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Innovation and competition in the smartphone industry: Is there a dominant design?

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ABSTRACT

The mobile phone industry is a very innovative segment within the ICT sector and the smartphone is becoming the standard configuration among the different types of mobile devices. Technical change and new product proliferation have made this industry extremely dynamic, even if market shares are highly concentrated in the hands of very few companies. The present article investigates whether a dominant design has emerged in the smartphone industry. In particular, it studies the evolution in hardware components relying upon an original dataset of product characteristics including all smartphones launched in the market between 2004 and 2013. Results show that, despite some convergence in the introduction of vertical innovations, product differentiation still characterizes the competition among manufacturers and a dominant design has not yet emerged.

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1. Introduction

Smartphones have emerged in the market as the standard configuration for mobile devices and currently represent the fastest growing market segment in the telecoms industry. For the first time, in 2013 sales of internet-connected smartphones exceeded those for more basic handsets.¹ Global mobile phone sales grew by 3.6% to 435 million units in the second quarter of 2013, for the first time smartphones accounted for more than half of the market. Although devices offering telephony and computing features were developed in the 1970s, it was not until the end of 2006, when the Blackberry was introduced onto the market by RIM, that the smartphone became a commercially successful product. In 2007 Apple entered the market by developing the first model of iPhone and soon after (June 2008), Samsung released the Samsung Instinct, a direct iPhone competitor. Since then competition in the market has been quite harsh among incumbents and between incumbents and new entrants. The recent legal battle over patents and designs between Apple and Samsung is a clear signal that smartphone vendors are fiercely competing for leadership in the market, even if Samsung is consolidating its leadership also thanks to the diffusion of Android operating system.² Despite the success of the iPhone design in the

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E-mail address: nicoletta.corrocher@unibocconi.it (N. Corrocher).¹ (<http://www.ft.com/cms/s/0/eb8ed76e-0500-11e3-9ffd-00144feab7de.html#ixzz2id9vhg8y>).² In August 2012, the court obliges Samsung to pay Apple just over \$1 billion in damages for infringing six of the American firm's software and design patents.

market, innovation activity among firms continued and many different versions of smartphones currently exist in the sector. This contrasts with the conventional wisdom concerning the emergence of a dominant industry design, which predicts that imitators tend to follow innovators and, if an innovation is commercially successful and widely adopted, it will become the dominant design because all products in the market will use that specific technology and design features.

The aim of this article is to discuss whether a dominant design has emerged in the market for smartphones by examining the innovation strategies of companies. In light of this, the paper will also investigate the relationship between innovative activity and industrial dynamics. In doing so, we will answer two research questions. First, has a dominant design in smartphone (hardware) characteristics emerged over time? Second, what are the implications of firms' innovation strategies for industrial dynamics? The empirical analysis relies upon the contribution of [Koski and Kretschmer \(2007\)](#) who discuss product innovation strategies of firms in the mobile phone industry, looking at the evolution of handset characteristics. Accordingly, we will distinguish among two types of innovation strategies, i.e., horizontal product innovation and vertical product innovation. Furthermore, even if our investigation mostly focuses on the hardware side, given the peculiarities of smartphones, we will also make some consideration on the evolution of software characteristics (operating system) over time. The remainder of the article is organized as follows. [Section 2](#) reviews the literature on dominant design underlining the implications for the mobile industry. [Section 3](#) provides evidence on performance of competitors in the market, while [Section 4](#) investigates whether a dominant design has emerged or instead different smartphone configurations are continuing to proliferate, and discusses the implications of firms' innovation strategies for industrial dynamics. [Section 5](#) concludes the discussion.

2. The emergence of a dominant design in the market: a review of the literature

The seminal article by [Utterback and Abernathy \(1975\)](#) refers to *dominant design* as a single architecture³ that establishes dominance in a product category. In the early stages of market evolution, high technical and market uncertainty results in a diversity of product designs ([Abernathy & Utterback, 1978](#); [Dosi, 1982](#); [Lee, Neal, Pruett, & Thomas 1995](#); [Smith, 1997](#); [Utterback, 1994](#)). A product category evolves due to the processes of variation, selection, and retention (e.g., [Anderson & Tushman, 1990](#); [Tushman, Anderson, & Murmann, 1998](#)). Technological breakthroughs create rivalry among alternative designs, resulting in a period of design variation or ferment. The emergence of a dominant design is the transition point between the periods of variation and selection. The article of [David and Greenstein \(1990\)](#) details the different processes that lead to the creation of standards, underlying the importance of compatibility in the standardization process.

The definition of dominant design is a specific path along an industry's design architecture, which establishes dominance among competing design paths. A dominant design usually takes the form of a new product (or novel set of features) synthesized from individual technological innovations introduced independently in prior product variants ([Utterback and Suarez, 1993](#)). A dominant design is a product within a product category that gains general acceptance as the standard for technical features that other market players must follow if they want to acquire significant market share ([Utterback, 1994](#)). [Christensen, Suarez, and Utterback \(1998\)](#) explain a dominant design as emerging in a product category when one product's design specifications (consisting of a single feature or a complement of design features) define the product category's architecture. In this respect, it is possible to argue that in complex products such as computers or smartphones, dominant designs might emerge in relation to a sub-set of characteristics that are the result of either vertical or horizontal innovations. [Srinivasan, Lilien, and Rangaswamy \(2006\)](#) add that a particular product design architecture can define the specifications for the entire product category. [Argyres, Bigelow and Nickerson \(2013\)](#) propose an innovative characterization, according to which a dominant design appears per se, in the form of a breakthrough that can resist market "shakes" and comprises only slight and not radical improvements. They define this type of a breakthrough as a "*composition desiderata*", because it represents a collection of desirable features, and they consider the iPhone to be an example of a *composition desiderata*.

A large strand of empirical studies documents the emergence of dominant designs in various product categories, including typewriters, televisions, electronic calculators, automobiles ([Utterback, 1994](#)), VCRs ([Cusumano, Mylonadis, & Rosenbloom, 1992](#)), cochlear implants ([Van de Ven and Garud, 1993](#)), fax machines ([Baum, Korn, & Kotha, 1995](#)), cement, glass, and minicomputers ([Anderson & Tushman, 1990](#)). [Koski and Kretschmer \(2007\)](#) used dominant design theoretical framework to study innovation in the mobile phone design. [Van de Kaa, Van den Ende, De Vries, and Van Heck \(2011\)](#) reviewed the literature on the topic and identified how format dominances can emerge using five categories: characteristics of the format supporter, characteristics of the format, format support strategy, other stakeholders, and market characteristics.

Dominant design is satisfying as long as its technical possibilities are driven by the commercial interests of suppliers, users, and competitors ([Srinivasan et al., 2006](#); [Tushman & Rosenkopf, 1992](#); [Wade, 1995](#)). However, the literature shows that the dominant design is not always the design that incorporates the best features and performance. [Gallagher \(2007\)](#) underlines the distinction between dominant designs and industry standards. In particular, standards are driven by the relative importance of network effects, while dominant designs are architectures with recognized implications for industries. This implies that standards are often important elements of dominant designs.

³ According to [Ulrich \(1995\)](#), a product architecture is the scheme by which the function of the product is allocated to physical components.

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