects to innovation and no one mentioned any consideration to lead users or start-ups. Moreover, when asked about their opinions on open innovation initiatives (innovation incubators, innovation accelerators) most answers showed an appreciation and support of open innovation, but said that without any current managerial commitment to open innovation, Rai stays without any on-ground practices of open innovation initiatives.

On top of the questionnaire, a presentation about "what CRITS has been doing and what others are doing" has been done to a couple of other CRITS' employees that were not surveyed. At the end of the presentation, attendees were asked through a couple of closed questions regarding on "what they think is different in their R&D activity compared to others" and "what do they think could be improved in the future". Unfortunately, no one gave a clear and structured answer but most of their responses went out towards a cycle of pointing fingers on those to be the blame of CRITS' backward performance. Even though the presentation didn't show any previous negative criticism to CRITS' performance and it was very biased, the attendees negatively judged CRITS by themselves and stated that CRITS continue to perform as we are in era of fifty years ago.

### STEP 2 Define:

Findings from the questionnaire and the presentation, in addition to a brainstorming session could be interpreted and narrowed down to specific CRITS needs. An **empathy map** is a tool that uses insights on what has been observed in the empathy step, and represents what can be inferred about needs, problem space and groups' beliefs and emotions (Stanford School of Design, 2010).

RaiCRITS

| THINK AND FEEL | SEE |
|---|---|
| • Technology is the main determinant of innovation<br>• R&D is important for media innovation<br>• Innovation should be continuous<br>• Innovation should be cross-organisational<br>• Innovation should be open to externa drivers<br>• Innovation should also be organisational | • Data is everywhere<br>• Technology is a source of competitive advantage<br>• Consumers keep changing their behaviours<br>• Open innovation is of great value<br>• Content innovation is essential<br>• New business trends are privacy, cybersecurity, fake news |
| **HEAR** | **SAY AND DO** |
| • Internet of things, Block chain, social media, machine learning, cognitive computing's are the next big things<br>• R&D is of extra costs<br>• Internal R&D is not essential<br>• Innovation can be outsourced<br>• Public is unsatisfied with the Rai's return of value on public taxes | • Technology is at the core of innovation process.<br>• Rai's objective is to become a digital company<br>• CRITS work on Content distribution over the internet protocol, delivery and production techniques<br>• Open innovation should be implemented in practice and not just in words |

*Figure 10 Empathy map "CRITS"*

Figure 11 shows an empathy map that has been developed to CRITS in the current situation. The map could be described that CRITS *thinks* the innovation conditions has changed, it *sees* and *hear* about successful open innovation initiative in the scene of others, moreover, it *do* support the implementation of open innovation within its innovation model.

Consecutively, the new business model shall fulfil the below defined CRITS' needs:

- *CRITS' needs to take advantage of Open innovation in real practice,*

- *CRITS needs to acknowledge users in its innovation cycle,*
- *CRITS needs to reduce its innovation costs and increase value propositions,*
- *CRITS need to search for new external partners*

### Steps 3 & 4 Ideation & Prototyping

In this phase, user needs are translated to become coherent value propositions. In view of this, all ideas are worthy and thus, it was iterated in teams and received several feedbacks. Osterwalder and Pigneur (2010) designed a "Business Model Canvas" as a tool for business model prototyping (see table 3). The canvas is built on nine different blocks (customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partners and cost structure). Each block represents a main business aspect that enterprise can creates, deliver and capture value from. In the practice of this process, the canvas was developed by hand on a white-board (see figure. 7), where every idea is written on a sticky note and corresponded to a unique block. The yellow sticky-notes represents the "As-Is" business model of CRITS, while blue sticky-notes correspond to improved dimensions that are modified.

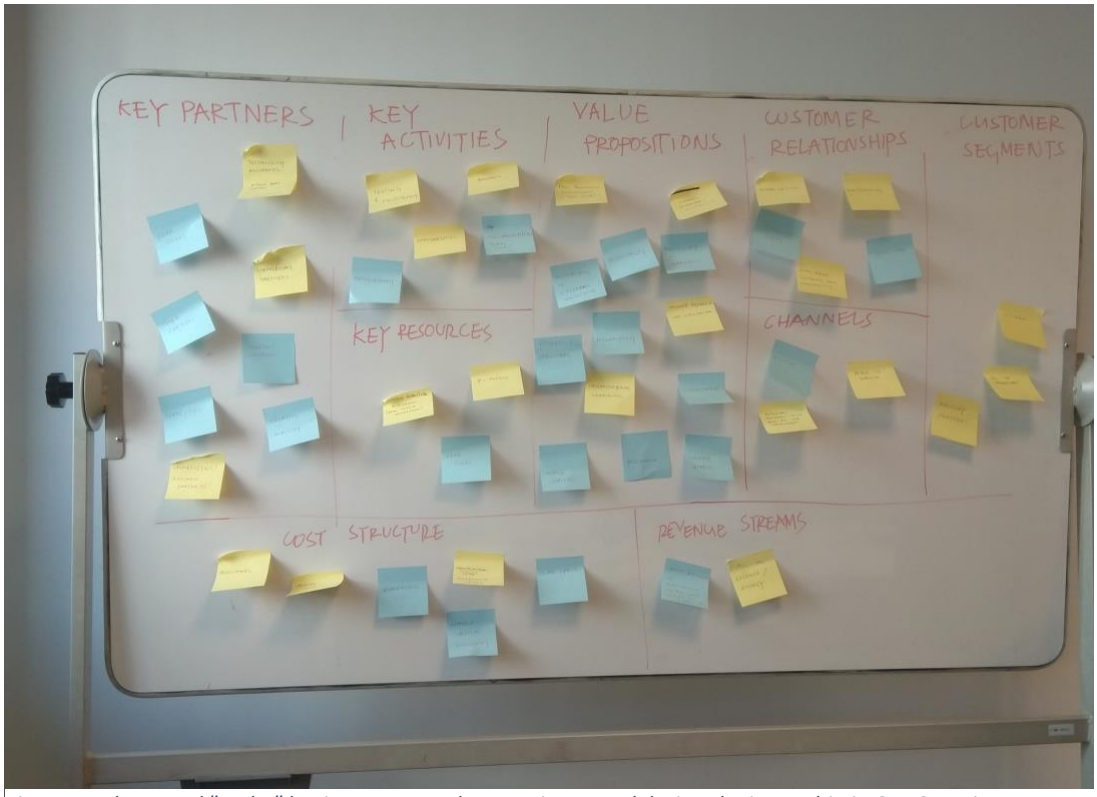


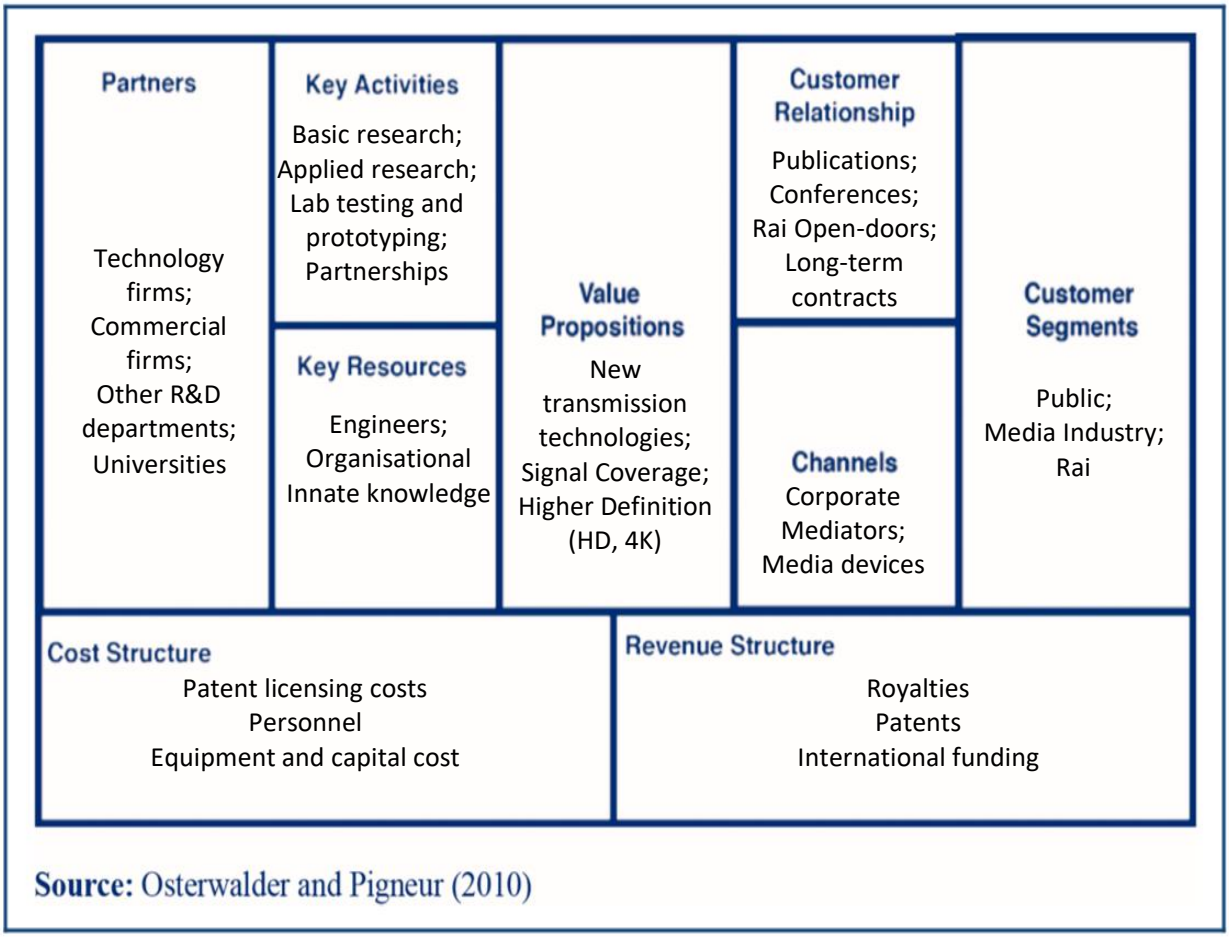

*Figure 11 The actual "To-be" business canvas that was innovated during the internship in CRITS, Turin.*

Obviously, figure.7 represents the result of this process. However various sub-steps have been done:

### *Developing the "As-Is" business model canvas*

The "As-Is" canvas serves to identify inconsistencies and to highlight which business model aspect that shall be improved. This is an essential prior step prior to drafting a new ("To-Be") business model. Table 3 represents a schematisation of CRITS "As-Is" model; it is a conceptual interpretation of CRITS current model, leveraged on brainstorming and internal observations techniques.

*Table 3 "As-Is" Business model of CRITS*




### *Analysis of inconsistencies*

The "As-Is" canvas shows several operational and managerial areas that CRITS consider as priorities. At the same time, it also highlights a couple of inconsistences that doesn't match with a networked-innovation strategy. Indeed, after a session of brainstorming and critical analysis, three main gaps in the "As-Is" business model has been singled-out so that the "To-be" model should serve to fulfil.

- CRITS focuses on certain innovation activities such as signal coverage and internet delivery, increasingly higher definition and sound quality (HD, HDR, Ultra-HD & 4K); and new transmission technologies and standards for mobile

telephony (5G). While these activities are of great necessity, CRITS' lacks experimenting on new forms of content; approaches for storytelling; interactivity and sharable technologies. CRITS is missing a lot on non-technological innovation. The interconnection of technology and content is now considered a must and content is no longer a mere replica or a complementary extension to innovation.

- Furthermore, CRITS should unlock the potential of data which permits it to generate user insights that can feed automated content, recommendations, and personalisation. Audiences are not anymore marginal or secondary but rather a crucial asset to the innovation cycle. Therefore, fostering user's data and participation is an opportunity for CRITS to maximise exploitation of user-generated content, as well as increase the traffic on their sites, which may result in additional revenues for either advertising or subscription formulas.

- Moreover, while collaboration with other R&D departments and universities is central to CRITS' R&D model, it however neglects collaboration opportunities with start-ups, creative community and lead users. In the sense, Rai can replicate successful initiatives of innovation incubators, such as VRT and its Sandbox or BBC and its connected studies. RAI have the required infrastructure, knowledge and audiences to establish its own innovation hubs. This will not only deliver a new platform for collaboration, but it will also leverage the public image of Rai and rebrands it for the younger audience.

To put things together, the digital offer of media is gradually developing its own innovation identity. In the most, it has become clear that content, users, and open collaboration, are key players in innovation and must be considered in business models.

*List of desired modifications*

Thus, the "To-be" model should accommodate the following:

- It should be networked-oriented;
- It should create a mechanism to engage with the wider industrial community;
- It should reduce costs and increase generated revenues;
- It should continue to engage with internet and mobile technologies groups and encourage the complete transition of Rai towards a digital company.

*Prototyping the "To-be" business model canvas*

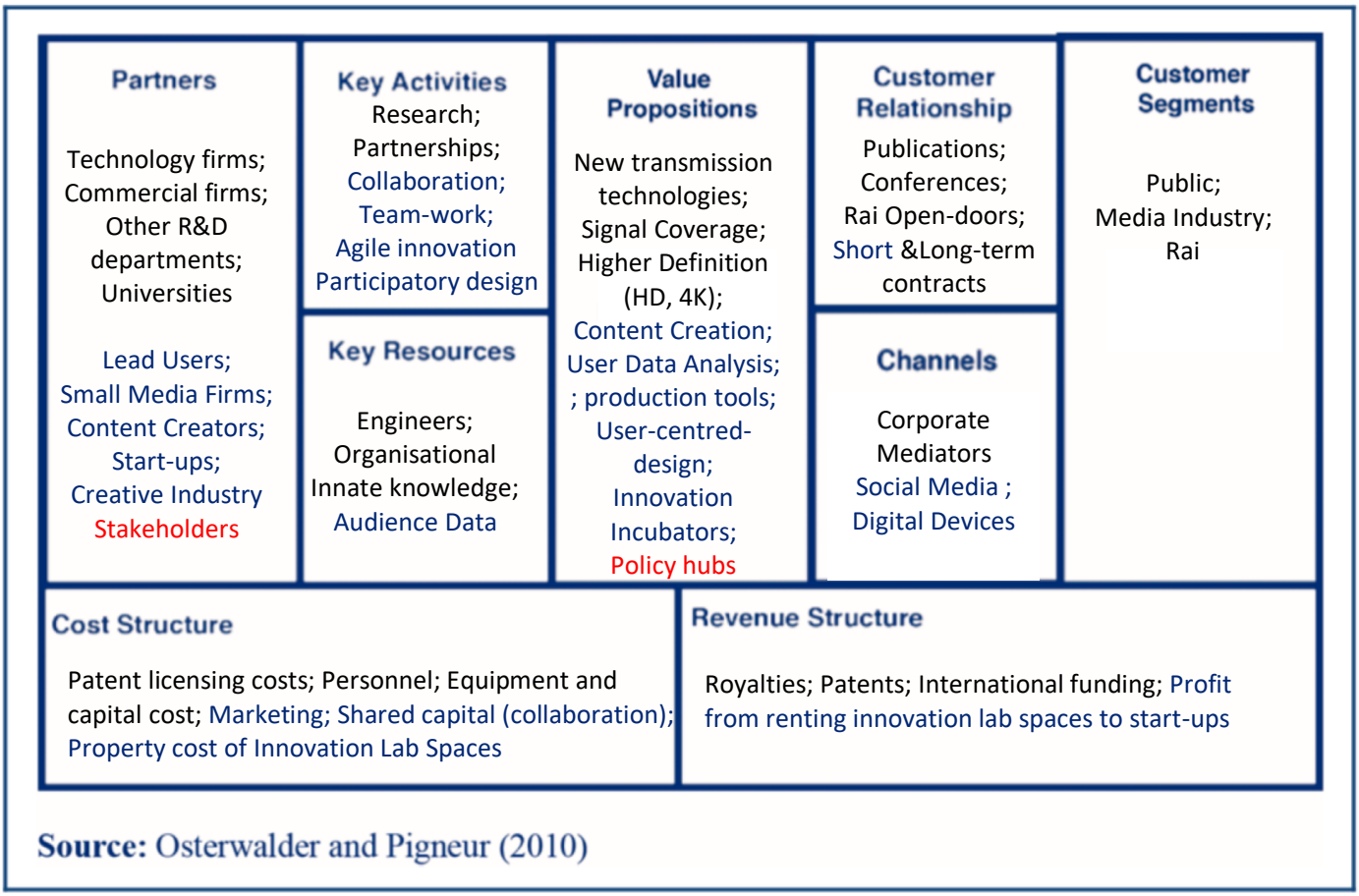



*Table 4 "To-be" business model Canvas*

## Step 5 Testing

The last and final step of the design thinking process is to test and receive feedback on the final version of the business model. The model was presented to one R&D expert in CRITS, and was further presented to two innovation experts from the Research and Cooperation Projects department in the German public broadcaster Deutsche Welle (DW). An e-mail was sent to each expert with an introductory brief description to this research projects and its objectives, at the end of the e-mail, recipients were asked to give their feedback on the proposed business model canvas in table 4.

Feedback questions were structured according to three aspects: Viability, Feasibility, and Desirability (Brown, 2009):

Is the canvas most likely to be sustainable?

Can it be achieved to cost and time budgets?

Is it functionally possible?

Does the canvas make sense?

Is there a significant need for it?

How easily can the business model be transitioned?

According to the feedback, media firms, CRITS, can create greater value from open innovation if they also incorporate stakeholders as key partners and invest in policy hubs. These two changes were added to the business model canvas in table. 4 (terms in red represent the new added values after receiving feedback). Figure 13 shows a summary of the received feedback in a capture-grid layout.

| LIKES | CRITICISM |
| --- | --- |
| Sustainable<br>Rational<br>Requires low budget<br>Encourages R&D to practice open innovation<br>Can be implemented also on non-R&D departments. | Too much openness risks lost in intellectual rights, a patent policy is missing |
| **QUESTIONS** | **IDEAS** |
| How can you convince the corporate strategy of Rai to be changed?<br><br>Does CRITS have current open job positions? How often does CRITS hire new employees? | The idea of innovation incubators can be expanded to cover Innovation policy hubs that connects top managers, R&D engineers, journalists, producers, innovation specialists and external corporation together. |

*Figure 12 Feedback-Capture Grid of the "To-be" canvas*

# BUSINESS ROADMAP

A Business Roadmap helps to successfully implement the new business model by creating a practical action plan. Designing the new business model to CRITS in the previous chapter was one important thing, but how can it put it into practice? How can CRITS move from traditional closed model to a networked open model? *With a clear mapping and planning of an adaptive competency portfolio, Rai can make it happen.* Business model innovation means changes in value propositions and key activities which requires a logical modification to organisational flow of knowledge (Martin 2009). Thus, to help CRITS make the migration from the "As-Is" to "To-be" business model, this chapter presents a roadmap to the "To-be" business model canvas.

1. *The starting point was brainstorming the key-points and differences between the current and future business model.*

The below grid summarises the main brainstorming conclusion. It can be induced that the roadmap shall be framed from a HR managerial perspective.

| |
|---|
| 1: What are the core changes? |
| *-Networking and collaborative innovation;* |
| *-Integration of Creativity and technology;* |
| *-Incorporation of Users.* |
| 2: What are the needed specific actions? |
| *-Adaptation of organisational resources pool and routines.* |
| 3: What is the ideal path? |
| *-Developing a competency model and framework for organisational learning.* |
| 4: What are the critical points and constraints? |
| -Organisational inertia of CRITS and managerial cognitive traps. |

2. *Build an inventory of current R&D resources and competencies.*

Based on theoretical and practical deductions of competency clusters in various innovation departments in European media firms, Figure 14 represent an inter-resource samples of BBC R&D and VRT's innovation department in comparison with CRITS (Sourced from their official websites, 2019)

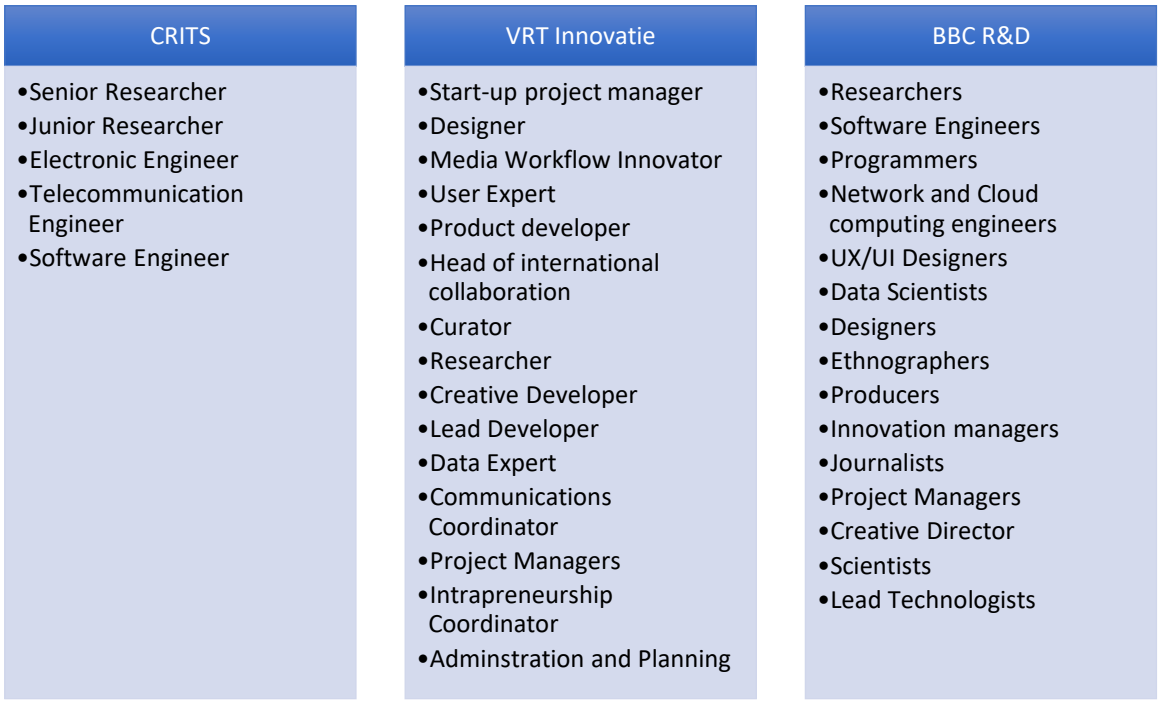



*Figure 13 Current organisational competencies in CRITS, VRT Innovatie, and BBC R&D*

3. *Build a shopping list of needed resources and competencies*

Therefore, drawing on the above, *CRITS' resources pool renders innovation with a scientific applicability, while it lacks* a list of notable skills and abilities can be assumed to be presented in BBC R&D and VRT Innovatie, thus the below are the needed complementary resources that CRITS' needs.

- Design mind-set
- Creative thinking;
- Business mind-set;

- Expert on new media literacy;
- Project management & Strategic planning
- Entrepreneurial skills and communicators

If those skills aren't complemented, the "To-be" business model canvas will not be functionally possible. As a result, the ideal path chosen for the roadmap is to direct on the best way to develop complementary competencies.

4. *Build a roadmap for the needed competencies*

To an original layout, figure 15 conceptually visualises a planned roadmap for the business model canvas defined in chapter 6.

The roadmap is self-explanatory and tackles three trade-offs

1. The first trade-off is CRITS' absorptive capacity; the ability to put external knowledge to effective use (Cohen & Levinthal, 1990). A skilled learning organisation is not only characterised by its skills for creating, but also acquiring and transferring knowledge and at modifying its behaviour to reflect new knowledge and insights (Garvin, 1983).
2. A second trade-off is between the levels of functional dynamic capabilities; Dynamic capabilities, represent intermediate steps between organizational learning capability and organizational performance (Zollo & Winter, 2002; Easterby-Smithh & Prieto, 2008).
3. A third trade-off is on organisational performance; ambidexterity is not only a cultural attitude of capabilities and absorptive capacity, but also specific performance actions to make sure progress is under close coordination (Cantamessa & Montagna, 2015).

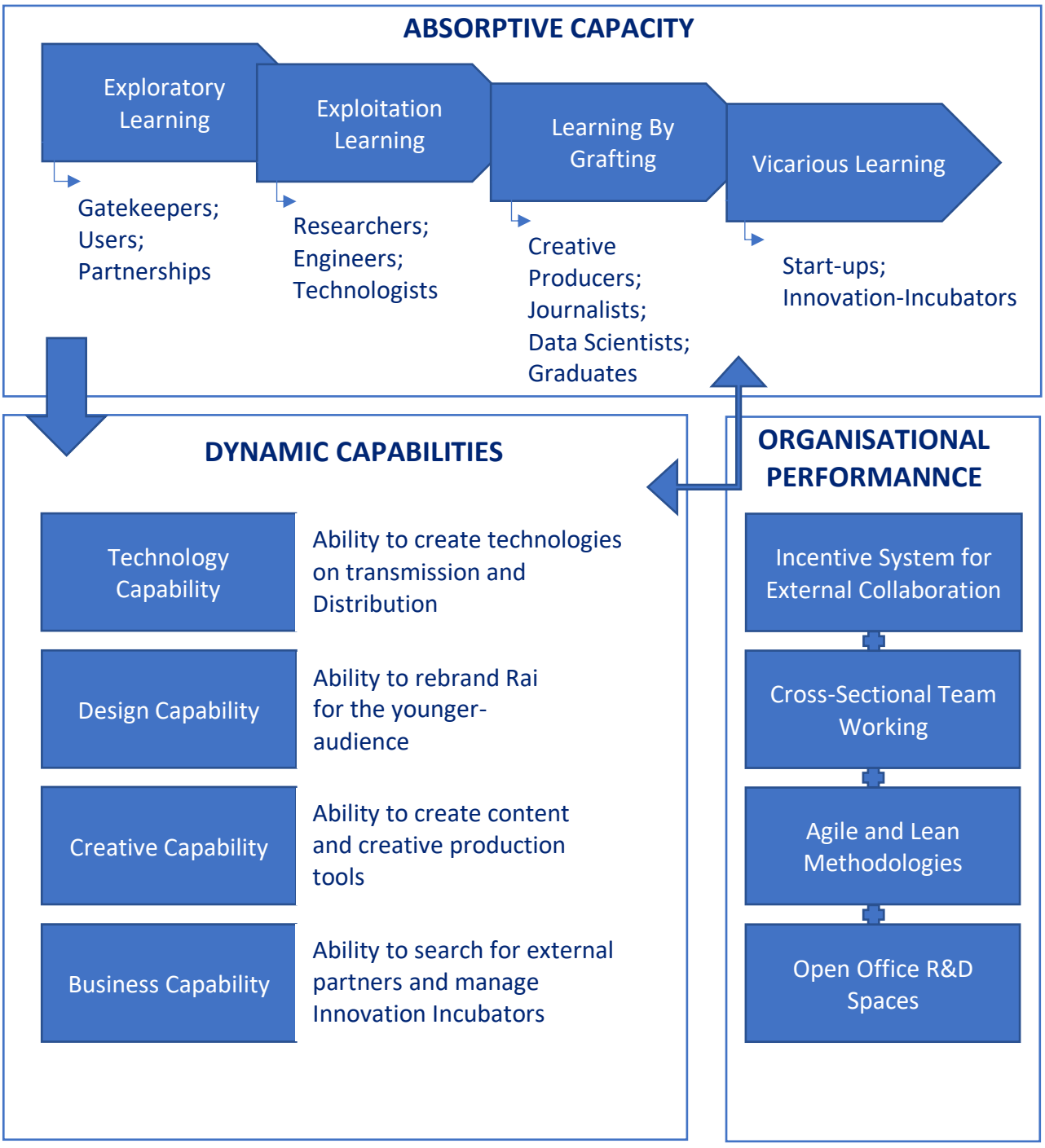



*Figure 14 Business Roadmap for CRITS*

# CHAPTER 7

# CONCLUSIONS

This chapter states a brief description to the main research conclusions and provides recommendations on future work

The aim of the thesis was to investigate whether, R&D in a way or another, remains vital for innovation. This hypothesis was tested through a literature review of key theoretical concepts and a qualitative study on R&D practices in BBC and Rai. According to the thesis's findings, it appears that R&D will continue to be a matter of great importance, but must transition to external experimentation with lead users and industry partners. R&D once prized for their independence and proprietary on scientific research, now must adapt to market scenarios and user demands.

The unceasing march of digital technology into the heart of media industry means that the scope of R&D has changed. R&D in media has become *a* source of innovation, and not t*he* source of innovation. Thus, R&D must evolve from its vertical narrow approach towards a more horizontal task-segmented one in which open innovation becomes a standard practice to responding to strategic challenges. Thus, as media innovation continues to converge, R&D will remain vital, but it must adapt to the changing market scenarios and innovation conditions**.**

The main conclusions from the previous seven chapters can be summarised as the following:

1. *R&D transitioned from internal-closed innovation to networked collaboration and co-innovation with users;*

Three consecutive phases can be defined as the driving forces in the media environment; "Monopoly, Market Competition, The Digital Era". In monopoly and

market competition, R&D was devoted to scientists and engineers working on technical and distribution infrastructure, recording, production and transmission technologies. This led to both symbolical and real independent subculture between R&D and other business units, in the sense, media departments practiced creativity and dealt with securing market share and user demands, while R&D captivated new technologies and developed incremental innovations. After media digitalisation, the long-standing technological captivity of R&D faced a retracted position, and innovation diverged at an alarming pace towards a market driven approach. Media industry faced *a major shift in consumer behaviour, fundamental change in competitive environment, and content is now being consumed anywhere, anytime and on any device*. R&D was forced to welcome a focus on "reinventing media for the younger audience". During the digital era, corporate profits have declined while the cost of R&D continued increasing R&D was shifted to creating good storytelling and better quality of content to compete against rivals in attracting and manoeuvring the attention of younger audiences.

2. *Open innovation is the new approach to R&D practices*

Before the digitalisation of the media industry, R&D was practiced with a strong influence of scientific context and linear model of innovation. R&D has traditionally been separate from, and subservient to users, it has also been an enabler of, not a contributor to, the generation of content.

Technology and creativity merged to one field of innovation. While technology is the practice of long-term innovation and development, creativity is per se of short-termed type characterised by a continuous need for newness. This has created a demand for new approaches to R&D innovation. Many media firms diverged to an open innovation model based on a networked collaboration with technology clusters and creative idea acceleration with lead-users. Open innovation did not only disrupt how R&D is practiced, but also the way in which major R&D departments are internally organised

and managed. There has been a cultural dichotomy in R&D resources pool and competencies of open innovation conditions. Drawing on the case of BBC, it has accumulated new competencies from merging its design department with BBC research, it has also constructed an innovation incubator that act as an external media lab and collaborates with lead users and experts. CRITS' preserved its traditional model of R&D from the monopoly and market competition days, its current model has now become a barrier to change and lead to a potential decline in its value propositions. Thus, R&D departments that continues to be organised as a parallel structure of technologists and engineers, are feeling the pain of their path dependency.

3. *How Open innovation can be practiced in media?*

The last three chapters of the thesis provides a synthesis on how any media firm can integrate open innovation into its *operational, managerial and organisational* parts. Key-concepts can be summarised on four core aspects:

- *R&D organisations should embrace the cultural duality of technology and creativity in its competency portfolio management.*
- *R&D must be geared towards a scaling up to networked ecosystems and connect technology experts, creators and media organisations together. Great initiatives and services such as the EU-funded MediaRoad are already paving the way on the European level.*
- *Nonetheless, R&D must continue to unlock the potential of the ongoing digital transformation and support with the development of new technologies (e.g. IP, cloud infrastructures, cybersecurity, big-data etc.) globally*
- *Finally, there is various evidence and an explicit necessity for a prominent inclusion of Digital Innovation Hubs into the scene of R&D in media. Innovation hubs would foster cross-sectorial collaboration and bridge R&D, technological innovation and creative content creation. R&D can practice user-centric methodologies "such as*

*six-sigma, design thinking, agile methodologies" with lead-users and accelerate the innovation cycle.*

Furthermore, the thesis suggests a new business model framework for practicing R&D in the context of media. The business model canvas could be of great help to any large or small media firm, that is having difficulty or seeking opportunity to transition towards open innovation. Moreover, the case-study could be of the interest of academic and scholars, who search for real-firms case studies in the context of business and media. In addition, the thesis shows successful results from practicing design thinking in emerging fields from outside the context of design, such as the business model innovation.

Case studies on R&D are a neglected field of media research. This could be so because the current tendency to think of innovation in present day terms, as exclusive to tech and IT companies like Apple and Google. This thesis shows that term media firms and innovation are inextricably. However, most research on R&D in media is done from a higher-perspective level, it is recommended that more research should be done on a real firm-practice level. More research should be done on new themes of innovation in media, such as big data, machine learning, artificial intelligence.

In the end, Research on media and open innovation is will certainly continue to grow as a main research specialty in coming decades. As media consolidation continues, there will be an increased demand for a better understanding for relationship between media, management, economics, and innovation. Consequently, more media research should be focused on delivering insights into effective management practices.

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# APPENDICES

**APPENDIX A : RAI CRITS**

Content (CRITS)

*Table 5 CRITS R&D activity on Content*

| Period | Project | Project Tag |
|---|---|---|
| 1990-2000 | Archives and digital Thecae | Audiovisua, Betacam, Storage |
| 1990-2000 | DigiMaster | Digital Archives |
| 2000-2010 | European Project PrestoPrime | Digtial Archives |
| 2000-2010 | ANTS project (Automatic Newcast Transcription System) | ASR (Speech Recognition), Automation |
| 2000-2010 | System for scanning News | Big Data, FTP (File Transfer Protocol), Computarised News |
| 2010-2020 | RAI Like | Big Data |
| 2010-2020 | Recommender Systems for Audio and Video Contents | Personalized Radio, Recommender System, Privacy |
| 2010-2020 | Personalized Linear Radio | Personalized Radio, Recommender System |
| 2010-2020 | Metadata standard for interoperable Recommender Systems | Big Data, Recommender System |
| 2010-2020 | ATLAS Project | LIS, Interactivity |
| 2010-2020 | TV and Social Web | EPG (Interactive Program Guides), Interactivity |
| 2010-2020 | HEAD project (Human Empowerment Aging and Disability) | Interactive Program Guides, Interactivtiy |
| 2010-2020 | Data Driven Journalism | Big Data |
| 2010-2020 | Bridget Project | Digital Archive |

Production (CRITS)

*Table 6 CRITS R&D activity on production*

| Period | Project | Projects Tag |
|---|---|---|
| 1990-2000 | Watermarking Digitale | |
| 1990-2000 | HDTV (Eureka 256) | |
| 2000-2010 | 3DVMS | 3D, VMS, Surround |
| 2000-2010 | 3D Interactive Computer Generated (CG) | GPU, Set-top boxes, Smart TV |
| 2000-2010 | Beyond HDTV | 4K, UHDTV |
| 2000-2010 | Computerization of Production | |
| 2000-2010 | Loudness | Advanced Audio |

| | | |
|---|---|---|
| 2000-2010 | Hyper Media News | RSS (Rich Site Summary), Video Production |
| 2000-2010 | Experimental System for visual search on Broadcast archives | Video Production |
| 2010-2020 | 4K, the evolution of Television | 4K, DVB-T2, UHDTV |
| 2010-2020 | HDR | 4K, HDR, UHDTV |
| 2010-2020 | Augmented Reality and Mixed Reality | New Media |
| 2010-2020 | Interaction Man Media | New Media |
| 2010-2020 | Technology for "Data Journalism" activities | Big Data, Data driven journalism |
| 2010-2020 | QC - Quality Control (Audio-visual Quality Control) | Digtial Archives |
| 2010-2020 | IP- Based Systems and technologies for Television Production | Encoding Video |
| 2010-2020 | Deep learning applied to video encoding system | Encoding Video |
| 2010-2020 | Next Generation Audio | Advanced Audio |
| 2010-2020 | Networked Audio | Advanced Audio |
| 2010-2020 | Multidrone (H2020) | Video Production |
| 2010-2020 | Deep Networks in Content Management Systems | Video Production |
| 2010-2020 | Supporting Media Workflows on Advanced Cloud Object Store Platforms | Big Data, Archive |
| 2010-2020 | Integrated Production Systems for Companion Screen | Video Production |
| 2010-2020 | Integration of Semantic Networks in Multimedia Production and Archiving | Video Production |
| 2010-2020 | Educating City | Digital Archives |
| 2010-2020 | Metadata Standard for interoperable Recommender Systems | Big Data |
| 2010-2020 | Testing Sony IP Live Production Chain | Encoding Video |
| 2010-2020 | Stretched TV for improved accessibility | Interactive Television |
| 2010-2020 | RAI Remote Controller | Interactive Television |
| 2010-2020 | Rai -LIS Project | LIS (Italian Sign Language) |

Distribution (CRITS)

| Period | Project | Project Tag |
|---|---|---|
| 1990-2000 | Satellite Transmission | |
| 1990-2000 | DVB | |
| 1990-2000 | DAB | |
| 1990-2000 | RDS | |
| 2000-2010 | DVB-H | |
| 2000-2010 | DVB-2nd Generation | |
| 2000-2010 | DVB-T | |
| 2000-2010 | Collaboration between CRIT, BBC, NHK on DVB-H and Mobile TV | |
| 2000-2010 | MIND (Multimedia in Digital Radio) | DAB, DAB+ |
| 2010-2020 | Digital Radio | DAB, DAB+, MIND, Digital Radio, Hybrid Radio, Personalised Radio |
| 2010-2020 | RaiPlay on connected TV | OTT, Interactive Television |
| 2010-2020 | 5G Broadcast Demonstration during the European Championships 2018 | 5G |
| 2010-2020 | Mitigation Techniques of the interference generated in TV Distribution installations by 4G/5G singals in the 700 and 800 MHz bands | 4G, 5G, DVB-T, DVB-T2, UHF |
| 2010-2020 | Assessment of the interference generated by the LTE signa on the head-end ampilfiers of the TV reception systems | 4G, DVB-T, UHF |
| 2010-2020 | Analysis of the Interferenc generated by TV White Spaces on TV reception systems | White Spaces |
| 2010-2020 | Vortex waves: Possible applications for radio communications | OAM (Orbital Angular Momentum of Light) |
| 2010-2020 | Long term perspectives of DTT Convergence towards 5G: Application of 3GPP Rel-14 to Italian Scenarios | 3GPP, 5G, eMBMS |
| 2010-2020 | DVB-I | DVB-I, IP, OTT (TV distribution over the Internet) |
| 2010-2020 | TV signals on ultra-wideband optical fibre networks | CEI, Optical Fibres, OTT |
| 2010-2020 | Satellite transmissions beyond S2X | DVB-S2, DVB-S2X |
| 2010-2020 | Application of the WiB concepts to DVB-T2 | WIB |
| 2010-2020 | DAB+ signal propagation in tunnels | DAB (Digital Audio Broadcasting) |
| 2010-2020 | IP-based Systems and Technologies for Television Production | IP, OB Van |
| 2010-2020 | DVB-S2X- the DVB-S2 extension for the future of satellite communications | 4k, DVB-S2 |
| 2010-2020 | Single Illumination | DTT, DVB-S2, DVB-T2, SFN |
| 2010-2020 | TV over the Internet: OTT distribution of audio/video content | CDN, IP, OTT, Smart TV |
| 2010-2020 | ESA Scorsese Project | CDN, DVB-S2, OTT |
| 2010-2020 | SFN Scope: an innovative analysis system for DVB-T SFN signals | DVB-T, SFN |

| | | |
|---|---|---|
| 2010-2020 | Experimentation of the coexistence of PMSE services and LTE in the 2.3-2.4 GHZ band | |
| 2010-2020 | The DVB-T2/LTE-A+Trial | 4G, LTE-A |
| 2010-2020 | Laboratory evaluation of the Demetra system for the distribution of time/ frequency references via geostationary satellite | DTT, DVB-T, GNSS, GPS, SFN |
| 2010-2020 | Link optimization between aerial shooting system and OB van | OB Van |
| 2010-2020 | DVB-T2: single frequency network in Aosta Valley | DTT, DVB, DVB-T, DVB-T2 |
| 2010-2020 | DVB-T2 lite in Aosta Valley | DTT, DVB, DVB-T, DVB-T2, DVB-T2 Lite |
| 2010-2020 | Networks and Protocols IP | Optical Fibers, WiMAX |
| 2010-2020 | 800 Mhz LTE interference on UHF TV reception: Laboratory characterization of antenna amplifies | UHF |

**APPENDIX B: BBC R&D**

Content (BBC R&D)

*Table 7 BBC R&D activity on Content*

| Period | Project Name | Project Tag |
|---|---|---|
| 2004-Present | Piero (Sports Graphic System) | Video, Graphics & Effects, Sport |
| 2005 | BBC Backstage | |
| 2007 | BBC Redux | Archive, Video On-Demand |
| 2008-2010 | MyMedia | |
| 2010-Present | Mood Metadata | On Demand, Audio, Video, User Interfaces, Metadata, Internet, Archives, Content Discovery |
| 2010-2010 | Mythology Engine | Content Discovery, User Interfaces, Audiences, metadata, Internet, Television |
| 2011-Present | Snippets | Achive, Content Discovery |
| 2011-2012 | The programme List | Personalisation, Content Discovery, User Interfaces, Radio, Television, On Demand, Internet |
| 2011-2012 | KiWI | Metadata, Content Discovery, Automation, Radio |
| 2011-2014 | The World Service Radio Archive | Internet, Archives, Participation, Content Discovery, Metadata, Audio, Radio |
| 2011-2012 | Roar to Explore | Interactivity, Accessibility, Content Discovery, Audio |
| 2011-Present | Natural Language Processing | Metadata, Archives, Content Discovery, Content Analysis Toolkit |
| 2011-Present | Multimedia Classification | Archive, Recommendations, Content Discovery, Metadata |
| 2012-2013 | Making Musical Mood Metadata | Metadata, Content Discovery, Recommendations, Audio, Audio Research |
| 2012-Present | Sibyl Recommender System | Internet, On Demand, Audiences, User Interfaces, Recommendations, Personalisation, Content |
| 2012-Present | Companion Screens | Synchronisation, Content Discovery, User Interfaces, Interactivity, Devices, Television |
| 2012-Present | Internet of Things | User Interfaces, Live, Interactvity, Audiences, Internet |

| | | |
|---|---|---|
| 2012-2013 | R&D Website refresh | User Interfaces, Internet, Archives |
| 2012-2016 | Subtitles Quality | Television, Personalisation, Live, Synchronisation, Audiences, Quality, Accessibility, UX |
| 2012-Present | Connected Studio | Content Discovery , Innovation Incubator |
| 2012-Present | BBC News lab | Content Discovery , Innovation Incubator |
| 2012-Present | Shuffle | User Interfaces, Recommendations, Audiences |
| 2013-Present | Venue Explorer | Audio, Video, Live, Interactivty, Graphics & Effects, Sport |
| 2013-Present | Unconventional Screens | UX, Interactivity, Video, Personalisation, Immersion, Content Visualisation |
| 2013-Present | Audio Visualization | User Interfaces, Audio, Content Discovery, Editing |
| 2013-2015 | Playlist Button | User Interfaces, Radio, Personalisation, Live, Interactivity, Devices, Content Discovery, Audiences |
| 2014-Present | StoryArc | User Interfaces, Radio, Metadata, Internet, Editing, Content Discovery, Audiences, Archives |
| 2014-Present | Elastic News | Atomised News |
| 2014-2014 | Snackable News | Atomised News |
| 2014-2017 | Editorial Algorithms | Metadata, Internet, Archives, Content Dicovery, Content Analysis Toolkit |
| 2014-2016 | Codam | Content Analysis Toolkit, Internet Research and Future Services |
| 2014 | 360 Video and Virtual Reality | VR, AR & 360 Video, Immersive and Interactive Content |
| 2015-Present | Visual Perceptive Media | Audiences, Video, Personalisation |
| 2015-Present | Story Expolrer | Stories, On demand, Television, User Interfaces, Radio, Metadata, Internet, Inetarcitivy, Audio |
| 2015 | YourStory | Content Discovery |
| 2015 | Micro:bit Prototype | Audience, Devices |
| 2016-Present | BBC Taster | Content Discovery, User Interfaces, Audiences, Innovation Incubator |
| 2016-Present | Talking with machines | User Interfaces, Content Discovery, Devices, Interactivity, Audiences, Audio, Accessibility, Voice |
| 2016-Present | Cook-Along Kitchen Experience | UX |
| 2016 | Newsbeat Explains | Audience, Elastic News |
| 2017-Present | Culture UK | |
| 2017-Present | BBC Taster App on Android and IoS | Content Discovery, User Interfaces, Audiences |
| 2017-2022 | Data Science Research Partnership | Data, Understanding Audiences, Curation and Personalisation, Content of the Future |

| | | |
|---|---|---|
| 2017-Present | BBC Reality Lab | Production, Content Formats, Internet, Graphics & Effects, Devices, Participation, Interactivity, Immersion, Video, Innovation Incubator |
| 2017-2018 | Reinventing the News Article | Production, Content Formats, Personalisation, Interactivty, User Interfaces, Journalism |
| 2018-Present | Living Room of the Future | Personalisation, Devices, Interactivity, Social |
| Present | DataBox | Internet, Audiences, Data |

Production (BBC R&D)

*Table 8 BBC R&D activity on Content*

| Period | Name of Project | Project Tag |
|---|---|---|
| 1995-1998 | NICAM Stereo | |
| 1990-2000 | HDTV | |
| 1990-2000 | Camera Tracking System | |
| 1990-2000 | First Demonstration of Audio Description | |
| 2000-Present | Loudness | Quality, Audio, Immersive and Interactive Content, Audio Research |
| 2005-2008 | iview: free-viewpoint video | Graphics & Effects, Visual Computing for Production, Immersive and Interactive Content |
| 2006-2009 | Beyond HD | Immersion, Quality, Video, Television, Immersive and Interactive Content |
| 2007-2011 | VSAR | Immersive and Interactive Content, Visual Computing for Production, Interactivity, Graphics & Effects, Live, Television, Video |
| 2008-Present | High Frame Rate TV | Video, Television, Quality, Broadcast |
| 2009-Present | VC-2 | Video, Quality, Production, Networks, Internet |
| 2009-Present | Ingex | Video, Metadata, Editing |
| 2009-2013 | FascinatE | Immersion, Audio, Video, Visual Computing for Production, Immersive and Interactive Content |
| 2009-Present | halfRF HD/UHD radio-camera | Television, Performance, Quality, Video |
| 2011-2014 | Re@ct | Immersive and Interactive Content, Visual Computing for Production, Graphics & Effects, Interactivity, Video |
| 2011-2015 | Audio Un-Mixing | Editing, Quality, Audio Research, Immersive and Interactive Content |
| 2011-Present | Portable Production Tool | User Interfaces, Participation, Television, Editing Production |
| 2011-Present | Spatial Audio for Broadcast | Audio, Immersive and Interactive Content, Audio Research |
| 2012-2012 | Stagebox | Internet, Video, Live, television, Multi-Camera Productions |

| | | |
|---|---|---|
| 2012-Present | IP Studio | Video, Metadata, Networks, Synchronisation, Internet, Production |
| 2012-Present | Internet of Things | User Interfaces, Live, Interactivity, Audiences, Internet |
| 2012-Present | Future Audio Formats | Editing, Metadata, Audio |
| 2012-Present | Augmented Video Player | On Demand, Interactivity, Video, Graphics & Effects, Visual Computing for Production, Immersive |
| 2013-Present | Radiodan | Devices, User Interfaces, Radio |
| 2014-Present | Nearly Live Production | Production, Editing, Live |
| 2014-Present | High Dynamic Range Television and Hybrid Log-Gamma | Distribution, Production, Editing, Quality, Live, Graphics & Effects, Broadcast, Archives, Recommendations, Television, Video |
| 2015-2017 | Tellybox | User Interfaces, Television, Audiences |
| 2015-Present | Squeezebox | Production, Editing, Video, UX |
| 2015-Present | Discourse | Editing, Production, User Interfaces, Immersive and Interactive Content, Audio Research |
| 2015-2018 | ORPHEUS | Audio |
| 2016-Present | Paper Editor | Editing, Production, User Interfaces |
| 2016-Present | Multiplayer Broadcasting | Graphics & Effects, Interactivity, Content Formats, Production, VR, AR & 360 Video, UX |
| 2016-Present | Object-Based Production Tools in the cloud | Production, Editing, Internet, Metadata |
| 2017 | BBC Reality Lab | Production, Content Formats, Internet, Graphics & Effects, Devices, Participation, Interactivity, Immersion, Video |
| 2017-2018 | Reinventing the News Article (Developing innovative story formats for online news) | Production, Content Formats, Personalisation, Interactivty, User Interfaces, Journalism |
| 2017-Present | Narrative Structures for Responsive Media (AR, VR and 360 Video) | Interactivity, Personalisation, Participation, Production, Immersion , Quality |
| 2018-Present | IP Production Facilties | Production, Networks, Video, Audio, Metadata, Live, Devices, Internet, Synchronisation, Automation, Television, Radio |
| 2018-Present | AI in Media Production | Production, Editing, Quality, Television, Radio, Video, Audio, Automation |
| 2019 | Perceptive Audio | Object-Based-Media |

Distribution (BBC R&D)

*Table 9 BBC R&D activity on Distribution*

| Period | Project | Project Tag |
|---|---|---|
| 1990-2000 | YouView | TV-on Demand |
| 1990-2000 | Internet name BBC.co.uk | |
| 1990-2000 | DAB | |
| 1990-2000 | DVB | |
| 1995-1998 | Atlantic | |
| 1990-2000 | Demonstration of Free-d camera tracking system at IBC | |
| 1990-2000 | Digital Radio | |
| 1997-Present | DTT | |
| 2000-2010 | FreeSat | |
| 2000-2010 | FreeView | |
| 2000-2010 | FreeView Play | |
| 2000-2010 | FreeView HD | |
| 2006-2010 | End to End Mimo Broadcast System | |
| 2006 | DVB-T2 | |
| 2007 | iPlayer | |
| 2008-Present | RadioVIS | |
| 2009-Present | TV White Spaces Devices | Television, Devices, Performance, Internet |
| 2009-Present | Adaptive Bitrate Technology | Broadcast and Connected Systems, Devices, Live, On Demand, Internet, Radio, Television |
| 2009-Present | Broadcast Record Lists | Broadcast and Connected System |
| 2010-Present | Video Coding | Distribution Core Technologies, Video Processing for compression, Broadcast, On Demand, Internet, Quality, Performance, Television, Video |
| 2011-Present | Broadcast WAV File Format | Audio, Audio Research, Immersive and Interactive Content |
| 2011-Present | Optimal Interlacing | Quality, Broadcast, Television, Video, Broadcast and Connected Systems |
| 2012-Present | IP Studio: Lightweight Live | End to End Broadcasting |
| 2010-2020 | BBC R&D collaborates with NHK for defining two HDR transfer functions | |
| 2012-Present | Internet of Things | User Interfaces, Live, Interactivity, Audiences, Internet |
| 2012-Present | Dynamic Adaptive Streaming over IP Multicast | Distribution , Internet, Networks, Television, Video, Live |

| | | |
|---|---|---|
| 2013-2015 | THIRA | Video Processing for compression, Performance, Television, Quality, Internet, On Demand, Video, Broadcast |
| 2013-2017 | Provision | Video, Video Processing for Compression |
| 2013-Present | 4G and 5G Broadcast | Mobile, Distribution, Devices, Broadcast, Television, Video |
| 2014-Present | High Dynamic Range Television and Hybrid Log-Gamma | Distribution, Production, Editing, Quality, Live, Graphics & Effects, Broadcast, Archives, Recommendations, Television, Video |
| 2016-2018 | COGNITUS | Video Processing for compression, Distribution Core Technologies |
| 2016-Present | Broadcast WIFI | Broadcast, Networks, Distribution, Performance, Live |
| 2017-2019 | 5G-Xcast | Mobile, Distribution, Networks |
| 2018-2019 | New Audience Experiences ffor Mobile Devices | Mobile, Distribution, Imeersion, Devices, Networks, Internet, Graphics & Effects, Interactivity |
| 2018-Present | Low latency UHD live streaming with MPEG DASH | Distribution, Networks, Live, Internet, Television, Radio, Video, Audio |
| 2018-Present | Computing and Networks at scale | Networks, Automation |
| 2018-Present | Building a Public Service Network | Social, Netowkrs, Internet, Audiences |
| 2018-Present | Cloud-Fit Production Architecture | Networks, Internet, End-to-End IP Broadcasting, Automated Production and Media Management |

**APPENDIX C**
**RAI**

| PERIODO | TECHNOLOGY PUSH | MARKET DEMAND PULL | TOTAL | |
|---|---|---|---|---|
| 1930-1935 | Trasmettitori radiofonici | - | 1 | 0 |
| 1936-1940 | Trasmettitori di disturbo | - | 1 | 0 |
| 1941-1945 | Trasmettitori di disturbo | - | 1 | 0 |
| 1946-1950 | test ripresa televisiva | - | 1 | 0 |
| 1951-1955 | adattamento installazioni a standard europeo | - | 1 | 0 |
| 1956-1960 | Filodiffusione, ponte radio televisivo mobile, forme d'onda per stato impianto | - | 3 | 0 |
| 1961-1965 | ponte radio televisivo mobile, prototipo memoria di quadro digitale, studio tv a colori | - | 3 | 0 |

| | | | | |
|---|---|---|---|---|
| 1966-1970 | prototipo memoria di quadro digitale, studio tv a colori | - | 2 | 0 |
| 1971-1975 | standard teletext, codifica digitale segnale televisivo, RDS | - | 3 | 0 |
| 1976-1980 | codifica digitale segnale televisivo, RDS, applicazione per formato MAC, studio su trasmissione satellitare | - | 4 | 0 |
| 1981-1985 | studio HDTV, studio su trasmissione satellitare, RDS | - | 3 | 0 |
| 1986-1990 | studio HDTV, studio su trasmissione satellitare, RDS | - | 3 | 0 |
| 1991-1995 | studio HDTV, studio su trasmissione satellitare, studi standard DVB, DAB, RDS | | 5 | 0 |
| 1996-2000 | studio HDTV, DVB-H, watermarking digitale, DigiMaster, Archivi e teche digitali, DAB | | 6 | 0 |
| 2001-2005 | studio HDTV, DVB-H, DigiMaster, Archivi e teche digitali, DVB-T, DVB 2nd gen | accessibilità (gruppo EBU P/AS) | 6 | 1 |
| 2006-2010 | DVB-H, PrestoPrime, DigiMaster, Archivi e teche digitali, DVB 2nd gen, Oltre l'HDTV, sonda sferica, progetto ANTS, sistemi di prod su piattaforme cloud avanzate, visual search per archivi tv, reti semantiche in prod e archivi multimediali | ATLAS, RAI-LiS, Multimedia in digital radio | 11 | 3 |
| 2011-2015 | PrestoPrime, DigiMaster, Archivi e teche digitali, studio interferenze segnali LTE su impianti ricezione tv, studio interferenze white spaces su impianti ricezione tv, Single Illumination, DVB-S2X, SFN Scope, Oltre l'HDTV, sonda sferica, sistemi di prod su piattaforme cloud avanzate, visual search per archivi tv, reti semantiche in prod e archivi multimediali, metadati standard per sistemi raccomandazione, RAI Like, radio digitale, DAB+ in galleria, Studio mitigazione interferenze segnali 4G/5G su impianti distribuzione tv, sperimentazione catena di produzione Sony IP Live, sistemi e tech IP per prod tv, reti e protocolli, networked audio, TV e social web | ATLAS, RAI LiS, HEAD, Stretch TV, Multimedia in digital radio, radio lineare personalizzata, metadati standard per sistemi raccomandazione, radio digitale, interazione uomo-media, Data Journalism, Bridget | 23 | 11 |
| 2016-2019 | DigiMaster, Archivi e teche digitali, studio su applicazione onde vorticose, applicazione WiB al DVB-T2, Oltre l'HDTV, 4K tv evoluta, High Dynamic Range, sonda sferica, metadati standard per sistemi di raccomandazione, sistemi di prod su piattaforme cloud avanzate, visual search per archivi tv, reti semantiche in prod e archivi | RAI LiS, HEAD, Stretch TV, metadati standard per sistemi di raccomandazione, radio lineare personalizzata, radio digitale, interazione uomo media, AR e realtà mixata, Data Journalism, Bridget, recommendation systems | 23 | 12 |

| | | | | |
|---|---|---|---|---|
| | multimediali, radio digitale, DAB+ in galleria, prospettive convergenza DTT verso 5G, dimostrazione 5G durante campionati europei 2018, progetto Scorsese, sperimentazione catena di produzione Sony IP Live, sistemi e tech IP per prod tv, reti e protocolli, networked audio, deep networks per sistemi di content management, deep learning per sistemi codifica video, multdrone | | | |

**APPENDIX D**
**BBC**

| PERIODO | AGGREGATION | | TECHNOLOGY PUSH | DEMAND PULL |
|---|---|---|---|---|
| 1930-1935 | 1 | 0 | Test ripresa televisiva | - |
| 1936-1940 | 1 | 0 | microfono L1 | - |
| 1941-1945 | 1 | 0 | test trasmissioni VHF/FM | - |
| 1946-1950 | 1 | 0 | microfono L2 | - |
| 1951-1955 | 1 | 0 | convertitore standard televisivi, | - |
| 1956-1960 | 2 | 0 | trasmissione a colori con standard NTSC, prototipo videoregistratore VERA | - |
| 1961-1965 | 4 | 0 | prototipo convertitore multi-standard, test standard tv a colori, studi digitale per la tv, sincro segnali audio e tv | - |
| 1966-1970 | 2 | 0 | convertitore standard, trasmissioni a colori | - |
| 1971-1975 | 4 | 0 | convertitore standard digitale, registrazione digitale segnali audio, teletext, trasmissione segnali tv digitali | - |
| 1976-1980 | 4 | 0 | trasmissione segnali tv digitali via satellite, registratore audio digitale multicanale, RDS, teletext | - |
| 1981-1985 | 3 | 0 | HDTV, watermarking, RDS | - |
| 1986-1990 | 4 | 0 | HDTV, predizione movimento immagini, editor audio digitale, RDS | - |
| 1991-1995 | 4 | 0 | HDTV, NICAM audio, DAB, tv digitale | - |
| 1996-2000 | 5 | 3 | HDTV, camera tracking system, infrastruttura DVB, radio camera digitale, Atlantic, | audio description, BBC website, Digital Radio |

| | | | | |
|---|---|---|---|---|
| 2001-2005 | 6 | 5 | HDTV, DVB, single-chip DTT demodulator, adaptive bitrate technology, Video Coding | speech recognition, Freeview, Piero, Beyond HD, BBC iPlayer |
| 2006-2010 | 5 | 8 | HDTV, MIMO sistema broadcast, UHD, halfRF UD/UHD radio camera, VSAR | accessibilità, Freesat, Freeview, Piero, IPTV, BBC iPlayer, MyMedia, digitalizzazione archivi (Redux) |
| 2011-2015 | 10 | 28 | UHD, HDR, Dynamic Adaptive Streaming over IP Multicast, Speech to Text, PRPHEUS, Thira, Provision, Augmented Video Library, Broadcast Wav Format | accessibilità, DVB, Piero, Youview, BBC Taster, Freeview, IPTV, Connected Studio, micro:bit, BBC iPlayer, Human Data Interaction, 360 Video and Virtual Reality, SqueezeBox, Codam, Live Production, Visual Perceptive Media, Connecyed Studio, BBC News Lab, Snackable News, Story Explorer, Elastic News, StoryArc, Subtitle Quality, Radio Tag, Portable Production Tool, Snippets, micro:bit, digitalizzazione archivi (Redux) |
| 2016-2019 | 16 | 31 | UHD, HDR transfer functions, HLG, audio binaurale, standard H265, next-gen audio, IA, 5G radio trials, Clout Fit Production Architecture, 5G-Xcast, AI in Media Production, Perceptive Radio, Augmented Video Library, Broadcast Wav Format | accessibilità, DVB (HbbTV), audio binaurale, iSpy, BBC Taster, IPTV, AR (Civilisation app), VR (BBC Taster), VR (Nothing to be written), Connected Studio, 5G/AR (Roman Baths), BBC iPlayer, CultureUKpartnership, Living Room of the future, DataBox, Data Science Partnership, StoryKit, TellyBox, Cook along Kitchen Experience, Paper Editor, Discourse, BBC News Lab, StoryExplorer, Elastic News, StoryArc, Subtitle Quality, Radio Tag, Snippets, micro:bit.digitalizzazione archivi (Redux) |

## Appendix E:

# Ricerca sull'innovazione in ambito media

Il progetto si prefigge lo scopo di valorizzare il processo di innovazione in generale all'interno di un'azienda broadcaster, non limitandosi alla sola innovazione tecnologica. A tale scopo, lo studio intende analizzare il processo di "innovazione" evidenziandone le potenzialità ed eventuali criticità.
Prima di effettuare un'analisi quantitativa, crediamo sia fondamentale conoscere il 'punto di vista' di diverse Direzioni le quali, sia pur da prospettive differenti, puntano al medesimo obiettivo, ovvero quello di 'innovare'. Per questo motivo, abbiamo preparato un breve sondaggio a cui Le chiediamo gentilmente di partecipare.
Ogni Suo commento aggiuntivo è per noi prezioso e potrà riportarlo, se lo ritiene necessario, al fondo dei questionario.

* Required

1. Cosa significa "fare innovazione" nel settore dei media e quanto è necessaria? *

Your answer

2. In che modo è cambiata l'innovazione nel settore dei media nel corso del tempo? *

Your answer

3.1 Perchè l'innovazione è importante per la business unit in cui lavora? *

Your answer

3.2 Perchè l'innovazione è importante per l'azienda in cui lavora? *

Your answer

3.3 Perchè l'innovazione è importante per l'audience dell'azienda in cui lavora? *

Your answer

3.4 Perchè l'innovazione è importante per l'intera industry dei media? *

Your answer

4. Attraverso quali metodologie/iniziative/ecc. l'innovazione può indirizzare le scelte strategiche dell'azienda? (Ad esempio: acceleratori di idee, medialab, open innovation, ...) *

Your answer

5. Quali indicatori (o una combinazione di essi) potrebbero essere identificati per misurare le attività di innovazione e/o il loro impatto in azienda ? (Ad esempio: indicatori economici, numero di brevetti, numero di pubblicazioni, numero di progetti finanziati, ...) *

Your answer

Commenti e suggerimenti

Your answer

**Grazie per la collaborazione!**

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