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User Innovation in the Digital Economy

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Аннотация

The paper reviews the current state of user innovation in the business and the households sectors and considers the impact of the digital economy on user innovation. A general definition of innovation, applicable in all sectors of the economy, is introduced to expand the domain of user innovation to all economic sectors, not just the business sector and households. This raises questions about innovation policy, especially in a digital economy, and how policy affects innovation in households. Outcomes of this study include the implications for skills needed to support user innovation in the different economic sectors of the digital economy and the relevance of user innovation to policy objectives.

Ключевые слова: definition, innovation, economy general, digital economic, innovation of sectors, training user

This paper examines user innovation and its place, or lack thereof, in official statistics and in innovation policy. Presence in official statistics provides an entry point for the development of innovation policy that focuses on promoting innovation in the business sector. The discussion starts with the state of user innovation a decade ago and then considers the impact of two significant changes: digitalization and the introduction of a general definition of innovation.

Digitalization goes beyond the use of computers and the internet to include the ways in which computer services are provided and the impact of artificial intelligence and the internet of things. A characteristic of the digital economy is the connectivity illustrated by social media and platforms for transferring knowledge and products. Digitalization is a radical change affecting both the economy and society, including how work takes place and which different skill sets are required to participate and to innovate.

The second change is in the general definition of innovation in the fourth edition of the Oslo Manual [OECD, Eurostat, 2018]. After the recognition of the presence of innovation in any sector of the economy' in the third edition [OECD, Eurostat, 2005, para. 27], a general definition of innovation was introduced in the fourth edition of the Oslo Manual [OECD, Eurostat, 2018, para. 1.25], which is applicable in all sectors.

In order to maintain the continuity of measurement for innovation in the business sector, the general definition in the Oslo Manual was restricted to provide a definition of innovation in the business sector [OECD, Eurostat, 2018, para. 3.9] that was very close to the definition in the third edition of the Oslo Manual. The implications of this are discussed below. After a review of user innovation a decade or longer ago and a discussion on user innovation in the digital economy, conclusions are drawn about where user innovation may be going in the future and the policy implications if user innovation is to be encouraged.

User Innovation before 2018

Work on user innovation has been led by Eric von Hippel. He examined the phenomenon in firms, public institutions, and households, including individuals. His most recent definition of user innovation is the following [von Hippel, 2017, p. 144].

> User innovation is sharply focused on the functional relationship that innovators have to have an innovation they develop. If the innovator develops an innovation for personal or in-house use, he, she, or it is a user innovator. If the innovator develops the innovation to sell, he, she, or it is a producer innovator [von Hippel, 1976,1988,2005]. The presence or absence of self-rewards and compensated transactions does not play a role in this simple definition. As a consequence, the user innovation lens can include both free innovators and profit-seeking individuals and firms as user innovators. A user innovator firm, for example, would be one that develops a novel process machine for in-house use rather than sale. The firm is indeed a user—but, unlike free innovators, it is also seeking profit from using that machine in its operations.

To simplify this, a user innovator is an innovator that develops a product or process for their own use. As von Hippel notes, a user innovator can be a firm or an individual. This paper adds general government institutions and those of the non-profit institutions serving households (NPISH).

User Innovation by Businesses

Business process innovation. The von Hippel definition fits well for firms where it aligns with the definition of innovation for the business sector in the third and fourth editions of the Oslo Manual. The business sector innovation definition [OECD, Eurostat, 2018, para. 3.9] follows.

> A **business innovation** is a new or improved product or business process (or combination thereof) that differs significantly from the firms previous products or business processes and that has been introduced on the market or brought into use by the firm.

As with all definitions of innovation in the Oslo Manuals, there are two requirements which have to be met for there to be an innovation. The product or business process has to be ‘new or improved’ and it has to be introduced on the market (product) or brought into use by the firm (business process). From a survey perspective, the respondent reports that the product is ‘new or

improved' and this requires judgement, but the second requirement is to report on what the firm did. Was the product introduced on the market (yes or no?) or was the business process brought into use by the firm (yes or no)?

Gault [Gault, 2016a] discusses process innovation at firms, which includes user innovation and notes that information on process innovation is collected in official surveys and reported in official statistics. The only problem in the reported statistics is that 'process innovation, where appropriate, is not labeled 'user innovation which makes user innovation invisible to policy makers.

Product innovation. Moving to product innovation, firms are not user innovators of products. They do not use products, they introduce them on the market in the hope that they will be purchased at economically beneficial prices [European Commission et al., 2009, para. 4.18]. To be an innovation, the product has to be introduced on the market, but it does not
have to sell. The 'introduced on the market' condition is discussed further.

User Innovation by Households or Individuals

Households, including individuals, may acquire products and change them for their own use, or, in the absence of the desired product, they may develop it for their own use. Both are cases of user innovation if they meet the two conditions of the innovation definition 'new or significantly improved' and 'introduced on the market'. However, they are not introduced on the market as the product developed or modified by the household or individual is not necessarily for sale but for one's own use.

This question was raised in a user innovation project in Finland in 2011 [de Jong et al., 2015] and a modification to the definition was proposed [Gault, 2012]. The third edition of the Oslo Manual was in use at this time and the definition of business innovation appeared in two paragraphs, 146 and 150 [OECD, Eurostat, 2005]. They are the following.

> 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, workplace organisation 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 organisational methods are implemented when they are brought into actual use in the firm’s operations.

The proposed change was to replace ‘introduced on the market’ with ‘made available to potential users’ [Gault, 2012]. This preserved the requirement that, to be a product innovation, the product had to be ‘new or significantly improved’ and it had to be ‘made available’ by some means. In the case of a business product innovation, one such means of making it available is to introduce the product to the market. This is not the only way of making it available, but this is discussed below.

The modification to the definition of innovation proposed in [Gault, 2012] had application in public sector innovation and this gave rise to proposals for definitions of innovation that could be applied in the government sector [European Commission et al., 2009, para. 4.24] and later, in any economic sector [Gault, 2015; Gault, 2016b; Gault, 2018].

The Digital Economy and User Innovation

Evolution

The digital economy has grown out of the availability of computing capacity for people and institutions. The personal computer (PC) appeared in the 1980s and grew in use as the internet was introduced and became a means of communication and data transfer, which further increased with the arrival of the world wide web (WWW). Mobile phones became the preferred means of communication, compared with land lines, especially in developing countries.

Statistical offices gathered data from firms on whether they used computers, had access to the internet or used the world wide web. As internet use became more common, the next set of questions asked about websites for promoting the business and then for engaging in electronic commerce. The OECD established a working party on indicators for the information society (WPIIS) in 1997 which produced definitions of the information and communication technology (ICT) sector and electronic commerce. This allowed statistical offices to provide information on the use of computers and networks and the magnitude of transactions on the web. It also

supported policy to provide internet access everywhere by various means and then broadband access so that businesses could function anywhere. This period also saw questions about the digital divide (those with and without a computer and network access) and about the knowledge divide [Chataway et al., 2003] (there is a computer and network access, but the knowledge needed to make use of the technology is not present). In the 21st century, connections between agents and objects became more relevant and extended to the internet of things, cloud computing and storage, and artificial intelligence (AI). Al has become a tool rather than a curiosity and is raising ethical questions about the use of personal data and what happens when machines write their own algorithms and create other machines. To address some of these questions, the OECD convened a Ministerial meeting in Cancun in 2016 on the digital economy which resulted in the Cancun Declaration [OECD, 2016]. While the Cancun declaration refers more than once to innovation, there is no explicit mention of user innovation. However, it is implicit in item 7 of the declaration:

> **Take advantage of the opportunities arising from online platforms** that enable innovative forms of production, consumption, collaboration and sharing through interactions among and between individuals and organisations, while assessing their social and economic benefits and challenges as well as the appropriateness of related policy and regulatory frameworks.

The declaration also makes the point that people have to have the skills needed to participate in the digital economy and society, which has implications for education and training. Nowhere is innovation limited to the business sector.

Innovation

A characteristic of the digital economy is that everything in it is digital, or soon will be, and can be manipulated by software or machines managed by software. This includes goods that carry a means of identification, such as a bar code and which can be moved and delivered by machines such as driverless vehicles and drones. As with the pre-digital economy, innovation, and user innovation can happen anywhere, but the issue remains that outside of the business sector, innovation statistics are not present in official statistics. Following [Gault, 2012] and research on public sector innovation [G

ault, 2018], the idea of a general definition of innovation was explored and presented in various international meetings including the OECD Blue Sky Forum [Gault, 2016b]. The fourth edition of the Oslo Manual provides the following general definition of innovation [OECD, Eurostat, 2018, para. 1.25].

> An **innovation** is a new or improved product or process (or combination thereof) that differs significantly from the units previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process).

Before returning to user innovation in the digital economy, the general definition is compared with the definition for business innovation cited in the previous section. It is a restricted version of the general definition as expected for a sector specific definition. The first restriction is the inserting of the word ‘business’ before the word ‘innovation which makes clear which sector is being discussed. The second restriction is to replace ‘made available to potential users’ by ‘introduced on the market’. The remaining changes are minor. Unit is replaced by ‘firm’ and the explanatory words in parentheses, (product) and (process) are removed as the definition of innovation in the business sector is well understood by the community that uses it.

The advantage of replacing ‘made available to potential users’ by ‘introduced on the market’ is that it makes the definition practically the same as the one used in the third edition of the Oslo Manual. This means that no fundamental change is required in surveys on innovation and there is no break in the series. This is important for survey statisticians and users of the data. However, this restriction excludes a class of products that, in the digital economy, are significant and of growing importance.

Consider the consequences of leaving ‘made available to potential users’ in place for the definition of innovation in the business sector. The first is that the market is just one way of making a product available to potential users, but it preserves the approach to statistical measurement that has gone on for decades. The second is that product innovations that are made available, but not at economically significant prices, could enter the class of official statistics on innovation in the business sector. This is an important change with implications for user innovation and for innovation in the digital economy.

In [Gault, 2012] there was reference to products that were free as examples of the free exchange of knowledge [von Hippel, 2005, p. 110]. Reference to free products also occurred in [Gault, 2018]. In 2012 Linux products were examples, but now there are many free products that influence the lives of consumers and can be product innovations. They can also be the starting point for innovation by users. Examples are free internet addresses, access to cloud computing and storage, social media such as Facebook, YouTube, Instagram, and a growing number of free apps. These are products that, from time to time, are improved and provided to potential users at no cost. They have significant social and economic impact, they are part of the digital economy, but they are not present in official statistics. The observation that these products are unmeasured contributions to consumer welfare appears in the literature [Brynjol fsson et al., 2018; Diewert et al., 2017; OECD, 2018a, p. 7] but the additional point made here is that while these products may or may not be product innovation, they are a starting point for user innovation which has not been explored.

Innovation in other economic sectors is not part of official statistics although there have been surveys of household innovation documented by von Hippel [von Hippel, 1988, 2005, 2017] and of the public sector (general government sector plus government institutions) [Arundel, Huber, 2013; Arundel et al., 2016; Bloch, 2010a, 2010b, 2013; Bloch, Bugge, 2013].

User Innovation

Now that there is a general definition of innovation that is an international standard for statistical measurement, it is possible to look more broadly at user innovation in all sectors of the economy and then to examine the influence and impact of the digital economy upon user innovation.

The general definition of innovation provided within the previous subsection is immediately applicable to the households sector (including individuals), the general government sector, and the non-profit institutions serving households (NPISH) sector while its application to the business sector has been discussed. Before the consideration of user innovation, some clarification on the use of language is needed.

The term ‘unit’ in the definition refers to an ‘institutional unit’ as defined in Chapter 4 of the SNA Manual 2008 [European Commission et al., 2009]. ‘Product’ is a good or a service [European Commission et al., 2009: para. 2.36]. In this, and other papers [Gaul

t, 2018], the author refers to the ‘business sector’. This term reflects the usage in all versions of the Oslo Manual [OECD, 1992; OECD, Eurostat, 1997, 2005, 2018] and in the Frascati Manual [OECD, 2015] which deals with research and development. The ‘business sector’ is a combination of non-financial corporations and financial corporations. The public sector is a combination of the general government sector and public institutions [European Commission et al., 2009, ch. 22]. Examples of NPISHs include: churches and religious societies, sports and other clubs, trade unions, and political parties.

The general definition, without change, is applicable to all SNA sectors if products made available to potential users at non-economically significant prices are included for the business sector. The household sector raises some statistical problems related to what a household does. Chapter 24 of the SNA Manual 2008 [European Commission et al., 2009] notes that households undertake final consumption but do not necessarily undertake production: ‘To the extent possible, the production activities within households are treated as quasi-corporations, included in one of the corporation sectors and separated from the rest of the household’.

This can be contested but for the purposes of this paper, user innovation in households is limited to products modified or developed for one’s own use and made available to potential users. In the general government sector, process changes can be made that improve the provision of products. Such an example is a single platform for accessing information about government services and ways of paying taxes or applying for benefits. This is not different from what goes on at a firm, but it will be governed by a policy of government rather than a corporate strategy. A trade union (NPISH) can improve the way in which it serves its members.

Making a new or significantly improved product available to potential users in any sector can be done in three ways. The new or improved product, the knowledge to produce it, or a prototype can be transferred to the original producer in the hope that a better product is produced. This would be the case of a user innovator who does not wish to produce the product innovation. In the second case, the user decides that there is value in making the product innovation available to potential users and starts a business to do this, or an institution unit in any other sector. In the third case, the product could be made available to potential users in a community or a peer group. An example is a new or improved method for treating an illness where the peer group consists of people with the illness and

the community works on treating the illness and tries to change its symptoms. If the new or improved product is not made available to potential users, it is not an innovation.

The Digital Economy and its Impact upon User Innovation

The characteristics of the digital economy are the speed with which it develops, its implications for society, innovation, and user innovation. Underlying this digital transformation are the skills needed by people to contribute to the transformation and, for the wider population, the skills needed to use digital products as a part of everyday life.

User innovation in the business, general government, and NPISH sectors will have to accommodate big data and artificial intelligence in their process innovation as well as the use of cloud computing and distributed databases for record keeping. To use digital technologies, the institutional units will have to employ skilled people or train their staff to work with the technologies. This has implications for the education and training system in general, and the universities and technical colleges in particular. Further this will impact capacity building programs at firms, government departments, and in NPISH. User innovation will continue to happen as part of process innovation as it did in the predigital economy. Households (including individuals) may be another matter.

Households (including individuals) can acquire digital products and modify them for their own benefit or, in the absence of the product being available, they can develop it and use it. So long as the product is made available to potential users it is user innovation. As with the other sectors, the difference with the predigital economy is the skill set required to modify and develop digital products. This suggests that the user innovator in the digital economy has a highly technical skill set and may be among a small number of user innovators. Compare the user innovator requirements with those required to modify or develop mountain bikes [Lüthje et al., 2005], kayaks [Hienerth et al., 2014], or domestic appliances.

There is a substantial literature on household innovation using products from the business sector, or the development of product innovations if the desired products were not available.

If all SNA sectors are considered, the products could come from any of them and they could be provided at economically significant prices or not. This adds another dimension to user innovation. In the

user innovation literature there are examples of user innovation with products from the government sector, such as medical services, medical devices, and social welfare services [von Hippel, 2017]. NPISH can also provide products that can be the basis of user innovation by households.

As all of the economic sectors connect in various ways, being part of a network or a system, the policies to promote or focus user innovation in all sectors are complex as they will be influenced by strategic initiatives from institutional units in other sectors.

Policies for User Innovation in a Digital Economy

The digital transformation is rapid and covers the whole economy. The development of a relevant innovation policy is challenged by this speed but the need to develop such a policy is recognized [OECD, 2017, p. 27] and being debated in many countries. An example response to the urgency is the artificial intelligence strategy, 'Al Made in Germany' introduced by the federal government in November 2018 [Government of Germany, 2018].

From the perspective of 'user innovation, this is likely to take place as process innovation in the business, general government, and NPISH sectors and it will be subject to the strategies and policies that apply in those sectors. Where the user innovation of products in the digital economy will happen is in the household sector and this could be encouraged as part of developing a culture of innovation. At first, the government has to enable people to function and work in a digital world. This would require a strong link between education and the demands of the digital economy. As a further step, policy could include the provision of 'maker spaces' where there are tools, databases, broadband access, and expert advice. Such spaces are also provided by businesses, an example of which is the BMW Customer Innovation Lab discussed in OECD [OECD 2018b, p. 77]. While businesses support user involvement in product development, the activity may not result in user innovation. Where it could advance user innovation is in improving the skill set of users participating in collaboration with business. This is happening in countries in different ways.

For individual users to consider user innovation in the digital economy, they need to know how to take advantage of the digital products introduced on the market or made available to potential users at no cost. If they proceed with product innovation, they

require more technical skills and access to databases that allow them to combine or develop products for their own use. The French government notes that thirteen million people in France have difficulty functioning in the digital economy. To deal with this, the Government of France has initiated a plan for an inclusive digital economy [Government of France, 2018]. Part of this plan is an experiment which will provide a 'digital pass' to provide access to training. More broadly, access to training to enable and support the use of digital products and their modification for one's own use has implications for the education and training system in all countries. This emphasis on the skills needed to work with digital products and processes does not preclude the type of user innovation that has been going on for years [von Hippel, 2017] involving different technologies.

In Russia, Strategy 2020 deals with innovation policy that emphasizes the fostering of mass innovation in all sectors of the economy, including low tech sectors. In a review of the policy by Gokhberg and Kuznetsova [Gokhberg, Kuznetsova, 2011], the emphasis is placed upon the social effects of innovation policy and the need to support the creative class. This fits well with policies in other countries to support the creative people who are able to engage in user innovation.

In Canada, there is an ongoing discussion of how to deal with the digital economy [Wolfe, 2019] and the challenges facing policy makers. One proposal is to create a federal innovation agency. There is no mention of user innovation but individuals engaging in innovation could access the support offered for innovation. However, individuals applying are likely to be more focussed on starting their business rather than innovating for one's own use.

In the developing world there are more challenges for supporting the digital economy and using it to engage in innovation [Bukht, Heeks, 2018]. A point made by Bukht & Heeks [Bukht, Heeks, 2018], which is applicable in all economies, is the need for ministries to understand the challenges and the opportunities of the digital economy for the coherence of policies. As user innovation by individuals is not seen in official statistics, there is a need for policy makers to understand the importance of an innovation culture in all sectors of the economy and for individuals and households to be a part of that.

Conclusion

This paper examined the scope of user innovation, especially in households, resulting from the publication in the fourth edition of the Oslo Manual of a general definition of innovation in all economic sectors. A second key influence has been the rapidly developing digital economy and its impact upon the skills that may be needed to function in it and to develop or change digital products for one's own use. To achieve this ability, there is a need for access to training and education that supports user activities and user innovation. An example of how to address this is France's digital pass or 'pass numerique' and related policies for social inclusion in promoting access to the digital economy.

Supporting individuals undertaking user innovation raises a question of the return on one's investment. Policy support could be seen as a long-term investment in a grass roots culture of innovation from which start-up firms that contribute significantly to the economy and society may arise.

An underlying issue with some technologies, of which Al and genetic editing are examples, is the ethical framework needed to guide major decisions by machines or altering of human embryos. While these activities can be regulated in businesses, governments, and NPISH institutions, households and individuals may require ethical guidance as well as policy support as these activities become more accessible.

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Сноски

1. Process innovation can include the purchase and use of technologies or services which are new to the firm. This is not an example of user innovation [OECD, Eurostat, 2018, section 3.3.2]

2. References to public sector innovation are found in [Gault, 2015, 2018]

3. As with any innovation, product innovation may not be used or purchased by potential users and, if they are, they may have good or bad outcomes

4. https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Non-profit_institutions_serving_households_(NPISH)

5. An example of a distributed database is blockchain and its role in recording and verifying Bitcoin transactions.