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Rethinking sectoral typologies: A classification of activity according to knowledge and technological intensity

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Abstract

This article aims to integrate and adapt two classifications of economic activity from the Organization for Economic Cooperation and Development (OECD) and the Statistical Office of the European Commission (Eurostat) into a Brazilian context and contemporary studies of economic development. The classification that emerges, called the "Classification of economic activity according to technology and knowledge intensity", results in (i) valuing the criteria that deals with the present and future factors of competitiveness, such as technology and knowledge, science and innovation, and transversability and dissemination of information; (ii) overcoming the old dichotomy between manufacturing and services with a new but flexible and gradual classification, ranging from more high-tech and knowledge-intensive activities to low-tech, less knowledge-intensive activities.

Keywords: Classification of economic activity; Technology; Knowledge; Competitiveness

> "We put the boat on the wind, but could make no headway at all for the eddies, and I was upon the point of proposing to return to the anchorage, when, looking astern, we saw the whole horizon covered with a singular copper-colored cloud that rose with the most amazing velocity."
> Edgar Allan Poe,
> *A Descent Into The Maelström*

Presentation

This article has the objective of integrating and adapting two current classifications of economic activity for a Brazilian context and contemporary studies of economic development. The featured classifications are from the Organization for Economic Cooperation and Development (OECD), which groups industrial sectors according to their technological intensity, and the typology from the Statistical Office of the European Commission (Eurostat), which separates service activities according to their knowledge intensity. Their respective integration and adaptation to state-of-the-art debate and Brazil's reality results in: (i) simultaneously considering all economic activity, without the rigid and inflexible opposition between manufacturing and services; (ii) emphasizing the central elements of contemporary competitiveness, such as technology, knowledge, and innovation; and (iii) adhering to existing information sources, allowing a broad sectoral disaggregation and construction of minimally homogeneous activity groups, with possible application in the study of national and regional Brazilian dynamics.

The classification that emerges from the integration and adaptation of these two types of activity will be called the "Classification of economic activity according to technology and knowledge intensity." Fundamentally, it recognizes the elements that deal with the present and future factors of competitiveness, such as technology and knowledge, science and innovation,

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transversability and dissemination of information. Such efforts allow the dislocation of old dichotomies that are focused on rigid opposition between manufacturing and services for a new, more flexible categorization that gradually segments activities according to technology and knowledge intensity.

From the point of view of empirical and typological work, the development of the classification—informed by the OECD and Eurostat—involved two returns: that to Innovation Research (PINTECs) of the Brazilian Institute of Geography and Statistics (IBGE) from 2000, 2003, 2005, and 2008, in order to review and replicate the criteria used by the OECD for the delimitation of technological intensity; and a return to the National Classification of Economic Activities (CNAE) to apply a refinement of the criteria originally developed by Eurostat.

It is important to note that the classification is the result of the progress and maturation of a research agenda carried out between 2003 and 2012 by a research group led by Alvaro Comin for the Brazilian Center of Analysis and Planning (CEBRAP). Although this article will give a final form to the classification, its conception and development is inseparable from the maturation of academic activities and research of the group. The following text expands, refines, and strengthens arguments and proposals developed in previous work (Abdal et al., 2011; Torres-Freire, 2010; Torres-Freire et al., 2012).[1]

The paper is structured in four sections in addition to this introduction, which contains the objectives and motivations of the article, and conclusions are drawn at the end. The next section provides justifications for the integration and adaptation of the two economic activity classifications. The third section develops a step-by-step construction of the classification, explaining each of the choices taken. Finally, the fourth section discusses the methodological and analytical implications of using the classification.

Introduction: in defense of a cross-sectional analysis of productive structure

Transformations in modes of organizing production starting from the 1970s with certain elements directly related to science, technology and research (ST&I) hitherto earned an unheard of role in the building and maintenance of the competitiveness of firms, cities, regions, and countries (Castells, 1999). This new role is embedded in a context of the restructuring of production and firm de-verticalization, which engenders a double and interconnected movement (Harvey, 2009). On the one hand, there is the emergence of a new geography of production with trends of dispersion of manufacturing and conformity to global production and distribution networks. On the other, there is a tendency for the functional concentration of world economy command, control, and management activities, with consequent specialization of certain areas and regions (Sassen, 2001). Thus, a functional type of specialization emerged in urban centers, in contrast to traditional sectorial specializations (Duranton & Puga, 2005).

Despite these changes, much contemporary analysis has continued to structurally conform to a logic that tends to place industrial and tertiary activities into opposing groups, with a clear favoring of the first. They have therefore maintained traditional perspectives in analyzing and classifying productive structures, considering "services" as a quasi-residual group of quite heterogeneous activities that only have in common the fact that neither is primary nor secondary (Kon, 2004).[2]

Analysis based on traditional paradigms ignore certain evidence. Firstly, the existence of complementary relationships and functionality of certain industrial activities and services (Cohen & Zysman, 1987), many of which gained strength with firm processes of vertical disintegration and externalization. Secondly, the emergence of convergence trends between manufacturing and services is shown in the integration of technological and organizational matrices and in the increasing homogenization of demands for specialized services, infrastructure, and human resources (Bernardes et al., 2005; Boden & Miles, 2000).[3]

The article draws attention to the viability and appropriateness of analyzing the structure of production according to a renewed perspective, due to this lack of coordination between changes in production systems and the inadequacy of traditional perspectives and classifications. A new view is needed that is (i) sensitive to the growing role played by technology, knowledge, and innovation; (ii) recognizes cross-sectional productive structures; and (iii) is less confined by the straitjacket of traditional sectoral divisions.

By shifting the established opposition of manufacturing versus tertiary activities for more technological and knowledge-intensive activities versus less technological and knowledge-intensive ones, our classification is designed to incorporate two advantages into the universe of taxonomies: (i) a logic that allows for a new way of studying manufacturing and services; (ii) emphasizing foundational elements of competitiveness in today's economy. The grouping of activities according to their technological and knowledge intensity allows a focus on production, use, and dissemination of intra- and inter-sectoral technology and knowledge.

It is worth noting that knowledge and technological intensity are not necessarily synonymous with innovation. Some business activities tend to be more innovative, such as the pharmaceutical industry or information technology; however, innovation can also be present in activities of lower technological intensity, such as the introduction of new processes to make biofuels or new materials in textile industry products.

[1] Analysis employing preliminary versions of the classification: Abdal (2010), Abdal et al. (2011), and chapters of the book *Metamorphoses Paulistanas* (Comin et al., 2012).

[2] Two works can be taken as representative of different points of view: Bell (1999) and Castel (2010).

[3] For a measuring attempt, see Tomlinson (1997).

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