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# New trademark registration as an indicator of innovation: results of an explorative study of Benelux trademark data

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# New trademark registration as an indicator of innovation: results of an explorative study of Benelux trademark data


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**Abstract:** This paper studies the extent to which new trademarks refer to innovation. A sample of 660 Benelux trademarks shows that the motives of trademark registration are not primarily related to appropriating rents from innovation. This confirms the view that trademarks provide exclusive rights but no incentive for innovation *per se*. However, further research reveals that about 60% of recently registered Benelux trademarks refer directly to a broad range of innovative activities. In addition, the sample reveals that most of the trademarks are filed close to the market introduction of both new products and services. Hence they may be useful to measure innovations in late stages of development. Finally, trademarks appear to capture innovative activity that is not captured by other IPRs. Particularly, trademarks may yield additional insights into innovation in small firms and into service innovation.



**Keywords:** trademarks; innovation; IPRs; indicator

**JEL classification**: O34, O39


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## 1. INTRODUCTION

The innovative performance of companies, industries and countries has been studied extensively and for a long period of time. The results of these studies, however, have not yet led to a generally accepted indicator of innovative performance or a common set of indicators (Hagedoorn and Cloodt, 2003; Kleinknecht, 2000). Recent studies argue that trademark analysis can contribute to capturing relevant aspects of innovation phenomena (Buddelmeyer, Jensen and Webster, 2009; Davies, 2009; Mendonça, Pereira and Godinho, 2004; Millot, 2008; Schwiebacher and Müller, 2009; Stoneman, 2010) in particular in service and low-tech industries, and in SMEs (Davies, 2009; Flikkema, Jansen and Van der Sluis, 2007; Heidenreich, 2009; Hipp and Grupp, 2005; Lee, Chen, Ho and Hsieh, 2010; Schmoch, 2003; Schmoch and Gauch, 2009). Empirical tests have yielded promising, but preliminary results. First, Allegrezza and Guarda-Rauchs (1999) showed a positive relationship between a firm's number of trademark deposits and its R&D efforts. Second, firms in the EU, which are classified as innovative according to the CIS-3 criteria, consistently use more trademarks than non-innovative firms, and they use more trademarks than patents (Mendonca *et al.*, 2004; Millot, 2009). Finally, in a recent socio-economic study Daizadeh (2009) reports strong correlation between US R&D expenditures and the number of trademarks filed.

The two facts that R&D statistics and trademarks statistics correlate positively and that innovative firms consistently use more trademarks are an indication that trademarks may be relevant for measuring innovation. However, to draw a definite conclusion about the value of trademark data for research and policy making around innovation, we also need to know to what extent trademarks actually refer to innovative activities and what types of innovation they cover. This paper aims to make a contribution in this area by studying the innovative content of 660

new Benelux trademarks in depth. In particular, our contribution could help policy makers to identify new opportunities for innovation policy. Currently, policy makers tend to focus on R&D investments and patents. If trademark counts are a useful measure for innovation, policy makers have another indicator available to support their decision-making.

The validity of using novel registered trademarks as an indicator of the innovative performance of firms and industries is a function of i) the propensity of firms to register new trademarks for capturing returns on innovations, ii) the extent to which novel, registered trademarks refer to single or groups of innovations, iii) the extent to which trademark registration and innovation processes proceed simultaneously and iv) industry homogeneity concerning i)-iii). Previous studies focused mainly on the first and fourth validity aspect and found that the firm-level propensity to register trademarks for capturing returns on innovations varies strongly in and between industries (Graham, 2004; Heidenreich, 2009; Malmberg, 2005; Schmoch, 2003). Therefore, trademark statistics should be used predominantly as partial measures of the innovative performance of companies, industries and countries (Martin and Irvin, 1983; Mendonca *et al.*, 2004). The main purpose of this paper is to study the other two validity aspects by determining the extent to which recently registered trademarks refer to recent innovative activities or not, and if so to what types of innovation. In addition, we study whether measuring trademarks will yield additional insights into innovation over measuring other IPRs (copy rights, model rights, growers' rights or patents). Together, our findings help to clarify under which conditions new trademarks are a valid measure of innovation and most relevant for policy making purposes.

A first research question that may shed light on the reference of trademarks to innovation is about the motives behind trademark registration. Hipp and Grupp (2005) put forth the

hypothesis that trademarks often are not directly 'linked' to an innovation. Instead, marketing and competitive considerations may be more important motives for trademark registration than signaling or protecting innovation. Empirical research testing this hypothesis is still lacking. Section 4.1 provides a first empirical analysis of registration motives.

Next, the fact that trademarks may not be directly linked to innovation does not necessarily imply that they do not refer to innovation at all. Even if the primary motive for trademarking a product or service is marketing, the underlying product, service or new business may of course still be innovative. Therefore, a second research question is to what extent trademarks refer to innovation. To answer this question we study three things. First, in section 4.2 we discuss the type of innovation trademarks refer to. Second, in section 4.3 we explore whether variation in the reference to innovation can be explained by differences in company size, frequency of trademark registration or NICE class in which the trademark is registered. Together the answers to these questions will give a first indication of the extent to which new trademarks can be used as an indicator of innovation validly. The third element relates to the timing of trademark registration (see section 4.4.). When trademarks are registered early in the innovation process, they may be well suited to measure activity early in the innovation funnel or stage gate process (Cooper, 1983). Registration in a later phase, as assumed by Hipp and Grupp (2005), will make trademarks useful as an indicator for researchers who aim to study innovations around the period of their market introduction.

Once we have established whether trademarks refer to innovation, we address the issue whether studying trademarks adds insights over and above studying other IPRs like patents (section 4.5). If trademarks and patens refer to the same innovations, clearly it will not be useful

to study both trademarks and patents. One of the two will do. By studying whether or not trademarks are parts of bundles of IPRs we may get a first insight into this issue.

This article will first discuss the theoretical background behind these questions in more detail. Next the research population, sample and the survey method will be described. This is followed by the empirical answers to our research questions. The final section contains the conclusions, discussion, consequences for policy making and suggestions for future research.

## 2. THEORETICAL BACKGROUND

### *2.1 Approaches to innovation*

The conceptualization of innovation as well as the types and patterns of innovation have been discussed widely since the publication of Schumpeter's Theory of Economic Development (Schumpeter, 1934). The rise of the service sector, the servitization of manufacturing and the increasing importance of branding are important motives for this discussion (Aaker, 2007; Barras, 1990; Drejer, 2004; Gallouj, 2000; Hollenstein, 2003; Miles, 2004; Ramello and Silva, 2006; Tether, 2005; Van der Merwe and Rada, 1988). Characteristics of services and service development hinder the identification of innovation and innovation-related-growth in service industries (Flikkema *et al.*, 2007). As a consequence, in the last two decades various academics have reconsidered the approaches to innovation, in particular for service industries (Barras, 1986; Den Hertog, 2000; Flikkema *et al.*, 2007; Sundbo and Gallouj, 2000).

Service peculiarities have led to pleas for comprehending the soft or non-technological side of innovation, including aspects as organizing, business modelling and branding (Den Hertog, Bilderbeek and Maltha, 1997; Gallouj, 2000; Hamel, 2000). The value of trademarks for

appropriating rents from innovation seems especially prevalent here, since trademarks can be used to leverage the value of immaterial assets like for example brand sense (Lindstrom, 2005) or cyber space positions (Burk, 1997). Opponents, however, consider including the soft side of innovation as an over-stretch of the Schumpeterian innovation notion (Drejer, 2004). On the other hand, paying attention to both the hard and soft side of innovation in both services and in manufacturing can be regarded as an attempt to comprehend the holistic way in which customers evaluate new or significantly adjusted offers (Schmitt, 1999). It may lead to the conclusion that innovation in services is significantly softer than innovation in manufacturing, although this does not seem to hold for all service industries (Hughes and Wood, 2000).

To be able to meet the requirements of the various sides in this debate, we define innovation broadly (Coombs and Miles, 2000) and try to show to what extent each conceptualization of innovation is referred to by trademarks. We distinguish technological, non-technological and marketing innovation (Fosfuri and Giarratana, 2009; Millot, 2008). In addition, we explore the relationship between these types of innovation and the introduction of trademarked new products, services and processes. This will enable both the academics and policy makers who define innovation narrowly (as the application of advanced technologies) and those who define it broadly (as any introduction of something new) to judge whether trademarks are useful for their respective purposes.

### *2.2 Trademark application in the European Union*

A registered trademark is a legally protected name, word, symbol, sound or design, and their combinations, used by a manufacturer or seller to identify a product or service and distinguish it from other goods and services (Economides, 1998; Greenhalgh and Rogers, 2007). Trademarks

are signs that serve as badges of origin – they indicate the individual source of the goods or services. However, there is also misrepresentation involved (Papandreou, 1956). For a trademark to function effectively, consumers have to be able to recall the mark and the associated features, and others shouldn't be able to use a confusingly similar mark. Both the 'source distinctiveness' and the 'differential distinctiveness' of a trademark should be high (Beebe, 2005). That is, in the minds of consumers a trademark and its semantic content should refer uniquely and correctly to a certain source. There should be no confusion about the features of the trademarked product or service as a consequence of trademark lookalikes in a related line of business or through dilution –by blurring or tarnishment- in an unrelated line of business (Economides, 1998; Ramello and Silva, 2006).

The trademark holder is given a legal monopoly on the use of the trademarked 'sign' in connection with the attached commodity and is therefore exclusively protected against infringement. A registered trademark protects a mark at least against exact imitation. It never provides complete protection, since in a sufficiently large pool of registered trademarks avoiding similarity between an application and both existing and new trademarks becomes extremely costly (Von Graevenitz, 2006).

At present, the European Union has three different systems for the protection of goods and services by means of trademarks: i) the national trademark system, ii) the international (Madrid) system and the iii) community trademark system (Rujas, 1999). The Community Trade Mark provides its owner trademark protection throughout the entire European Union, with the same rights in all member states. In all of the three registration systems trademarks are classified according to the 1957 NICE Agreement Concerning the International Classification of Goods and Services for the Purposes of the Registration of Marks. The NICE classification system

distinguishes between goods and services. It has 34 classes of manufactured goods and 11 classes of services (see Appendix B). It is regularly revised and now in its 9th edition, which has been in force since January 1, 2007.

Trademark applications are not necessarily classified according to the main product line or productive sector of the applicant company (Mendonca *et al.*, 2004). The NICE classification has no direct connection with more detailed sectoral nomenclatures such as NACE (Statistical Classification of Economic Activities in the European Community). Moreover, a given product or supplier can also be protected by more than one trademark. That is, there is no one-to-one correspondence between a new product or service and a new trademark.

*2.3 Motives for trademark registration*

The literature has identified a number of motives companies may have to register trademarks. An important view on trademarks stems from Landes and Posner (1987). They emphasize the role of trademarks in solving information asymmetry between buyers and sellers: firms use trademarks to signal quality, reducing customer search costs and enabling the firm to build and maintain customer loyalty (Davies, 2009). As a consequence a firm can charge a higher price (Reichheld and Teal, 1996) and firm profits increase (Heskett *et al*., 1994).

A second set of motives can be distilled from the industrial organization literature on brands, entry and barriers to entry (Greenhalgh and Rogers, 2007). The practice of differentiating products horizontally and protecting them with trademarks is well-known (Davies, 2009, Ramello and Silva, 2006). The use of trademarks in this way is one of the several legitimate ways to 'pack' a product space to reduce the number of profitable niches for competitors (Reitzig, 2004). The productive use of trademarks, however, is not restricted to horizontal

competition. As Reitzig (2004) illustrates with patents, firms use IP rights as well to increase bargaining power with suppliers, that is, to increase power in different upstream segments of the value chain. As opposed to patents, trademarks seem to be more appropriate to increase power in downstream segments of the value chain or in end markets. Consider the effects of Intel's 1990 "Intel Inside" marketing and branding campaign. The idea of ingredient branding was new at the time with only Nutrasweet and a few others making attempts at that (Tedlow, 2007). This campaign established Intel, which had been a component supplier little-known outside the PC industry, as a household name. In the 1980s, Intel was among the top ten sellers of semiconductors (10th in 1987) in the world. In 1991, Intel became the biggest chip maker by revenue and has held the position ever since.

A third motive for registering trademarks may lie in franchise systems. Franchising can be defined as 'a license from the owner (franchisor) of a trade or service mark permitting the user (franchisee) to market a product or service under that name in accordance with the franchisor's system' (Norback and Norback, 1982). It is a way to allocate decisions between the franchisor and the franchisee in order to promote efficiency and provide incentives. Franchisees make decisions regarding local operations, such as hours, prices, and locations, because they have the knowledge about local trading conditions. Franchisors make decisions regarding the product, its production, and associated marketing efforts that together create the standardization that the trademark signals. The franchisor and franchisee share a common trademark, which is the embodiment of the value of the franchise relationship and in addition a governing device (Spinelli and Birley, 1996).

The 'management fad' view is the fourth view on trade marking. In this view trade marking has little inherent value but is simply a case of companies imitating each other because

registering trademarks is fashionable (Abrahamson, 1996, Greenhalgh and Rogers, 2007). According to Greenhalgh and Rogers (2007, p. 7) 'It is possible that the increased use of trademarks is largely due to changing management practices and, specifically, a rush by managers to copy rivals' activities, rather than any inherent value relevance for trademarks perse'. However, their recent UK study (Greenhalgh and Rogers, 2007) shows that managers were not just seeking trade marks to follow a management fad or fashion, but could expect to receive real returns from trademarked product innovations.

In the final view trade mark flows are considered as a proxy of innovation and industrial change (Martin and Irvine, 1983; Mendonca *et al*., 2004; Schmoch, 2003), since firms rely on trademarks as single or complementary means to appropriate returns from innovation (Aaker, 2004; Amara, Landry and Traoré, 2008; Arbussa and Coenders, 2007; Graham and Somaya, 2006; Miles *et al.*, 2000). The complementarity of trademarks, patents and copyrights in service industries is shown by Miles *et al.* (2000), while Amara *et al.* (2008) show that patents, registration of design patterns and trademarks are complementary legal methods on which knowledge intensive business services rely.

Summarizing, the literature has identified different motives for trademark registration. Obviously companies may have combinations of these motives when they register trademarks, rather than only one. Empirical research into which are the dominant motives and whether they occur in combination or not, is absent.

### *2.4 The innovative content of trademarks*

The final motive mentioned in subsection 2.3 requires some deeper investigation because novelty and technological progress are no requirements for registering trademarks. On the other

hand inventions and technological novelties do not speak for themselves (Schwiebacher and Muller, 2009) and may require trademarks to be visible for consumers in the market place. According to Barnes (2006) trademark law was not designed to elevate discourse or disseminate knowledge the way copyright law does or lead to promote innovation, as patent law does. He argues that in fact trademarks are not really "intellectual" at all. 'Whereas patents are granted to inventions on the basis of non-obviousness, inventiveness in the face of prior art and the potential for industrial application, a commercial sign, on the other hand, may be denied registration, but only if judged deceptive to consumers, if it is deemed contrary to morality or if it denotes symbols reserved for the use of the state or public organizations' (Mendonca *et al.*, 2004, p. 1387). By informing other market players that a product is protected by a trademark, the trademark holder signals that no other company or invention can bear the same distinguishing mark, but not that the product, itself is innovative (Davies, 2009, p. 8.). Therefore, Fosfuri and Giarratana (2009) argue that new trademarks may serve better as an indicator of new advertising or marketing innovation (see also Millot, 2009).

Mendonça *et al.* (2004) on the contrary believe that trademarks are filed primarily for new products and services. Similarly Malmberg (2005) argues that minor and incremental improvements of existing products will not be trademarked, since they run the risk of triggering existing customers to perform an evaluation of other suppliers' products rather than just sticking to the brand they used to prefer. Which of these views is correct is a matter that still awaits an empirical answer.

The answer may also differ across big or small firms. The literature provides some inconclusive arguments here. Some might argue that small firms' trademarks refer more frequently to innovation than large firms' trademarks. A reason for this might be that small firms

seeking to appropriate the value of their technological assets might use trademarks sooner than large companies. Due to their small size and accompanying lack of resources, the costs of patenting, which are at least ten times the costs of trade marking, might be beyond them (Mendonca *et al.*, 2004; Davies, 2009). Trademarks may be a cheap alternative. Another strand of literature argues that in some industries smaller companies are more innovative than larger ones (Acs and Audretsch, 1988; Baldwin, 1991; Baldwin and Gellatly, 1993). If this is true, trademark registration by small companies may refer to innovation more often. More in particular, company size may also have an impact on the type of innovation trademarked. If high-tech start-ups are indeed an important phenomenon (Motohashi, 2005), then we may expect that the trademarks of smaller companies refer more often to technological innovation than to service innovation.

There also is an argument for the opposite view, namely that trademarks registered by small companies are 'less innovative'. Small companies may predominantly file trademarks which act as trade names or personal brands. Large companies may file more trademarks and these might refer more often to the introduction of new products and services. Therefore, small firms' trademarks may be less indicative of innovation than trademarks filed by large ones. Empirical research will have to settle this debate.

Since trademarks are by definition used to 'identify a product or service and distinguish it from other goods and services' (Economides, 1998), we may expect that the reference rates of new trademarks to product innovation and service innovation exceed the reference to process and marketing innovation. Fosfuri and Giarratana (2009), as discussed before, do not support this reasoning for marketing innovation. Again, only studying empirics will reveal which of the arguments is valid.

Finally, we expect that the reference of trademarks to product innovation is highest for trademark registrations in NICE industry classes: 1-34, although trademark applications are not necessarily classified according to the main product line or productive sector of the applicant company. It is likely that that trademark reference to service innovation is highest in NICE service classes 35-45.

*2.5 Timing of trademark registration*

A final aspect is the question at what moments in time companies register trademarks. They may do so early in the innovation funnel to mark an invention. In that case trademarks would refer to results from research. However, according to Hipp and Grupp (2005) it is more likely that they register trademarks late in the innovation process, for example just before or at market introduction. The earlier in the innovation process these trademarks are registered, the more they may be indicative of basic research efforts and technological innovation. The later they are registered, the more they may be useful to study innovations that are close to market introduction.

It is meaningful to test if there are differences between product and service innovation concerning the timing of trademark registration. A priori, it seems likely that trademarks used to identify service innovation are registered closer to market introduction than trademarks used to identify product innovation. Service innovation is considered in the literature as R&D extensive, supplier dominated and frequently emerging on-the-job (Gallouj and Weinstein, 1997; Pavitt, 1984; Sundbo, 2000).

## 3. SURVEY AND SAMPLE

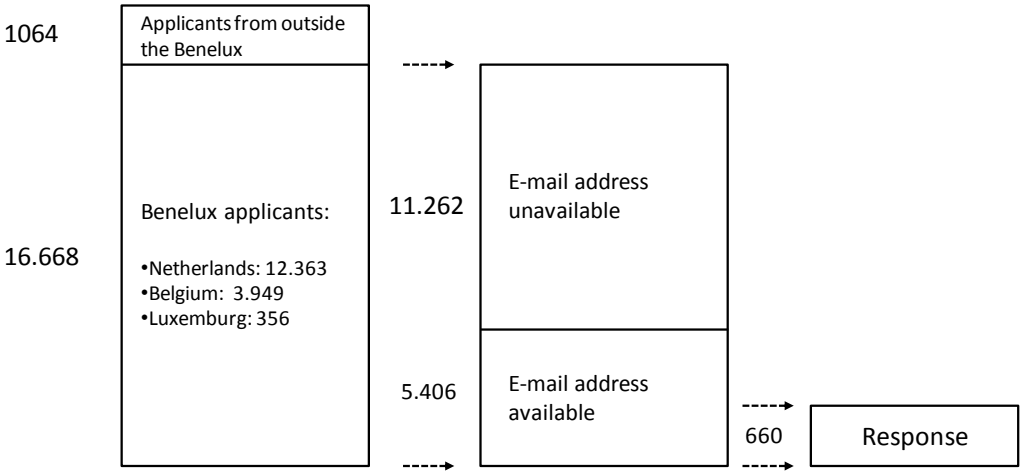
To answer the research questions of our study, we have approached all Benelux applicants of Benelux trademarks (BTMs) filed in the database of the Benelux Office for Intellectual Property (BOIP) between January 2007 and March 2008, whose e-mail address was available (see Figure 1). We invited the 5406 applicants to fill out an on-line questionnaire, the Trademark Innovation Survey (TIS) about the motives of BTM registration, the innovative content of BTMs and the timing of BTM filings. In addition we gathered information about applicant characteristics, including the use of other IPRs.

We compiled a list of 20 possible registration motives primarily based on the suggestions made by Mendonca *et al.* (2004, p. 1389) and the literature on motives as reviewed above. To explore the relationship between BTM registration and innovation, we have integrated CIS-5 questions on innovative activity and innovation policies into TIS (see also Appendix A). In addition, we added questions on non-technological innovation and marketing innovation as suggested by Fosfuri and Giarratana (2009) and elaborated by Millot (2009), which implies that we embrace a broad view on innovation (Coombs and Miles, 2000). That is, we define innovation broadly in the tradition set by Schumpeter (1934). To compare the timing of BTM filing in the process of innovation, we have used the new product development process model of Cooper (1983) as a reference model. Coopers (1983) model comprises a linear sequence of seven stages: idea generation, research, development, testing, marketing, market introduction and commercialization.

To test whether trademarks refer to innovation, we asked the BTM applicants to judge on a dichotomous scale if there is a direct relationship between the BTM filing and various types of innovation. Inspired by the work of Kapferer (1991) on the relationship between brands and

products and in order to learn more about the direct or indirect relationship between BTMs and innovation, we asked the BTM applicants to clarify whether the trademark is used as a sign for i) a single product, service, technology or process or ii) a range of products, services, technologies or processes, or iii) start ups or mature firms. The various questions about applicant characteristics in the Trademark Innovation Survey (TIS) are predominantly based on suggestions from the economic literature (Davies, 2009; Mendonca *et al.*, 2004; Malmberg, 2005).

**Figure 1** Decomposition of the research population




To improve the face validity and content validity of the survey, we asked a team of entrepreneurs, IP experts from BOIP, the Dutch Ministry of Economic Affairs, and the multinationals Philips and ING to make suggestions for survey improvement. Their comments were incorporated, to ensure the survey was both correct and easy to understand.

The questionnaire was linked electronically with the BOIP trademark database, which means that respondents could complete the on-line survey and inspect the details of their BTM

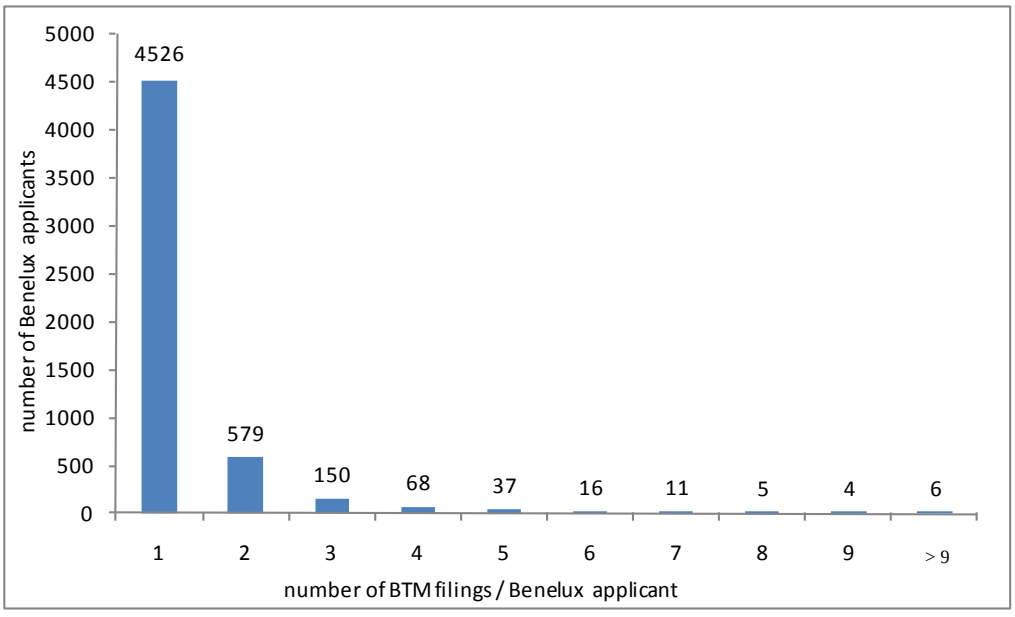
filing in another window at the same time. In case of Benelux applicants with multiple BTM filings in the research period, we have selected one of these filings randomly and asked the applicants to fill out the questionnaire for this BTM only. In Figure 2 we have depicted the distribution of the number of BTM filings per applicant between January 2007 and March 2008 in the research population. The number of BTMs filed per applicant varies between 1 and 20. About 85% of the applicants filed one BTM and on average the applicants filed 1.3 BTMs in the research period.

Note that most of the Benelux BTM applicants, who couldn't be contacted by e-mail, because their e-mail address was missing in the BOIP database, were serviced by trademark attorneys during the filing and registration process (see Figure 1). This might be a potential weakness of our research method. It is possible that applicants, who frequently file trademarks, enlist the services of trademark attorneys more frequently, because they consider trademarks as strategic assets and not as a nice-thing-to-have for a rather low price. As frequent filers may be more innovative, our results may underestimate the reference of BTMs to innovation or certain types of innovation in the Benelux area. In addition, we only researched Benelux trademarks and did not include International Trademarks (ITMs) or Community Trademark (CTM) applications, though one could argue that many (radical) innovations result from international R&D partnerships (Hagedoorn, 2002; Miotti and Sachwald, 2003), have impact on an international scale (e.g. Zhu, Kreamer and Xu, 2006), and are protected with IPRs that fit with their intended multi country marketing scope (Dumont and Holmes, 2002).

We received 660 responses on our initial and reminding request to fill out the on-line questionnaire. Since 976 of the 5406 e-mails could not be delivered, this implies a response rate of almost 15%. The sample is dominated by first users: 60% of the BTM applicants in the sample

had neither filed a trademark before at BOIP nor at OHIM (the European trademark office), while 30% already had a trademark filing history with BOIP. Up to 10% of the applicants had already filed multiple trademarks, both at BOIP and OHIM. The applicants filed the sample BTMs for mature firms (69%), start-ups (11%), firms to be started up in the future (10%) and for organizations not registered at the Chamber of Commerce (10%). The large majority (95%) of the applicants in the sample represent firms with less than 50 employees (see Figure 3). Very small firms (2 employees) and one man businesses together constitute 48% of the sample; 3% of the applicants represent medium sized firms (51-250 employees), while large firms account for less than 2% of the BTM filings. Concerning the core activities of the applicants: the service sector (74%) is better represented than industry (20%) and the primary sector (6%). These proportions show important parallels with the sector contributions to the Gross Domestic Product and the labor force in the Benelux.

Figure 2 Distribution of the number of BTMs per applicant (January 2007-March 2008)



To test if the sample is representative, we compared the country distribution (Belgium, Netherlands and Luxemburg), the trademark type distribution (verbal-figurative-collective[1]), the distribution of 'invalid' trademark filings (deleted trademarks, canceled trademarks, expired trademarks-refused trademarks) and the volumes in the NICE classes in both the sample and the research population. The results indicate that our sample does not differ significantly from the overall population, except for some different registration volumes in NICE classes 3, 14, 19, 20, 21, 22, 28, 34. (see Appendix B for a description of the 45 NICE classes and Appendix C for the sample distribution over the 45 NICE classes). Hence the sample may not be completely representative for eight out of 45 NICE classes. Further analysis showed that this only led to a small overestimation of product and service innovation through registrations in NICE class 21.

**Figure 3** Firm size distribution in the sample

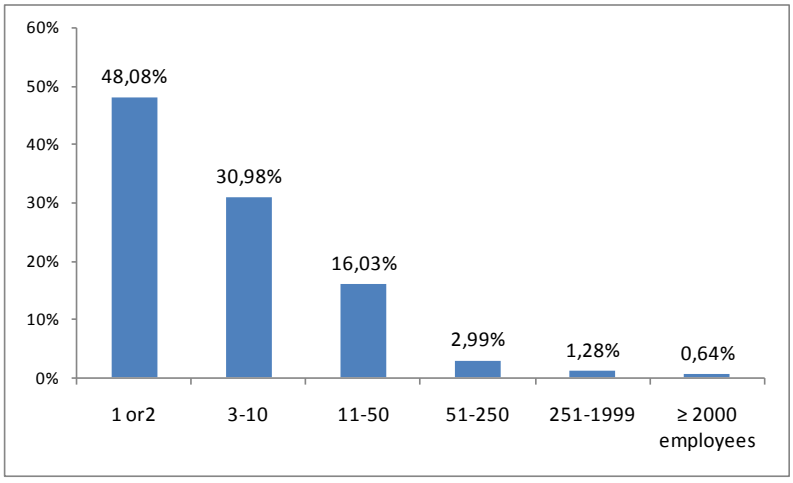
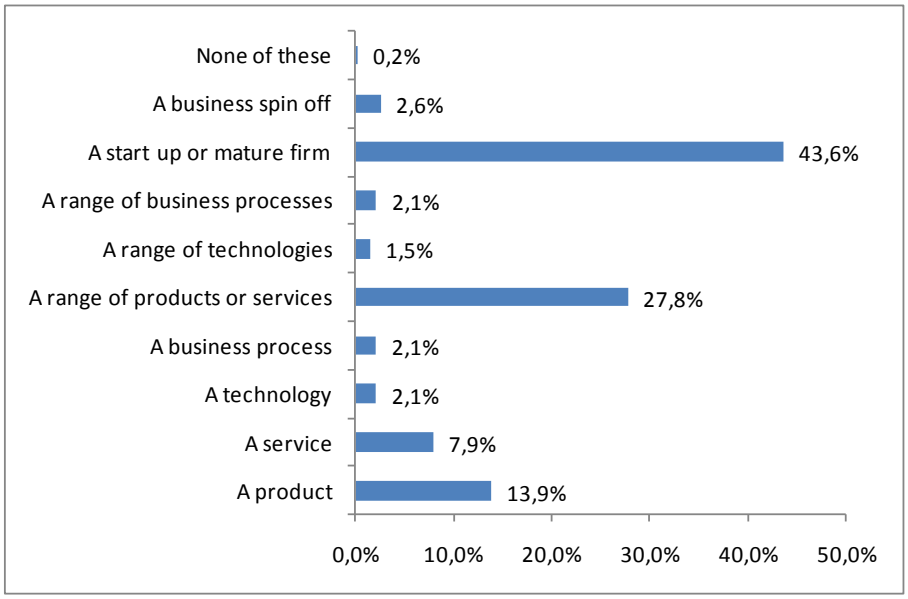



Figure 4 shows the distribution of the trademark-use in the sample, inspired by the work of Kapferer (1991). About 44% of the trademarks in the sample seem to be used predominantly as a

[1] A collective trademark is a trademark owned by an organization (such as an association) whose members use it to identify themselves with a level of quality or accuracy, geographical origin, or other characteristics set by the organization.

trade name for a company, 28% as a label for a range of products or services and almost 22% for the marketing of single products or services. Almost 8% of the trademarks refer to (a range of) technologies or business processes. The classification seems collectively exhaustive, since only 0.2% of the trademarks refer to an object not in the current classification.

**Figure 4** Distribution of the BTM use in the sample.

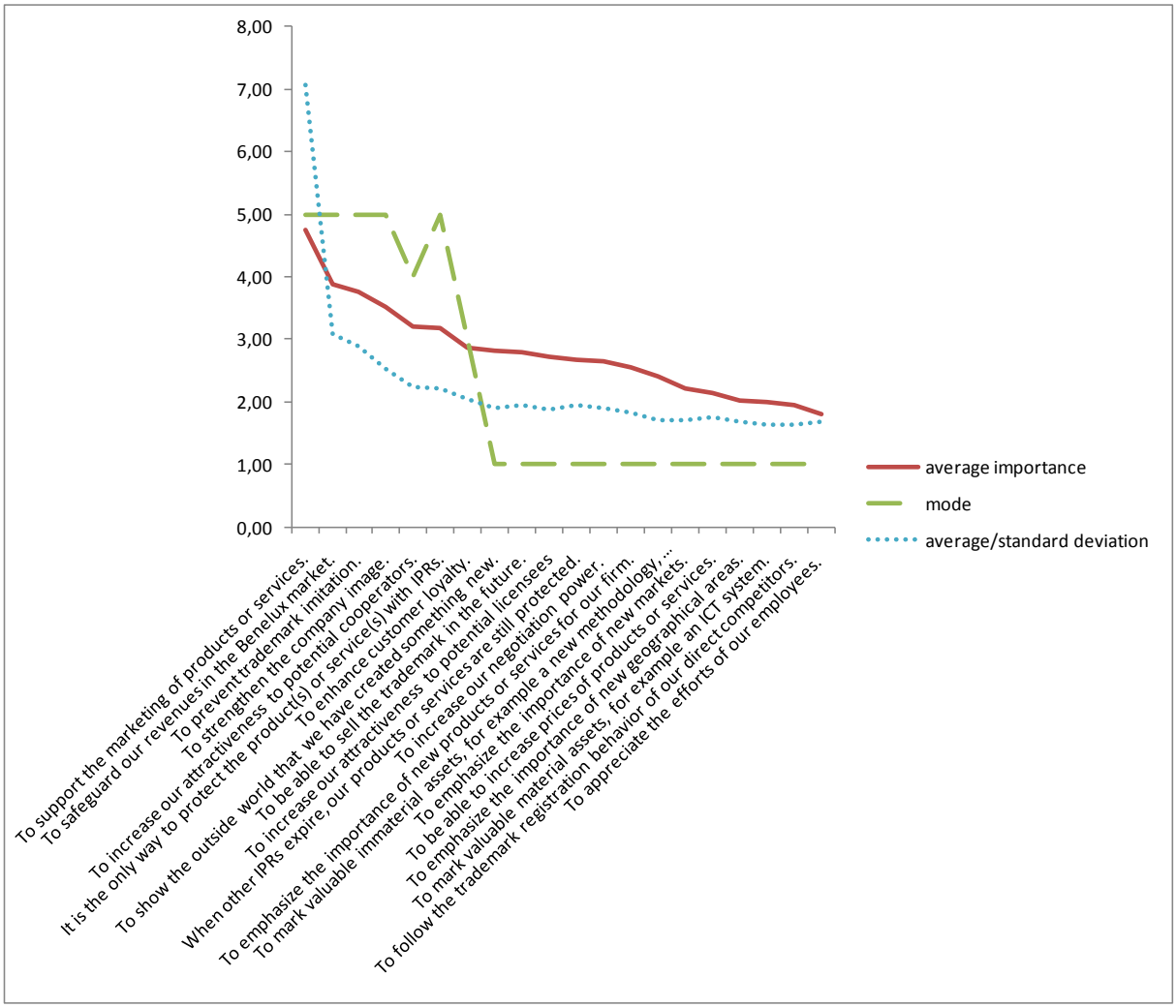



## 4. RESULTS

### *4.1 Motives of trademark registration*

In Figure 5 we have ranked the twenty trademark registration motives from our survey. The ranking was based on the average importance of the various motives of trademark registration for our respondents. From the ranking in Figure 5 we can learn that six motives have been motivating for the majority of our respondents (mode score $\geq 3$ and average importance $\geq 3$).

**Figure 5** Importance of trademark registration motives




Innovation-related motives seem to play a subordinate role at first sight. This may be caused by a weak relationship between innovation activity and trademark registration or vice versa, or by the existence of motives in which innovation-related motives are more or less embedded. Take for example the 2nd motive in the ranking: "To safeguard our revenues in the Benelux market". If a trademark applicant uses a trademark to capture the returns on innovation, then he might have given this motive a high score.

To explore if the twenty registration motives can be reduced to underlying factors, we performed a Principal Components Analysis (PCA) with Varimax rotation. We transformed the 'not applicable' scores to a score of "0", so that all motives are scored on a scale from 0 to 5, instead of 1 (very unimportant) to 5 (very important). Note that we could use information of 468 out of the 660 respondents to perform the PCA. Respondents from not-for-profit firms (n=64), from firms (likely) to be started up in the future (n=69) and in addition respondents claiming that the BTM was not registered for commercial purposes (n=59) have not been invited to fill out the question on registration motives for validity reasons. The results of PCA are reported in Table 1. It reveals four principal components, which we labeled based on information from motives loading strongly (> .4) and dominantly on one of the four factors. All supposed motives except for one, motive 17 –To be able to sell the trademark in the future- are explained well by the four factors (see the extraction scores in the final column of Table 1).

Inspired by the data, we deduced four underlying motives of trademark registration. The first one is to leverage other firm assets. This motive relates to trademarks that are used to increase the value of assets a company already possesses, be it the company image, customer base or negotiation power. A new brand can strengthen any of these assets. The second motive is to emphasize the importance of product or market innovation to both firm insiders and outsiders. A new trademark will show that something new is happening and acts as a signaling device for this. The third motive is to improve the marketability of firm assets. If an asset is marked, this is an indication that it is valuable and helps in exploiting that asset in the market, because it becomes a recognizable entity. A final motive is to prevent marketing imitation. By claiming a trademark, direct imitation by a competitor is made more difficult.

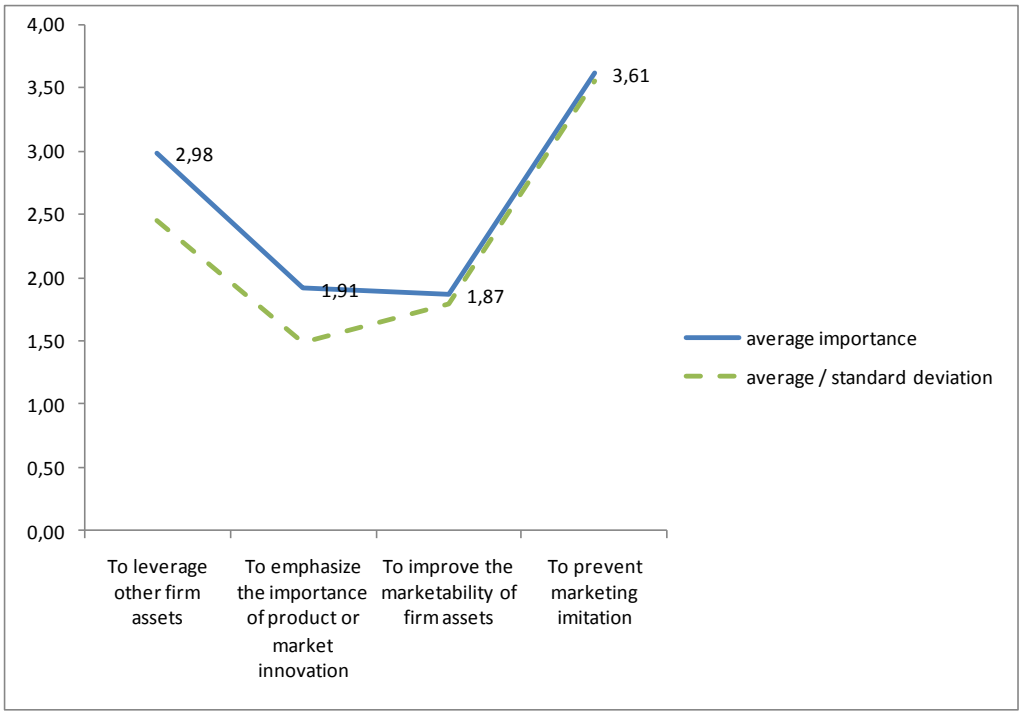
**Table 1** Underlying motives of trademark registration

| | | To leverage other firm assets | To emphasize the importance of product or market innovation | To improve the marketability of firm assets | To prevent marketing imitation | Extraction |
|---|---|---|---|---|---|---|
| 1. | To support the marketing of our products or services. | ,087 | ,010 | -,158 | **,689** | ,508 |
| 2. | To safeguard our revenues in the Benelux market. | **,712** | ,029 | -,030 | ,223 | ,559 |
| 3. | At the moment the registration of (a) trademarks is the only way to protect the marked product(s) or service(s) with IPRs. | ,243 | ,288 | ,133 | **,560** | ,473 |
| 4. | To prevent trademark imitation. | -,077 | ,050 | ,350 | **,618** | ,513 |
| 5. | When other IPRs expire, our products or services are still protected. | ,121 | ,155 | **,533** | **,447** | ,523 |
| 6. | To follow the trademark registration behavior of our direct competitors. | ,300 | ,082 | **,514** | ,212 | ,406 |
| 7. | To show the outside world that we have created something new. | **,636** | ,151 | ,317 | ,064 | ,532 |
| 8. | To increase our negotiation power. | **,501** | ,381 | ,303 | ,227 | ,539 |
| 9. | To strengthen the company image. | **,792** | ,193 | ,051 | -,102 | ,677 |
| 10. | To enhance customer loyalty. | **,726** | ,323 | ,111 | ,060 | ,647 |
| 11. | To increase our attractiveness to potential cooperators. | **,671** | ,257 | ,255 | ,077 | ,587 |
| 12. | To increase our attractiveness to potential licensees | ,362 | ,358 | **,472** | ,191 | ,519 |
| 13. | To be able to increase prices of products or services. | ,349 | **,557** | ,359 | ,116 | ,574 |
| 14. | To emphasize the importance of new geographical areas. | ,177 | **,836** | ,190 | ,145 | ,788 |
| 15. | To emphasize the importance of new markets. | ,210 | **,833** | ,154 | ,140 | ,782 |
| 16. | To emphasize the importance of new products or services for our firm. | ,258 | **,743** | ,168 | ,023 | ,647 |
| 17. | To be able to sell the trademark in the future. | ,144 | ,199 | **,441** | ,264 | ,324 |
| 18. | To appreciate the efforts of our employees. | ,112 | **,494** | **,469** | ,029 | ,477 |
| 19. | To mark valuable immaterial assets, for example a new methodology, standard of index. | ,115 | ,128 | **,730** | -,047 | ,565 |
| 20. | To mark valuable material assets, for example an ICT system. | ,034 | ,254 | **,729** | -,084 | ,605 |

N=468, KMO=.9, eigen values > 1, TVE=56.2%, Bartlett's Test of Sphericity is passed successfully at the 0.000 level.

In Figure 6 we present the average importance of these four motives. Clearly, the second and third motives are on average less important than the first and fourth motive, though the importance of the first motive is quite variable, compared to motive three and four.

**Figure 6** Average importance of the four trademark registration motives



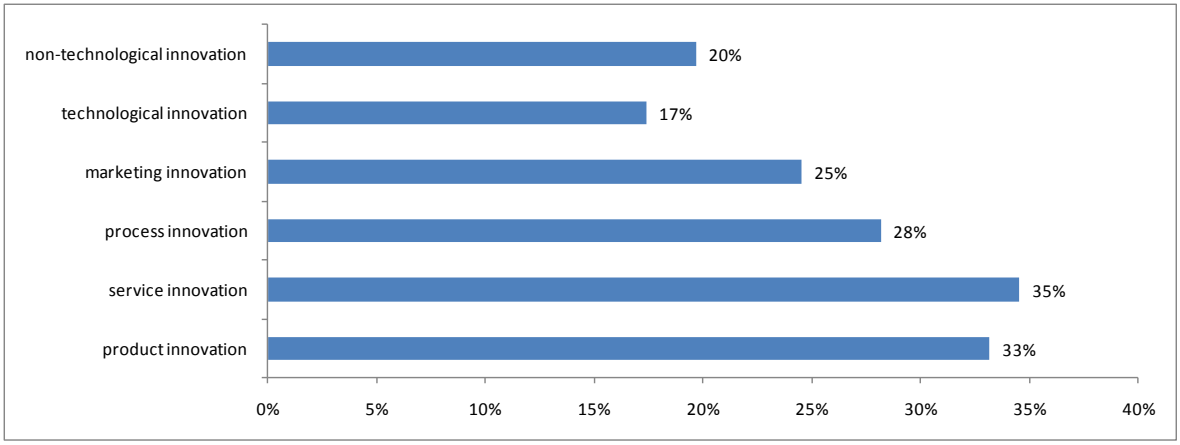

For our investigation into the relevance of trademarks for measuring innovation, we can conclude that innovation plays a role as a motive for trademark registration, but that it seems to be a subordinate role. This confirms Davies' (2009) view that trademarks provide exclusive rights, but no incentive for innovation per se. However, this does not mean that trademarked products or services are not innovative. A new, innovative product may primarily be trademarked for other motives than innovation or the motives may be related to innovation

indirectly. Therefore, it is necessary to look beyond the initial motives for registration and to study the innovative content of trademarks in more detail.

*4.2 Reference of trademarks to innovative activity*

In Figure 7 we show the reference of BTMs to innovative activity graphically. We asked the respondents to indicate whether the trademark they registered referred to any of the types of innovation mentioned in Figure 7 (see Appendix A for the conceptualization of the various innovation types). Overall, 58% of the BTMs in the sample refer to at least one of the distinguished types of innovative activity. The reference of BTMs to product (33%) and service innovation (35%) is relatively high and outperforms the reference to marketing innovation (25%), which does not support Fosfuri and Giarratana's (2009) argument that trademarks may serve better as an indicator of new advertising or marketing innovation. In addition, the reference to process innovation (28%) is remarkably high. So even though, as Hipp and Grupp (2005) state, trademarks may not be directly linked to innovation, this does not lead to the conclusion that trademarks are of limited use for measuring innovation. In fact, in our data about 60% of the trademarks refer to innovation or innovative activity.

**Figure 7** Trademark reference to innovative activity



Next we tested for patterns of multiple references to innovative activity, based on results of correlation analyses (see Appendix A). A single trademark may refer to more forms of innovation. For example, often service innovations are process innovations as well (Johne and Storey, 1998) or as some hold, it is hard to distinguish the two conceptually (Drejer, 2004; Flikkema *et al.*, 2007; Preissl, 2000). To discover such patterns we performed PCA with Varimax rotation. Table 2 shows that BTMs seem to refer to three underlying types of innovative activity. The first component shows that service innovation coincides with process innovation and the implementation of new technology, not its invention. This is in keeping with the literature on service innovation that emphasizes the importance of process innovation for service innovation and identifies a greater role for exploiting existing technology than creating new technology (Flikkema *et al.*, 2007). The second component refers to what can be termed 'traditional' innovation: a technology that is incorporated in a new product. The final component consists of non-technological and marketing innovation. This component seems to be logical as well: marketing innovations rarely have technological components. Hence, trademarks refer to a broad set of innovative activities.

**Table 2** Underlying innovative activity

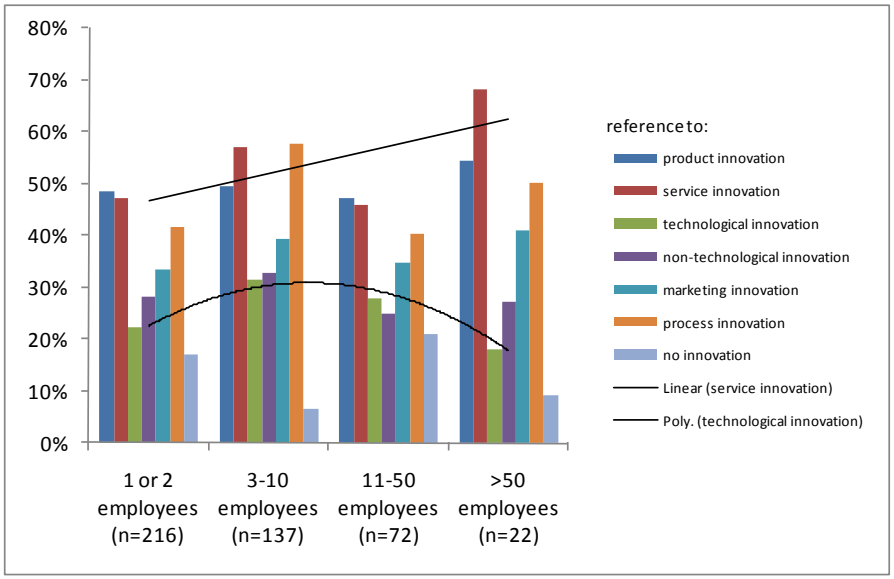
| | | Component 1 | Component 2 | Component 3 | Extraction |
|---|---|---|---|---|---|
| 1. | process innovation | **,804** | ,077 | ,099 | ,662 |
| 2. | implementation developed technology | **,788** | ,260 | -,025 | ,690 |
| 3. | implementation purchased technology | **,692** | ,337 | ,093 | ,600 |
| 4. | product innovation | ,002 | **,824** | ,130 | ,696 |
| 5. | service innovation | **,680** | -,215 | ,175 | ,540 |
| 6. | technological innovation | ,399 | **,651** | -,159 | ,608 |
| 7. | non-technological innovation | ,202 | -,250 | **,762** | ,684 |
| 8. | marketing innovation | ,012 | ,333 | **,789** | ,733 |

N=660, KMO=.75, eigen values > 1, TVE=65.1%, Bartlett's Test of Sphericity is passed successfully at the 0.000 level.

*4.3 Differences in the use of trademarks*

As the theory has some conflicting predictions regarding differences in the use of trademarks for different company sizes, registration policies and NICE classes, we analyze those differences here. Delving further into the data, we studied whether the content of trademarks registered by big firms is more innovative than those registered by small and medium sized enterprises. To explore the relationship between firm size and trademark reference to innovative activity, we have composed the graph in Figure 8, with trend lines for service innovation and technological innovation. Two things should be mentioned. First, the trademark reference to any form of innovative activity is lowest in mini firms (1 or 2 employees) and firms with 11-50 employees. Second, the reference to service innovation tends to increase with firm size, while the reference to technological innovation tends to decrease with firm size, with a maximum reference for firms with 3 to 10 employees. Together, this may indicate that small firms relatively often are technology based start ups. The conclusion is that trademarks indicate technological innovation in small firms and less in big firms, where they tend to be more indicative of service innovation.

**Figure 8** Firm size versus trademark reference to innovative activity.



To test the existence of a relationship between the frequency of trademark registration and the reference to innovative activity, as discussed in the theory section, we performed $\chi^2$ tests for both trademark registration at BOIP and OHIM (the EU trademark office). The results are reported in Figure 9[2]. Repeat registration of trademarks, both at BOIP and OHIM seems to coincide with higher reference rates to innovative activity. This seems not to illustrate the risk of falling into the "trademark trap" on a large scale, as Davies (2009) expects for firms having a strong trademark position[3]. In only one case, however, the difference is statistically significant: reference to marketing innovation in case of multiple registration of CTMs. Note that multiple CTM registration goes along with a higher reference rate to innovation than repeat registration of BTMs, with two exceptions: the reference to service innovation and to process innovation. In conclusion, there is limited evidence that multiple registration indicates a higher innovative content of trademarks. The effect is stronger for frequent users of community trademarks than for users, who frequently file Benelux trademarks but who have not filed CTMs yet.

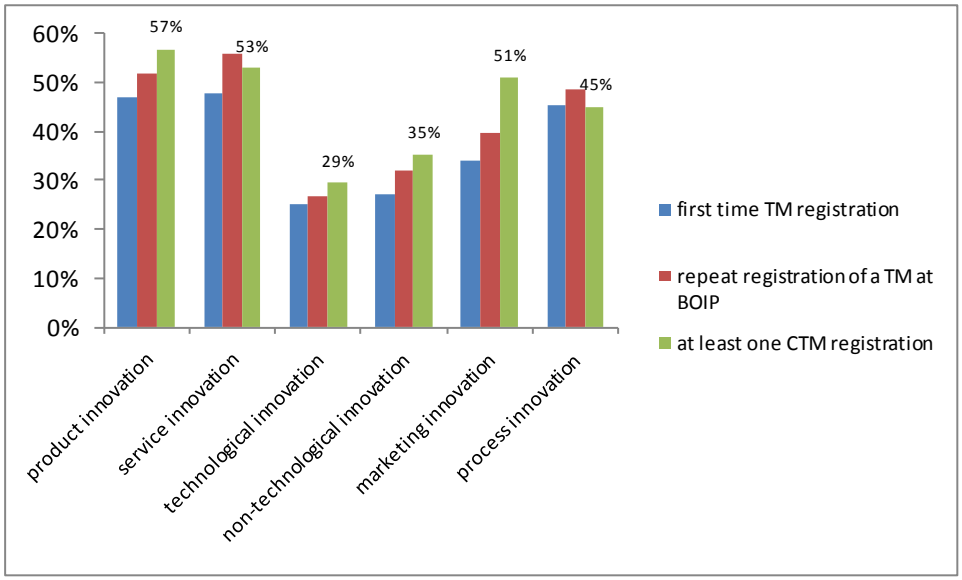
Finally, trademarks in some (high-tech) NICE classes may have a higher innovative content than trademarks in other NICE classes. Chi-square tests are used to test if there is a relationship between the reference of BTMs to innovative activity and the NICE classes the BTMs are registered in. We distinguish BTMs that are only registered in NICE classes 1-34 (industry classes; 21% of trademarks fall in this category), BTMs that are only registered in NICE classes 35-45 (service classes; 34% of the trademarks in the sample fall in this category) and BTMs that are registered in both industry and service classes (45% of the trademarks in the sample fall in this category). We found no overall significant relationship between these three

[2] We have limited our analysis here to trademarks filed by existing firms with a profit orientation.

[3] According to Davies (2009, p. 11) 'a strong trademark position might lead a firm to devote too many resources to incremental improvements in existing products, at the expense of more radical forms of innovation'.

groups and the reference to product innovation ($p$=0,197). However, the reference to product innovation of trademarks registered only in NICE classes 1-34 is higher than the reference to product innovation of trademarks in other NICE classes in the sample ($p$=0,074). Although counterintuitive, the reference to service innovation in the NICE service classes tends to be somewhat lower than in the NICE industry classes, while trademark registrations in both industry and service classes tend to refer relatively strong to marketing innovation. The former might reflect the servitization trend in manufacturing. The latter might reflect the marketing of configurations (or bundles) of products and services, which is pervasive in today's markets (Stremersch and Tellis, 2002). Alternatively, it may indicate the protection of strong or promising brands.

**Figure 9** Frequency of trademark registration versus reference to innovation

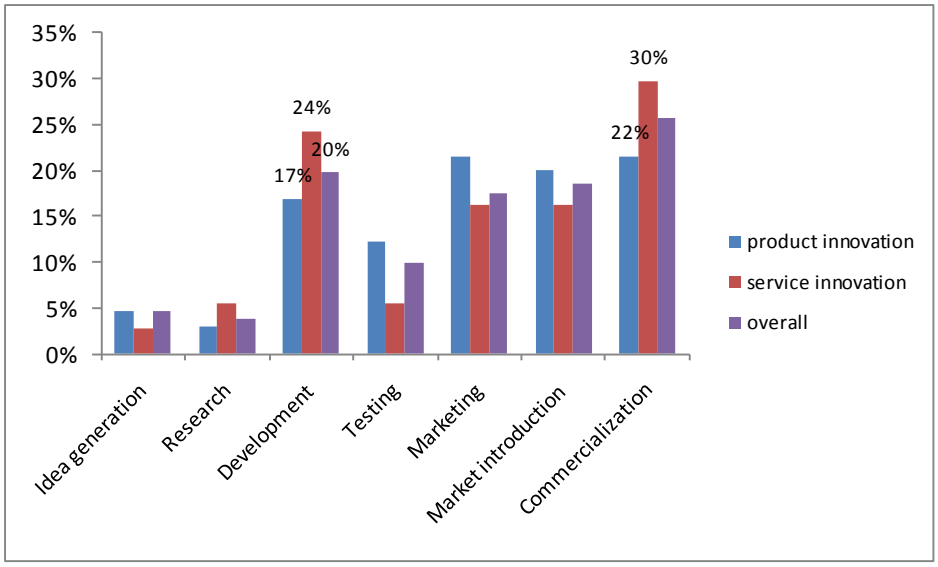



*4.4 Timing of trademark registration*

'It can be assumed that brands are registered just shortly before the launch of the product or service on the market, so they indicate a later phase as patents in the innovation process' (Hipp

and Grupp, 2005, p. 526). Because no empirical material was available Hipp and Grupp (2005) had to work with this assumption. Figure 10 shows that their assumption about the timing of trademark registration is largely correct, albeit some qualifications are in place. Figure 10 depicts the timing of the BTM filings in relation to the stages of the innovation process (Cooper, 1983). Trademarks registered in the last three stages of the innovation process account for 62% of all trademarks registered. However, 26% of the trademarks is actually filed after the market introduction, so not before the launch of the product, but after. The number of trademarks filed in the early phases of the innovation process is very limited. Only 5% of trademarks was filed in the idea generation phase and only 4% in the research phase. An interesting peak however occurs in the development process. One out of five trademarks is filed during development, which is relatively early.

**Figure 10** Trademark registration related to the stages of the innovation process.




The parallels between trademark registration in case of product and service innovation are relatively strong. Nevertheless, trademarks referring to service innovation are registered

relatively frequently in the development stage or after the market introduction and less frequently in the testing and marketing stage. These differences may be rooted in differences between product and service innovation processes, both in terms of the required time to market new products and services and in terms of the role of customers in the innovation process. Codifying knowledge after innovation through services (Den Hertog, 2000) and reusing it in other client cases, might explain partly that 30% of the service innovation cases is trademarked in the stage of commercialization. Relatively long times required to market new products might explain why trademarks referring to new products are registered more frequent in the testing and marketing stage.

*4.5 Added value of trademarks over other IPRs*

With some qualifications, the previous analysis showed that trademarks may be a valid indicator for innovation. This does not mean that they are a better indicator than other IPRs or that they render additional insights than other IPRs (design rights, patents, grower's rights or copy rights). Our data can give insights in the added value of trademarks over other IPRs by studying IPR bundling. If trademarks and, for example, patents are always used in conjunction, than patents measure the same innovations as trademarks. If on the other hand they are not used in conjunction, then patents will miss some innovations and measuring trademarks in addition to patents will give additional insights. In our dataset we have two ways of looking at IPR bundling. We can study IPR bundling for product versus service innovations and we can study differences in IPR bundling between big and small firms.

From Figure 11 we can learn that trademarks are bundled with other IPRs in case of both product and service innovation. Bundling is measured here as a combination of bundling that already has occurred and bundling that is planned in the near future (i.e. the company already has

a trademark but will apply for another IPR as well). The figure reveals some stark differences. For example, when a trademark refers to a new product, then in 25% of the cases that product will be protected by a patent as well. If however a trademark refers to a new service, then it will have a patent as well in only 3% of the cases. This indicates that patents cover product innovation in 25% of the trademarked cases but neglect service innovation almost completely.

The overall bundling figures, taking into account that some innovations will be protected by more than two IPRs, are 44% for product innovations and 27% for service innovations. Hence, this means that bundling of trademarks with other IPRs is done 40-45% more frequent in case of product innovation; the vast majority of service innovations will only be protected by trademarks. Therefore, the use of trademark data seems most interesting for service innovations, because data of other IPRs will underestimate the number of service innovations more than the number of product innovations. However, to be more resolute on this, we need information on the propensity to trademark product and service innovation as well, as explained in the introduction section.

Figure 11 Bundling of trademarks with other IPRs.

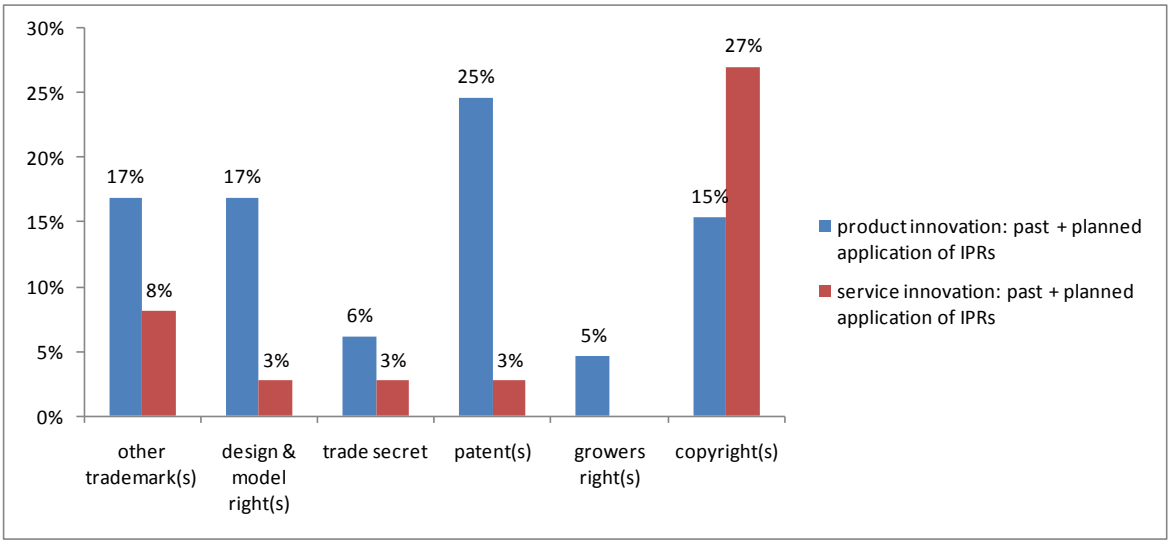
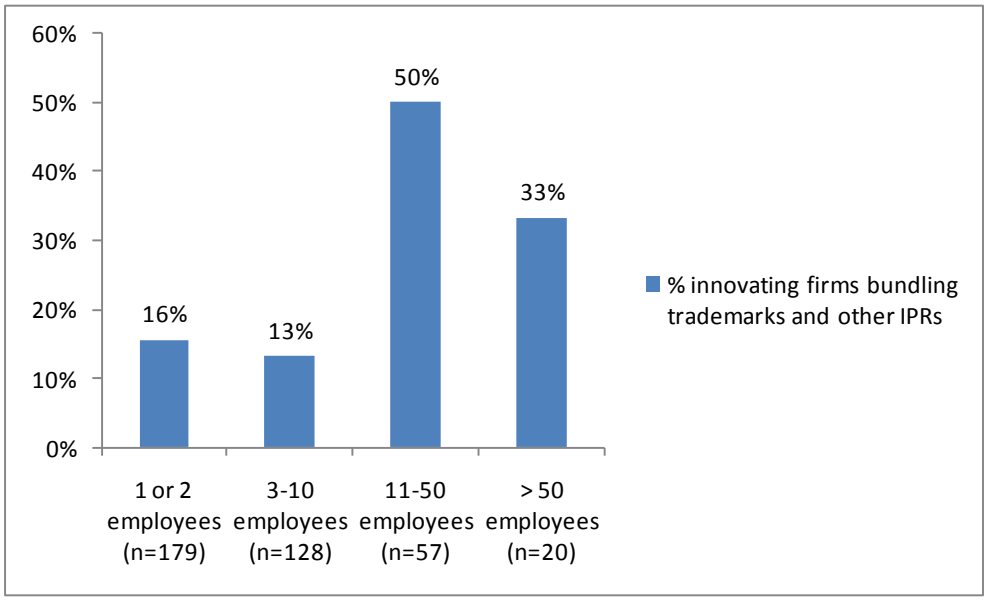


Figure 12 shows bundling figures for companies of different sizes. Small companies with less than 11 employees mainly use trademarks only for their innovation. Only a small minority uses other IPRs as well. Firms with more than 10 employees engage in bundling more frequently. This indicates that using other IPRs than trademarks to measure innovation in small companies grossly underestimates their level of innovation. This may indicate that using trademarks as an indicator of innovation may be very valuable to measure innovation in small firms.

**Figure 12** Firm size versus bundling of trademarks with other IPRs




## 5. CONCLUSION, RESEARCH AGENDA AND POLICY IMPLICATIONS

### *5.1 Conclusion*

In general, our in depth study of Benelux trademarks has revealed a high innovation reference rate, and therefore counts of new trademark registration can't be considered as an *in*valid output indicator of innovation, when we define innovation broadly. However, we have studied only two

out of four validity aspects: the reference and timing of trademark registrations to innovation, not the propensity to trademark innovation and inter and intra sector-level variation. Whereas some authors believe the use of trademarks for innovation has strict limits (Hipp and Grupp, 2005) and others believe it is useful (Mendonca *et al.*, 2004), so far no empirical test has been done to decide the debate. Our research tends to be more supportive of Mendonca *et al.* (2004). However, there are some qualifications and issues that need to be taken into account when using trademarks as an indicator of innovation.

First, it is important that the initial motive for registration may not be indicative of the innovative content of the trademark. Of the four motives for trademark registration we identified in the literature, three showed up in our dataset. The motive of preventing imitation is a typical industrial organization motive; the announcement of innovation and improving the marketability of firm assets also fit well with the literature. However, the second most important motive we find in our principal component analysis, leveraging other firm assets through trademarks, was not found in the literature. Clearly, there is room for theory development here and a resource based perspective might be helpful. Regarding innovation, we find that although it plays a role as a motive for registering trademarks, albeit a modest one, the actual reference of trademarks to innovation is higher than current research into the motives suggests. Therefore, it is necessary to look beyond motives for registering trademarks and to study their actual innovative content.

Regarding the innovative content we find that 60% of trademarks refer to innovative activities, when we define innovation broadly in the Schumpeterian tradition. Service innovation plays a very important role here: 35% of trademarks refer to it. However, we find some contingencies concerning the relevance of trademark data for innovation measurement and policy making. First, new trademark registrations seem good indicators of innovation for both

large and smaller companies, although predominantly for small ones. Although trademarks registered by larger companies have a higher innovative content in general than those registered by smaller companies for technological innovation only the situation is different. Trademarks of smaller companies refer more frequently to technological innovation than those of larger companies. This may support the theory that start ups generate more new technologies, while paying less attention to service and marketing innovation. Hence it is likely that counts of new trademark registration can in particular contribute to capturing relevant aspects of innovation in small firms.

Second, trademarks registered by companies that register trademarks frequently, may be only slightly more innovative than trademarks registered by companies that only register a trademark once. The difference between the two groups however is statistically hardly significant.

Third, in industrial NICE classes trademarks refer more to product innovation than trademarks in other NICE classes and, surprisingly, they also refer more to service innovation than trademarks registered in service NICE classes. This may be explained by the idea that increasingly companies add services to products to generate more sustainable revenue streams (Van der Merwe and Rada, 1988). Alternatively, it may indicate that Drejer's (2004) idea is correct that differences between service and product innovation are overestimated.

Fourth, regarding timing, it was interesting to note that trademarks indicate innovations in the later stages of the innovation process. Still, 20% of the trademarks are registered in the development phase. Maybe in this phase the commercial viability of many innovations becomes clear and so registration of a trademark already makes sense. This may especially be true for services, as the development phase for services may be closer to market introduction than for

products. Intriguingly, one out of four trademarks is registered after market introduction. The literature provides limited clues as to why this happens. Perhaps companies want to rush their products to the market as soon as possible and believe they can always claim the trademark later, because the cycle time of trademark filing and registration is limited to about 4 months (source: http://www.boip.int). Alternatively, service innovations may be developed together with clients (Johne and Storey, 1998). So they may be developed in the commercialization phase and branded and scaled up for large scale delivery at a later point in time. A final explanation may be that especially smaller companies may simply forget to trademark their innovations, as they may not have the professional management that large firms have. The finding of late registration shows trademarks are less suitable as an indicator for innovative activity early in the funnel like basic R&D.

Finally, trademarks may add something over measuring other IPRs. Particularly regarding service innovation and innovation in small companies, trademarks capture innovative activities that are not captured by measuring patents, copyrights and the like.

The initial findings described above give a first indication of *whether* and *how* counts of new trademark registrations can be used as an indicator of innovation validly. Our findings suggest they can, keeping in mind that trademarks do not cover all types of innovation equally well for all types of companies and keeping in mind that we have not studied the propensity to trademark innovation. They seem particularly valuable as measures of service and small firm innovation. In addition, trademarks are useful for measuring innovations that are close to market introduction. Within these limits, trademarks may be a useful addition to the existing set of innovation indicators mentioned by Hagedoorn and Cloodt (2003). However, more work needs

to be done to establish whether and under what conditions trademarks are the best choice when an innovation indicator is needed.

*5.2 Research agenda*

Further research may be more precise in defining the circumstances that make trademarks most suitable as an innovation indicator. This study considered a number of those circumstances separately: small versus large firms, NICE classes, single or multiple registration and trademark policy (BTM versus ITM and CTM). It will be interesting to find out with econometric estimation techniques whether in certain combinations of those elements trademarks are more or less effective as an innovation indicator. For example, a trademark registered in NICE classes 1, 2 and 3 by a large company that has registered trademarks before may indicate primarily product innovation in the development phase. Alternatively, a trademark registered in NICE classes 8, 9 and 10 by a small company who has only registered a trademark once may indicate a service innovation. Getting a grip on such more detailed combinations may help researchers to be more precise in their use of trademarks and may help practitioners to become more effective in shaping and timing their IPR strategies.

A second area for further research may be to include branding strategies of companies. Some companies use the branded house strategy (Aaker, 2004), in which a variety of products are marketed using one single brand. Others use the house of brands strategy, where one company launches products with each product having its own brand. In a branded house, a trademark may indicate a range of innovations or, on the opposite the trademark may be a trade name. A house of brands may register trademarks for new products or, alternatively, may file so many brands that only occasionally a brand refers to an innovation. The effect of branding

strategies on the validity of trademarks as an indicator for innovation is therefore worth researching.

A third area for further research is into regional differences. This study has only used data from the Benelux countries. It is known that registration habits for patents differ across geographical areas, also depending on the legal context. It may be possible that for trademarks something similar happens. This may imply that in some countries trademarks are a better indicator for innovations than in other countries.

Finally, our research has some limits. First, as discussed in section 3 we might face a selection bias. We have selected Benelux trademark applicants who have probably not been serviced by trademark attorneys during the trademark filing and registration process. Since these applicants might be more frequent users of trademark services, it is possible that we slightly underestimated the reference of BTMs to innovative activity. Second, we have used a broad definition of innovation. Some researchers might disagree with the overall reference rate to innovation, because of this broad definition. For those who would like to limit innovation to technological innovation, our study however also presents some results on the link between technological innovation and trademarks.

*5.3 Implications for policy makers*

The results of this study are of particular value for policy makers. First, so far policy makers have mainly used R&D investments and patent data as indicators of innovation. This has always raised the question whether that accurately captured the innovative capacity of industries and economies. By including trademarks as an indicator of innovation, within the boundaries discussed above, policy makers may do more justice to the differences between industries.

Absent a good understanding of the usefulness of trademarks for measuring innovation, so far trademarks could not be used. As our research has identified the contours of the conditions under which trademarks maybe useful, policy makers may start experimenting with them. With this better understanding, they may be able to decide when patents are the best indicator, when trademarks and when a mix of both may adequately capture innovation in a certain sector. This may point the way towards new policies, for example in stimulating the use of trademarks or certain types of innovation in certain industries.

More specifically, a second contribution lies in measuring service innovation. Trademarks provide a relatively good picture of this and therefore policy makers may use trademarks to track innovation in service sectors. With the increasing economic importance of service sectors the question how to measure innovation in services has become increasingly pressing. By using trademarks as an indicator, policy makers may start to understand which service industries have a strong track record of innovation and which parts fall behind. Next they may target specific policies to the weaker parts. In addition, by tracking trademark activity over time and in comparison to other countries, policy makers can see whether their country falls behind or gets ahead in the innovation race. Again, this may present them with warning signals that may lead to new policies. The same reasoning applies to measuring innovation in small companies.

Third, trademarks may help to indicate whether a policy aimed at stimulating service innovation is effective. If more trademarks get registered as a consequence of a new policy this may show the policy worked. However, governments must keep in mind that applying for a trademark is easy and low cost. Organizations that receive an innovation subsidy may therefore apply for a trademark only to show the policy makers that they have used the subsidy well, even

though in reality no innovation was developed. It is easier to 'cheat' in this way with trademarks, than with patents.

To make trademark data more useful for policy makers, our analysis shows that it makes sense to register more data when an organization applies for a trademark. By registering not only company size, but also company trademark filing policy and the timing of filing, it will be possible to better monitor innovative activity of companies.

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**Appendix A** Correlation of the trademark reference to various types of innovation.

| | process innovation | implement. developed technology | implement. purchased technology | product innovation | service innovation | technological innovation | non-technological innovation | marketing innovation |
|---|---|---|---|---|---|---|---|---|
| process innovation | 1 | | | | | | | |
| implementation developed technology | ,564** | 1 | | | | | | |
| implementation purchased technology | ,445** | ,589** | 1 | | | | | |
| product innovation | ,135** | ,176** | ,221** | 1 | | | | |
| service innovation | ,437** | ,318** | ,294** | -,015 | 1 | | | |
| technological innovation | ,303** | ,382** | ,369** | ,334** | ,137** | 1 | | |
| non-technological innovation | ,189** | ,092 | ,132** | -,046 | ,174** | -,084 | 1 | |
| marketing innovation | ,119* | ,105* | ,174** | ,201** | ,124** | ,099* | ,265** | 1 |

*p<0,05, ** p<0,01

**Conceptualization of the various types of innovation in the questionnaire:**

- **Non-technological innovation**: "the development of a radical organizational change, a new methodology, a new way workplace design or the implementation of a new business model."
- **Technological innovation**: "the development of a technologically advanced artifact, which will be marketed or utilized otherwise by our firm."
- **Marketing innovation**: "a significant change in product design, product packing, product promotion or product pricing (idem for services)."
- **Process innovation**: "a new or significantly improved production process (or service delivery process)."
  - **Implementation of a developed technology**: "the implementation of a new technology, developed in our firm and used for the improvement of our production process (or service delivery process)."
  - **Implementation of a purchased technology**: "the implementation of a technology, bought from a supplier or various suppliers, and used for the improvement of our production process (or service delivery process)."
- **Service innovation**: "the market introduction of a new or significantly improved service."
- **Product innovation**: "the market introduction of a new or significantly improved product."

**Appendix B** The Nice classification system in its 9th edition.

## Products

Class 1 Chemicals used in industry, science and photography, as well as in agriculture, horticulture and forestry; unprocessed artificial resins, unprocessed plastics; manures; fire extinguishing compositions; tempering and soldering preparations; chemical substances for preserving foodstuffs; tanning substances; adhesives used in industry.

Class 2 Paints, varnishes, lacquers; preservatives against rust and against deterioration of wood; colorants; mordants; raw natural resins; metals in foil and powder form for painters, decorators, printers and artists.

Class 3 Bleaching preparations and other substances for laundry use; cleaning, polishing, scouring and abrasive preparations; soaps; perfumery, essential oils, cosmetics, hair lotions; dentifrices.

Class 4 Industrial oils and greases; lubricants; dust absorbing, wetting and binding compositions; fuels (including motor spirit) and illuminants; candles and wicks for lighting.

Class 5 Pharmaceutical and veterinary preparations; sanitary preparations for medical purposes; dietetic substances adapted for medical use, food for babies; plasters, materials for dressings; material for stopping teeth, dental wax; disinfectants; preparations for destroying vermin; fungicides, herbicides.

Class 6 Common metals and their alloys; metal building materials; transportable buildings of metal; materials of metal for railway tracks; non-electric cables and wires of common metal; ironmongery, small items of metal hardware; pipes and tubes of metal; safes; goods of common metal not included in other classes; ores.

Class 7 Machines and machine tools; motors and engines (except for land vehicles); machine coupling and transmission components (except for land vehicles); agricultural implements other than hand-operated; incubators for eggs.

Class 8 Hand tools and implements (hand-operated); cutlery; side arms; razors.

Class 9 Scientific, nautical, surveying, photographic, cinematographic, optical, weighing, measuring, signalling, checking (supervision), life-saving and teaching apparatus and instruments; apparatus and instruments for conducting, switching, transforming, accumulating, regulating or controlling electricity; apparatus for recording, transmission or reproduction of sound or images; magnetic data carriers, recording discs; automatic vending

machines and mechanisms for coin-operated apparatus; cash registers, calculating machines, data processing equipment and computers; fire-extinguishing apparatus.

Class 10 Surgical, medical, dental and veterinary apparatus and instruments, artificial limbs, eyes and teeth; orthopedic articles; suture materials.

Class 11 Apparatus for lighting, heating, steam generating, cooking, refrigerating, drying, ventilating, water supply and sanitary purposes.

Class 12 Vehicles; apparatus for locomotion by land, air or water.

Class 13 Firearms; ammunition and projectiles; explosives; fireworks.

Class 14 Precious metals and their alloys and goods in precious metals or coated therewith, not included in other classes; jewellery, precious stones; horological and chronometric instruments.

Class 15 Musical instruments.

Class 16 Paper, cardboard and goods made from these materials, not included in other classes; printed matter; bookbinding material; photographs; stationery; adhesives for stationery or household purposes; artists' materials; paint brushes; typewriters and office requisites (except furniture); instructional and teaching material (except apparatus); plastic materials for packaging (not included in other classes); printers' type; printing blocks.

Class 17 Rubber, gutta-percha, gum, asbestos, mica and goods made from these materials and not included in other classes; plastics in extruded form for use in manufacture; packing, stopping and insulating materials; flexible pipes, not of metal.

Class 18 Leather and imitations of leather, and goods made of these materials and not included in other classes; animal skins, hides; trunks and travelling bags; umbrellas, parasols and walking sticks; whips, harness and saddlery.

Class 19 Building materials (non-metallic); non-metallic rigid pipes for building; asphalt, pitch and bitumen; non-metallic transportable buildings; monuments, not of metal.

Class 20 Furniture, mirrors, picture frames; goods (not included in other classes) of wood, cork, reed, cane, wicker, horn, bone, ivory, whalebone, shell, amber, mother-of-pearl, meerschaum and substitutes for all these materials, or of plastics.

Class 21 Household or kitchen utensils and containers; combs and sponges; brushes (except paint brushes); brush-making materials; articles for cleaning purposes; steelwool; unworked or semi-worked glass (except glass used in building); glassware, porcelain and earthenware not included in other classes.

Class 22 Ropes, string, nets, tents, awnings, tarpaulins, sails, sacks and bags (not included in other classes); padding and stuffing materials (except of rubber or plastics); raw fibrous textile materials.

Class 23 Yarns and threads, for textile use.

Class 24 Textiles and textile goods, not included in other classes; bed and table covers.

Class 25 Clothing, footwear, headgear.

Class 26 Lace and embroidery, ribbons and braid; buttons, hooks and eyes, pins and needles; artificial flowers.

Class 27 Carpets, rugs, mats and matting, linoleum and other materials for covering existing floors; wall hangings (non-textile).

Class 28 Games and playthings; gymnastic and sporting articles not included in other classes; decorations for Christmas trees.

Class 29 Meat, fish, poultry and game; meat extracts; preserved, frozen, dried and cooked fruits and vegetables; jellies, jams, compotes; eggs, milk and milk products; edible oils and fats.

Class 30 Coffee, tea, cocoa, sugar, rice, tapioca, sago, artificial coffee; flour and preparations made from cereals, bread, pastry and confectionery, ices; honey, treacle; yeast, baking-powder; salt, mustard; vinegar, sauces (condiments); spices; ice.

Class 31 Agricultural, horticultural and forestry products and grains not included in other classes; live animals; fresh fruits and vegetables; seeds, natural plants and flowers; foodstuffs for animals, malt.

Class 32 Beers; mineral and aerated waters and other non-alcoholic drinks; fruit drinks and fruit juices; syrups and other preparations for making beverages.

Class 33 Alcoholic beverages (except beers).

Class 34 Tobacco; smokers' articles; matches.

## Services

Class 35 Advertising; business management; business administration; office functions.

Class 36 Insurance; financial affairs; monetary affairs; real estate affairs.

Class 37 Building construction; repair; installation services.

Class 38 Telecommunications.

Class 39 Transport; packaging and storage of goods; travel arrangement.

Class 40 Treatment of materials.

Class 41 Education; providing of training; entertainment; sporting and cultural activities.

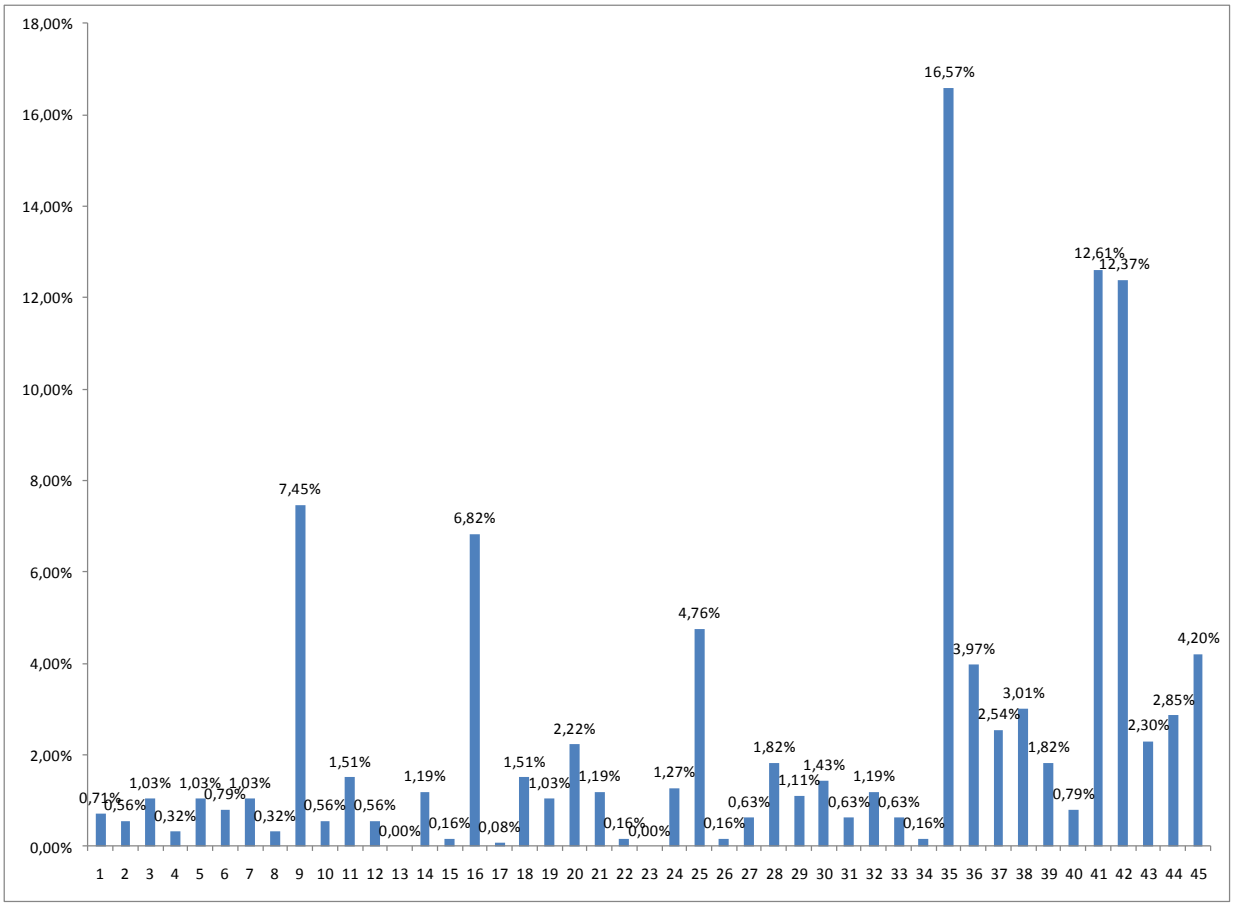
Class 42 Scientific and technological services and research and design relating thereto; industrial analysis and research services; design and development of computer hardware and software.

Class 43 Services for providing food and drink; temporary accommodation.

Class 44 Medical services; veterinary services; hygienic and beauty care for human beings or animals; agriculture, horticulture and forestry services.

Class 45 Legal services; security services for the protection of property and individuals; personal and social services rendered by others to meet the needs of individuals.

**Appendix C** Sample distribution over the 45 NICE classes.



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