



On the Formation of a Sector: The Case of Computer Services

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1. Introduction

Industries can no longer be taken for granted. As sectors dis-integrate and re-integrate, converge and transform, the question of how exactly entrepreneurial activities are structured, and what determines the firms' and sectors' boundaries evolution becomes more crucial than ever. Firms are increasingly trying to shape the nature of their environment and the ways in which labor is divided in the sector; they try to shape the "rules and roles" through which labor (and knowledge) is divided and coordinated. As Brusoni et al. (2009) argue, by using a recently coined term, firms try to shape and re-define their "industry architectures", i.e. the templates that determine "who does what" in a sector, as they appreciate that this will affect "who takes what". Research that takes place at the Management Science Laboratory of AUEB, studies the evolution of industries resulting to the formation of the industrial architecture in the case of the Computer Services Sector in Greece.

Some argue that the ability - and need - to change industry architectures derives from the emergence of new scientific and technological knowledge which affect the competitive dynamics of the entire economy and the way business takes place. New sectors have emerged on the basis of new disciplines (e.g. biotechnologies) as well as on the basis of the integration of old ones (e.g. mechatronics). Moreover, traditional sectors are affected by new disciplines in ways which challenge incumbents' positions and favor the entry of new actors (e.g., telecommunications).

As Brusoni et al. (2009), stress the "political" role played by old established organizations. For example, incumbents may influence which technological paths are pursued: leveraging on their role as industrial leaders, through strategic moves such as mergers and acquisitions, focused investments, lobbying for the adoption of specific standards, etc. Thus, as firms try to re-organize their industry environment, one major issue emerges: firms must create and simultaneously integrate knowledge to create advantage as well as coordinate sets of complex interdependencies that cut across firms' boundaries.

2. Strategic Dynamics and Industrial Evolution

In terms of the existing theoretical apparatus, as Brusoni et al. (2009) argue, research has offered key building blocks that provide answers to partial questions to understand the evolution of industry architectures. Researchers from the New Institutional/Transaction Cost economics, for instance, have explained how firms may choose their boundaries. Scholars of technological change have considered how organizations and technologies co-evolve over time. Yet, only recently have we started understanding what shapes the nature of the sectors that we study, and in what are the forces that explain why and how sectors swing between knowledge boundaries.

Likewise, it seems that the link between the boundaries of organizations and the knowledge bases in the sector has been shown to be important in the strategy literature, and it is clear that the boundaries of knowledge and the boundaries of specific organizations are not fully mapped onto each other. However, our understanding of how knowledge becomes integrated in a complex web of relationships in a sector is still in its early stages. As Brusoni et al. (2009) argue:

- First, we have a very limited set of empirical studies that consider the dynamics at the level of "industry architectures", which can exhibit how new sectors emerge, or how the roles of various industry participants are (re)-defined.
- Second, we do not yet have a set of studies that considers how sectors change as a result of new opportunities, new knowledge bases, and / or new technologies.
- Third, we have yet to propose the micro-mechanisms that explain how the structures that integrate knowledge emerge, and how they affect the industries' prospects, or how they change over time.

3. The Formation of the Computer Services Sector in Greece

The recent European Trend Chart Reports (2004, 2005, 2006) using data from the Community Innovation Services - CIS indicators present Greece, followed by Belgium and Finland, as an innovation leader in the Computer Services Sector. Computer services enjoy a high knowledge creation and knowledge diffusion intensity meaning that such services position high on an innovation intensity scale.

Leading countries in Computer and related activities in Europe are Greece and Belgium. Greece is leading in share of SMEs co-operating, innovation expenditures, share of firms that receive public subsidies to innovate, gross investment in machinery and equipment, R&D expenditures and growth rate of employment. Belgium is leading in share of firms innovating in-house and sales share of both new-to-market and new-to-firm products. Computer and related activities is one of the most innovative services sectors. In the six CIS indicators the sector performs at least twice as good as total services. Computer and related activities is now the most innovative sector of all the services sectors. In six CIS indicators the sector performs at least twice as good as total services. The SIS characterizes the CS sector as being a knowledge-diffusion, rather than as a knowledge-creator sector. Below we present a table with a detailed definition of NACEK.72 code used by the sectoral innovation scoreboard in its analysis.

Research that takes place in MSL has been occupied with examining the processes of formation what is now known as "the Computer Services Industry". Our analysis adopts a longitudinal field study methodology and uses firm level data dated back from 1940 to 2008.

3.1 Data Collection

In order to examine the evolution and the formation of the sector we collected data covering the years 1940-2008 from the ICAP Databank (v.7.34). Our sample included firm level information relevant to the year of establishment and to the product activities in terms of NACE codes, for all the companies with four digit codes at NACE72. The initial number of the sample of the firms was 489. Additionally, we manage to locate and confirm the NACE codes for the products/services of the 482 of them which is the final sample of our research. The firms of our sample cover a wide spectrum of different activities as the list of NACE codes on the following table (Table 1), shows.

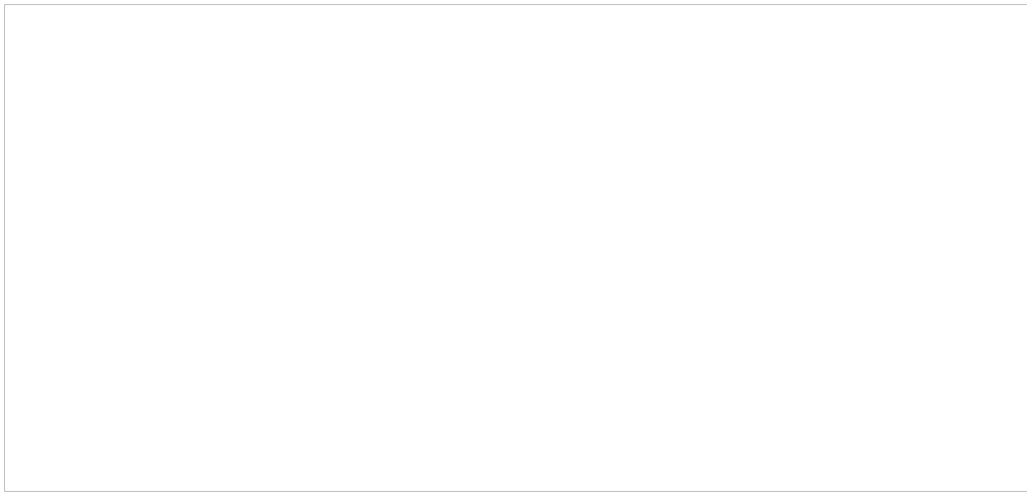
Table 1: NACE Codes of the Firms of the Sample

NACE Code	
G .51.84	Wholesale of Computers, Computer Peripheral Equipment and Software
G .52.48	Other Retail Sale in Specialized Stores
K .72.10	Hardware Consultancy
K .72.22	Software Consultancy and Supply
K .72.30	Data Processing
K .72.40	Database Activities
K .72.60	Other Computer Related Activities
K .74.14	Business and Management Consultancy Activities
M .80.42	Adult and Other Education n.e.c.

3 Data Analysis and Results

We analysed the data of our sample in terms of the year of establishment in order to create the "firm entry" diagram for the evolution of the new venture creation activities. Additionally, we studied the specific NACE orientation of that new entrant firms select during their establishment. This provides important knowledge on the orientation of the entrepreneurial activities during the time of the establishment and further allows us to map and understand the dynamic of changes during a long term period. The following figure (Figure 1) exhibits the way in which the Computer services sector was formulated, in terms of its knowledge domains and product activities. The numbers illustrated on the graph show the firm entries per year while, the different colours exhibit different products and activities of the respected firms.

Figure 1: Firm Entries in the Computer Services Sector, n=482



Conclusions and Discussion

In this paper we exhibit the sectoral dynamics in the formation of the computer services industry architecture from year 1940 to 2008. Our analysis contributes by showing how the industrial structure of the sector is evolved for the years studied and add to our common understanding of what shapes the nature of the sectors that we study, and in what are the forces that explain why and how sectors swing between different knowledge and product boundaries.

Data gather and analysed for the case of the Computer Services map and exhibit the process of evolution of the sector from its initial set as a group of firms in a variety of complementary services, (such as the wholesale of computers, or computer peripheral equipment and software and adults education in IT, only to name a few); to a more focused into its core competencies in the area of "Software Consultancy and Supply" (NACEK.72.22) dynamic cluster.

Although, it begun as an amalgam of different activities during the nineties the sector was transformed to a purely service sector. Besides its main orientation towards "Software Consultancy and Supply" activities the fields that also survived during this transformation just to prove its service orientation were that of the "Data Processing" (K.72.30) and the "Other Computer Related Activities" (K.72.60). These are until now the main lines around which the sector is organized, although the "Software Consultancy and Supply" remains the major activity.

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