

## Chapter 6

# A Method for Content Analysis of (Pre-) Standardization Activities: The Case of Cognitive Radio

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### ABSTRACT

*This chapter is aimed at developing a document content analysis method to be applied in studies of standardization and technology development. The proposed method integrates two theoretical frameworks: the co-evolutionary technology development framework and the “D-N-S” (design, negotiation, sense-making) framework for anticipatory standardization. At the backdrop of the complex and diversified landscape of science and R&D efforts in the technology domain, and the repeated criticism of the weak link between R&D initiatives and standardization, the authors argue that the method offered in this chapter helps better understand the internal dynamics of the technology development process at the early stage of standardization or pre-standardization, which, in turn, can help mobilize and direct the R&D initiatives. To demonstrate the practical usefulness of the proposed method, they conduct a content analysis of the research contributions presented in the COST Action IC0905 “Techno-Economic Regulatory Framework for Radio Spectrum Access for Cognitive Radio/ Software Defined Radio” (COST-TERRA).*

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## INTRODUCTION

There is a general understanding and empirical evidence for the importance of standardization to economic development and regional competitiveness (Brykman, 2011). Scholars agree that the (technology) standardization process is a complex phenomenon, and insufficiently understood among businesses and politicians (Bousquet, Fomin, & Drillon, 2009; Delaere & Ballon, 2008; Isaak, 2006; Jakobs, 2003; K. J. Lyytinen, Keil, & Fomin, 2008). Policy makers often call for standardization process improvements (European Commission, 2007), specifically with regard to the repeatedly criticized “weak link” (Jakobs & Blind, 2011, p. 102) between standardization communities and R&D ones, or “research-to-standardization gap” (Sales, Darmois, Papadimitriou, & Bourse, 2012) – the critique, which, among others, points at the lack of direct support by the European Community for early- and pre-standardization activities. The growing complexities of Information and Communication Technologies (ICT) in general (Schneberger & McLean, 2003) and ICT standards in particular (Delaere & Ballon, 2008) aggravate the situation, which is referred to as “blurred ICT standardization landscape” (European Commission, 2007; Jakobs & Blind, 2011). The latter is also attributed to the lack of theoretical and practical understanding of the processes leading to the creation of standards. More often than not, development of a particular technology is advanced by several standards development organizations (SDOs) and/or consortia, whereas areas of standardization activities may be overlapping (Baldini et al., 2013). Thus, while focused, targeted efforts can help mobilize diverse R&D and standardization initiatives, the “blurred landscape” and the lack of tools or methods for “seeing through” makes it difficult for an observer to command the landscape view (Sales et al., 2012) and hence to efficiently contribute to the technology and standards development.

An analysis of R&D activities directed at emerging technology (i.e., technology at an early or pre-standardization stage) can be helpful in informing the policy makers and standardization professionals on the research directions in general, and on “promising findings” of the research community in particular. Seeking to respond to the contemporary academic and practitioner challenges of the standardization domain, in this work we take a closer look at diverse research initiatives contributing to the development of a particular technology. These research initiatives at the early, pre-standardization stage of technology development constitute the *venue for trying and learning* through which immature technology gradually forms into a product(s) which can be successfully standardized and commercialized (Schot & Geels, 2007; Schot, Hoogma, & Elzen, 1994). An improved understanding of the R&D process and its topical content can not only contribute to establishing the links between similar activities in R&D and standardization communities, but also strengthening existing links through the reduction of duplicate efforts – i.e., contributing to a better pre-standardization environment, which lays ground for future standardization of the technology (Sales et al., 2012, p. 22).

This paper makes a contribution by empirically examining discourses at the early stage of technology and standard evolution, which has been rarely done before (Nickerson & zur Muehlen, 2006), and thereby helps better understand the dynamics and the content of the process. To fulfil on our goals, we choose an emerging technology called Cognitive Radio. CR/SDR<sup>1</sup> (Cognitive Radio / Software Defined Radio; hereafter referred to as Cognitive Radio (CR)) – a new generation for wireless communications, which carries a promise to overcome the existing limitations and imperfections of extant technologies in spectrum access and use.

Recognizing the importance of the wireless communications in general, and CR-enabled technologies in particular, many (if not all) major SDOs and relevant regulatory organizations have embarked on developing standards or defining norms and regulation for one or another aspect of CR-related telecom-

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