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Defining and measuring innovation in all sectors of the economy

Fred Gault[a,b,*]

[a] UNU-MERIT, Boschstraat 24, 6211 AX, Maastricht, The Netherlands
[b] Institute for Economic Research on Innovation (IERI), Tshwane University of Technology (TUT), 159 Nana Sita Street, Pretoria CBD, 0002, Tshwane, Gauteng, South Africa

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ABSTRACT

This paper combines general definitions of innovation applicable in all economic sectors with a systems approach, to develop a conceptual framework for the statistical measurement of innovation. The resulting indicators can be used for monitoring and evaluation of innovation policies that have been implemented, as well as for international comparisons. The extension of harmonised innovation measurement to all economic sectors has implications for innovation research and for policy learning.

1. Introduction

"Innovation drives growth and helps address social challenges" (OECD, 2010a). Innovation mitigates climate change, advances sustainable development, and promotes social cohesion. To support these claims, to inform policy development, and to monitor and evaluate implemented policy, innovation must be measured. For innovation to be measured, it must be defined.

For the last twenty-five years, the Oslo Manual (OECD/Eurostat, 2005) has provided definitions of innovation, but only for use in statistical measurement in the business sector. There have been innovation surveys in the public sector and the households sector but there is no international standard providing definitions that apply in these sectors. This is a significant gap which prevents the analysis and understanding of innovation in the whole economy and how innovation in one sector is influenced by activities in others.

To address this gap, a systems approach is used for classification and as a basis for the construction of a conceptual framework which could lead to a theoretical framework. The definitions of the economic sectors used in the System of National Accounts 2008 Manual (EC et al., 2009) are adopted and the present definition of innovation used in the business sector is reviewed, along with work on measuring innovation in other sectors. This leads to the introduction of a general definition of innovation, applicable in all sectors.

The benefit of using a general definition of innovation is that innovation can be measured in a consistent way in all sectors and new indicators developed that describe the interactions between actors in sectors and between sectors. These indicators can be used to inform policy development and for monitoring and evaluation of existing policy. This approach to a system wide understanding of innovation is the principal contribution of the general definition.

2. Building a conceptual framework

The characteristics that are present in the existing definition of innovation that are used in the general definition are identified, the sector definitions and a systems approach are introduced.

2.1. The current definition of innovation

The definition used since 2005 for the statistical measurement of innovation in the business sector consists of paragraphs 146 and 150 of the Oslo Manual (OECD/Eurostat, 2005).

146. An *innovation* is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices,

* Corresponding author at: UNU-MERIT, Boschstraat 24, 6211 AX, Maastricht, The Netherlands.
E-mail addresses: gault@merit.unu.edu, fred@ieri.org.za.

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workplace organization or external relations.

150. A common feature of an innovation is that it must have been *implemented*. A new or improved product is implemented when it is introduced on the market. New processes, marketing methods or organizational methods are implemented when they are brought into actual use in the firm's operations.

The definition deals with product, process and two methods, marketing and organisation.

Product and process innovation are required to be 'new or significantly improved' while the two methods are required to be 'new'. In an innovation survey, the state of the product, process or methods is determined by a survey respondent. In addition to being 'new or significantly improved' a product has to be 'introduced on the market' and a process or method has to be 'brought into actual use in the firm's operation'. The innovation takes place the moment the two conditions have been met.

The Oslo Manual is partially implemented by the Community Innovation Survey (CIS) of the European Union (EU)[1] and the survey is conducted every two years with core questions and a module of current policy interest which changes with each survey (Arundel and Smith, 2013). In this, and similar innovation surveys around the world, a definition of innovation for measurement purposes is essential. It makes possible comparison of innovation overtime and across jurisdictions.

2.2. Economic sectors

The paper is about measuring innovation in all economic sectors and the implications of doing that. The sector definitions are taken from the System of National Accounts (SNA) 2008 Manual (EC et al., 2009).[2]

According to SNA 2008 (EC et al., 2009, para. 4.24) "All residential institutional units are allocated to one and only one of the following five institutional sectors:

- The non-financial corporations sector;
- The financial corporations sector;
- The general government sector;
- The non-profit institutions serving households sector;
- The households sector"

In this and earlier papers (Gault, 2015, 2016) the non-financial and the financial corporations sector are combined to form the business sector[3] and when the public sector is discussed it is the general government sector combined with the aggregate of public corporations (EC et al., 2009, para 22.41). The "institutional unit" referred to in the definition is "an economic entity that is capable, in its own right, of owning assets, incurring liabilities and engaging in economic activities and in transactions with other entities" (EC et al., 2009, para. 4.2). There are two classes of institutional units, persons or groups of persons in the form of households, and legal or social entities. In the business sector, the institutional unit is the firm.

The SNA 2008 makes a key distinction between the business sector, as just defined, and the general government sector as follows: "Fundamental to the distinction between corporations and government is the basis on which production is undertaken. Corporations produce for the market and aim to sell their products at economically significant prices. Prices are said to be economically significant if they have a significant effect on the amount that producers are willing to supply, and the amounts purchasers wish to buy" (EC et al., 2009, para. 4.18). Economically significant prices will recur in the discussion of innovation in the business sector. 'Products' in the SNA "are goods and services (including knowledge-capturing products) that result from the process of production". This definition (EC et al., 2009, para. 6.14) is used in the Oslo Manual and in this paper.

The relative magnitude of economic activity in the sectors varies with the stage of development of the country. Developing countries tend to have a smaller business sector than developed ones and larger public sectors. In developed countries the contribution of the NPISH sector to GDP is less than 2%. For the households sector, actual individual consumption can be used to gauge its weight and 70% of GDP is not uncommon. In terms of the measurement of innovation, the business sector has been studied for over twenty-five years and studies of innovation in the public sector are emerging. The NPISH sector is less well studied but it includes organisations such as grant making and giving services and family services (Statistics Canada, 2009) which can influence innovation activities in other sectors. This makes the NPISH sector a key element in a systems approach to innovation measurement and it can be surveyed in the same way as the business or the public sector. In the households sector, von Hippel (2017, p.21) has reported on the percentage of consumers in the population aged 18 or over for the UK, US, Japan, Finland and Canada and finds that between 4 and 6 percent develop products for their own use.[4] Of these populations about 1% make the resulting knowledge available to potential users. This is a significant number with economic and social implications for an innovation system.

2.3. A systems approach

A system consists of actors, or economic agents, engaged in activities, having linkages with other actors. The activities and linkages lead to short term outcomes and longer-term impacts. The system is bounded, which means that there are boundary or framework conditions which influence the activities of the actors and what flows through the linkages.

When a systems approach is applied to innovation,[5] the actors are firms, public institutions, non-profit institutions serving households, and households (including individuals). The innovation activities include, but are not limited to, in-house and external research and development (R&D), capital expenditure, human resource development, design and market development. The linkages are any interaction between actors such as grants, contracts, use of intellectual property instruments, hiring human resources and many others. Examples of framework conditions are the rules governing incorporation of a firm, bankruptcy, health and safety in the workplace, basic wages, approval of credentials, tax legislation, intellectual property law, trade rules and culture.

The systems approach for the description and analysis of innovation is a basic instrument[6] which can be applied to national, regional, or sectoral systems of innovation. It is used in this paper for classification purposes and as a basis for a conceptual framework discussed in Section 3.2.

3. A general definition and why it is needed

3.1. A general definition

In earlier work (Gault, 2012), a proposal was made to change 'introduced on the market' for product innovation in the Oslo Manual definition to 'made available to potential users'. The objective at the time was to make the definition applicable to the households sector as well as to the business sector. While 'potential users' was broader than

[1] See http://ec.europa.eu/eurostat/web/microdata/community-innovation-survey.

[2] Building the System of National Accounts – basic concepts (Eurostat, 2017) provides a good overview of the SNA.

[3] In this paper and the Oslo Manual, SNA sectors are used. The Frascati Manual, that deals with R&D, uses a Higher Education sector, not found in the SNA (OECD, 2015a).

[4] There was also a survey done in South Korea with a result of 1.5%. This is discussed in von Hippel (2017).

[5] See Edquist (2005) and Edquist (1997, p.43) for descriptions of innovation systems.

[6] See Forrester (1971, 1982), Simon (1996) and von Bertalanffy (1968) for applications of system thinking.