Research Policy 43 (2014) 1334–1352

Contents lists available at ScienceDirect

Research Policy

journal homepage: www.elsevier.com/locate/respol

Knowledge systematisation, reconfiguration and the organisation of firms and industry: The case of design

Beatrice D'Ippolito[a,d,*], Marcela Miozzo[b], Davide Consoli[c]

[a] Grenoble Ecole de Management, France
[b] Manchester Business School, The University of Manchester, United Kingdom
[c] INGENIO (CSIC-UPV), Valencia, Spain
[d] The York Management School, University of York, United Kingdom

ARTICLE INFO

Article history:
Received 31 May 2012
Received in revised form 7 March 2014
Accepted 20 March 2014
Available online 19 April 2014

Keywords:
Knowledge systematisation
Knowledge reconfiguration
Design
Firm organisation
Industry organisation
Home furnishing

ABSTRACT

The paper explores two pathways that are crucial for making knowledge economically useful – knowledge systematisation and knowledge reconfiguration – and analyses how their interplay enables the emergence of a new business function or activity. Knowledge systematisation is the abstraction and diffusion of operative principles to the effect of expanding to broader remits practices that had been initially conceived for a narrow purpose. Knowledge reconfiguration involves the conversion and formalisation of these novel practices within existing firm and industry organisation. Using the design activity as a lens, and drawing on primary and secondary interviews and archival data on the home furnishing sectors in Italy, our case study articulates the processes that facilitate the abstraction of general rules from novel practices and the changes that are necessary, both within firm and industry organisation, to foster their diffusion.

1. Introduction

What makes new knowledge economically useful? Many would argue that it is a spectrum of mechanisms that permits the recognition of opportunities and favours the implementation of new activities within the established mode of economic organisation. But knowledge implies a process, it is neither information nor facts, and the pathways through which it is rendered economically useful exhibit important peculiarities that depend on the context of development and use. Understanding the mechanisms that facilitate the progressive abstraction and formalisation of knowledge and practices into new organisational-level practices and organisational forms is important to appreciate the nature of those peculiarities, and their economic consequences. The present paper addresses these broad questions through the lens of the design activity, and seeks to uncover the processes that facilitate the translation of design know-how from being project-specific to becoming relevant to broader remits. Design can be prima facie regarded as a set of practices aimed at determining the formal qualities of products and defining how their functionalities will be delivered to users (Utterback et al., 2006). The broad range of organisations and sub-sectors design impinges on and the heterogeneity of expertise, skills, and techniques that it entails make design an appropriate context for our empirical investigation.

The paper analyses two pathways that are crucial for making design knowledge economically relevant. The first is knowledge systematisation, that is, the abstraction and diffusion of operative principles to the effect of expanding the remit of practices that had been initially conceived for a narrow purpose (Rosenberg, 1976a). The second is knowledge reconfiguration, involving the conversion and formalisation of these novel practices within firm and industry. This involves the development of new routines or practices and relations between routines as a result of new knowledge. Our articulation of these two processes and of their interdependences fills two gaps in the area of innovation studies. On the one hand, while the concept that knowledge evolves as a by-product of practice is widely accepted, the institutional mechanisms that permit the diffusion of practical know-how are still understudied (Baumol, 2005; Vona and Consoli, 2011). For many industries,

* Corresponding author. Current address: 12, rue Pierre Sémard, Grenoble Ecole de Management, 38000 Grenoble, France/The York Management School, University of York, Freboys Lane, Heslington, York YO10 5GD, United Kingdom.
Tel.: +33 4 76 70 60 60/44 1904 325062; fax: +33 4 76 70 60 99/44 1904 325021.
E-mail addresses: beatrice.dippolito@grenoble-em.com, beatrice.dippolito@york.ac.uk (B. D'Ippolito), marcela.miozzo@manchester.ac.uk (M. Miozzo), davide.consoli@ingenio.upv.es (D. Consoli).

http://dx.doi.org/10.1016/j.respol.2014.03.013
0048-7333/

future viability depends not on today's technology but on the contribution of tomorrow's trained professionals. This raises cogent questions concerning the effectiveness of the systems that are expected to ensure the replenishment of the skill base, such as: how is new professional know-how formalised for wide use? On the other hand, while the processes of technological convergence, specialisation, and vertical (dis)integration have been explored in the past (Rosenberg, 1963; Sturgeon, 2002; Miozzo and Grimshaw, 2011), the study of how the formalisation of novel know-how affects firm boundaries, the development of new types of firms, new routines, or even the formation of new industries, is still in its infancy. In short: how do new practices become progressively formalised within organisations and are aligned with (and, in turn, change) the existing 'ways of doing things'? We are still short of understanding how both these processes work, how they affect (and change) economic organisation, and under what circumstances.

The case study presented here draws on different sets of primary and secondary data sources on the Italian home furnishing sectors and contributes to existing scholarly work by affording a number of insights. First, it calls attention to the process of capability development both at firm and industry level. This dual lens resonates with the extended remit of design, which involves not only form and function of products but also modes of production and delivery, as well as product meanings (or symbolic value) (Walsh, 1996). A second insight of this work is an appreciation of the nuances of problem-solving in design activities, partly drawing on art and partly on engineering and, to a lesser degree, science. Design is a bridge between the craftsmanship required to master materials and the social sensibility necessary to capture and convey meanings to society. The chief preoccupations of professional designers revolve around where objects are placed, what they communicate and how. Clearly, their ability to capture and convey meanings rests on a distinctive feedback system that links the domain of practice with the organisation of production. Yet another contribution of the paper is a novel set of insights on how new practices, some of which are easily codified and some of which remain largely tacit, are accommodated within (and change) existing firm and industry organisation.

The remainder of the paper is structured as follows. Section 2 lays out the conceptual framework to understand how a focus on knowledge systematisation and reconfiguration can help explore the processes of emergence of a new business activity or function. Section 3 discusses the research methodology. Section 4 presents the main findings on knowledge systematisation and reconfiguration in the context of design, and the organisational consequences at firm and industry level. After the discussion in Section 5, the last section concludes and summarises.

2. Knowledge systematisation and knowledge reconfiguration

Types of knowledge differ from one another not only in relation to the content but also in the ways in which they generate opportunities. By and large these differences can be ascribed to the peculiar combination of circumstances that underlie each domain of knowledge generation and use. Here we consider two mechanisms that facilitate the translation of innovative, at times disruptive, knowledge inputs into economically viable courses of action: (i) the abstraction and diffusion of useful knowledge stemming from novel practices, namely, knowledge systematisation; and (ii) the development of new routines or practices and relations between routines as a result of new knowledge, namely, knowledge reconfiguration.

2.1. Knowledge systematisation

Let us begin by operationalising useful knowledge, that is, "knowledge that deals with natural phenomena that potentially lend themselves to manipulation, such as artefacts, materials, energy, and living beings" (Mokyr, 2002: 3). Useful knowledge is the practical know-how that is needed to make things work. Scholarly research articulates the latter as an evolutionary construct, as the process through which initially tacit and dispersed notions are progressively selected and become embedded in tangible outcomes such as novel techniques, rules or practices (David, 1975; Constant, 1980; Basalla, 1988; Cragg, 1989; Vincenti, 1990; Ziman, 2000; Nelson, 2003). The breadth of perspectives on the question "what is useful knowledge?" stands in contrast with the lack of contributions on a particular aspect: what institutional processes facilitate the consolidation of specific forms of know-how into broadly applicable instructions? That is, how does knowledge become economically 'useful'?

The work of Nathan Rosenberg stands out as a pioneering attempt towards articulating these issues beyond the abstract evolutionary metaphor. His early work (Rosenberg, 1976a) deals with crucial questions concerning knowledge diversification, division of labour, and the mechanisms that ensure coherence across increasingly specialised production activities. He argued that the viability of mass production systems depends on stable systems of rules, or standardised instructions, based on the systematic observation of how materials react to certain treatments in large-scale operations. This type of know-how, Rosenberg insisted, stems not from basic scientific areas like chemistry or physics but is rather a by-product of cumulative practice on the part of engineers and technicians who run experiments in different contexts. While the point that knowledge evolves as a by-product of practice has been widely accepted by innovation scholars inspired by Rosenberg, the institutional mechanisms that permit the formalisation and diffusion of practical know-how is still arguably underdeveloped (Vona and Consoli, 2011). In later work, Rosenberg (1998a,b) returned to this theme by calling attention to 'roundabout' areas of specialisation acting as incubators for novel practices. One among them is chemical engineering, which emerged in the 1920s out of progressive interpenetration of two established but traditionally separate realms – chemistry and engineering. Despite being initially conceived to meet the specific needs of the petroleum sector, chemical engineering has acquired increasingly universal character to become the main feedstock for a broad range of industries. Put otherwise, this branch of engineering has generated an inter-temporal spillover that binds together existing know-how with new knowledge: "a new blueprint today spills over to lower the cost of future blueprints" (Rosenberg, 1998a: 168).

The study by Vincenti (1990) on the history of the aeronautical industry offers further insights on the role of practical forms of know-how. Focusing on the relationship between experiential know-how and scientific knowledge in the collection of instructions for aircraft control, he described the institutionalisation of operative standards for aeroplane control culminating in a newly created teaching module, control-volume analysis. The latter encompasses practices and specifications for engineers to apply "the physical laws governing mass, momentum, energy and (when needed) entropy" (Vincenti, 1990: 113). This is an example of how recursive learning in practice contributes to the definition of operative criteria, thus consolidating the notion of engineering epistemology as an autonomous body of knowledge based on problem-solving heuristics rather than on science. Building on Vincenti's contribution, Nightingale (2000) elaborated a framework to articulate how technology-specific knowledge generates interdependent problem-solving tasks. In a nutshell, innovation processes depend on the physical characteristics of the product