D3.2 Study of R&D tax credits and incentives for SMEs

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1. The R&D Tax Relief & Incentives Landscape

1.1 Introduction

A review of the literature shows that there has been a long debate dating from the economist Joseph Shumpert about the different roles of large, small, and medium enterprises in the technological progress of innovation. While the pioneering role of large enterprises with their Research and Development (R&D) units was stressed by academics and policymakers during the eighties, in the nineties the role and impact of Small Medium Enterprises' (SMEs) were reborn. Today, empirical evidence shows many examples of successful innovation that has stemmed from SMEs. Start-ups, university spin-offs and young entrepreneurs have often produced major technological breakthroughs. Indeed, SMEs act as essential vehicles for knowledge spill-overs; their competencies, ideas, products and technologies are frequently acquired and marketed by large firms creating new market and consumer demands.

It is a fact that SMEs are considered the backbone of Europe's economy; representing 99 per cent of all businesses in the EU. According to the European Commission (EC), in the past five years, SMEs have created around 85 per cent of new jobs and provided two-thirds of the total private sector employment in the EU. The EC considers SMEs and entrepreneurship as key to ensuring economic growth, innovation, job creation, and social integration around Europe. Although most SMEs in Europe are in the service sector, such as wholesale and retail trade, hotel and restaurant business and communication and business services, they are also an increasing presence in technology-intensive industries such as information and communications technology (ICT) and biotechnology. However, given the importance of R&D-intensive SMEs, as mentioned above, our systematic and explicit knowledge of them is surprisingly weak and is even more so for R&D-intensive SMEs.

Galbraith (1952) affirms that SMEs do not have time to spend on R&D because it is too costly and risky, whereas large firms can spread the risk over a large number of R&D projects and can spread their risk through diversification of their research and innovation activities. In addition, a lack of access to financing has been identified in many countries as one of the most significant obstacles to the survival and growth of SMEs. Usually, SMEs are more dependent on bank credit. After the crisis in 2008, banks have reduced lending (credit crunch effect), so government-funded access to finance programmes are necessary to address market failure.

The issue of focusing R&D tax incentives on SMEs only, or treating SMEs preferentially, is strongly linked to the question of differences in barriers to private R&D investment by firm size. There are several arguments for more R&D barriers in SMEs: Lack of government policy and regulation, lack of

technological and market information, inadequate research and development, organizational culture, size of enterprises, lack of skilled personnel and absence of cooperation, and high cost of innovation. Since R&D expenditure is a fixed cost, SMEs will have a higher fixed cost exposure from R&D than large firms. In cases where R&D activities fail to produce earnings, high fixed costs may jeopardise the whole firm. With regards to the size of firms, Schumpeter (1942) emphasised the positive influence of size on innovation, while many theoretical studies claim that larger companies have potential factors such as economies of scale, lower risk, and a broader market which enable them to perform sophisticated R&D projects. Some authors argue that SMEs usually have fewer resources and capabilities for conducting in-house R&D activities and limited external contacts (Hausman, 2005; Srinivasan et al., 2002). Although the literature shows that there are some positive relationships between size and innovation, large scale firms are considered more effective in exploiting and internalising the features of technological knowledge (Scherer & Ross, 1990; Love et al., 1996; Cohen & Klepper, 1996). Other empirical studies have suggested that these effects unclearly defined.

According to Griliches, Hall and Pakes (1991), SMEs have an innovative advantage in flexibility and adaptability to any new environment. Other studies highlight that "the pattern of R&D investment within a firm is essentially a random walk" (Griliches & Klette, 2000). Evidence suggests, that SMEs can harness their flexibility and adaptability to new scenarios, compared to large firms, who are more dependent on higher accessibility to finance and infrastructure. Hence, SMEs can capitalise more on their flexibility, and larger companies their physicality (Hausman, 2005).

1.2 Small and Medium Enterprises in Europe

Small and medium-sized enterprises are non-subsidiary, independent firms which employ fewer than a given number of employees - this number varies across countries. The most frequent upper limit designating an SME is 250 employees, as in the European Union (EU). However, some countries set the limit at 200 employees, while the United States considers SMEs to include firms with fewer than 500 employees. Small firms are generally those with fewer than 50 employees, while micro-enterprises have at most 10, or in some cases 5 employees. In the EU a new definition came into force on 1 January 2005 applying to all Community acts and funding programmes as well as in the field of State Aid where SMEs can be granted a higher intensity of national and regional aid than large companies. The official European Commission definition of Small and Medium Enterprises takes into consideration different factors:

- Level of employment;
- Level of turnover;
- Size of the balance sheet.

The new definition provides for an increase in the financial ceilings: the turnover of medium-sized enterprises (50-249 employees) should not exceed EUR 50 million; that of small enterprises (10-49 employees) should not exceed EUR 10 million, while that of micro firms (less than 10 employees) should not exceed EUR 2 million. Alternatively, balance sheets for medium, small and micro enterprises should not exceed EUR 43 million, EUR 10 million and EUR 2 million, respectively.

Table 1. Definition of Small and Medium Enterprises.

Company category	Employees	Turnover	Balance Sheet total
Micro	< 10	< €2 million	< €2 million
Small	<50	< €10 million	< €10 million
Medium size	<250	< €50 million	< €43 million

Source: Commission Recommendation of 6 May 2003 concerning the definition of micro, small, and medium-sized enterprises. (2003/361/EC), Official Journal of the European Union, L 124/36, 20 May 2003.

According to the European Commission in 2016, 24 million Small and Medium Enterprises generated EUR 4030 billion of value-added and employed 93 million people across Europe. On average, SMEs in the EU employed 3.9 persons in 2016. Altogether these sectors account for 67.5 per cent of people employed and 65.9 per cent of value-added in 2016. In terms of value-added, the contribution of SMEs to the national economy is particularly significant in Greece, Malta and Cyprus, where SMEs account for more than 70 per cent of value-added of the “non-financial business economy”. From an employment perspective, SMEs are important in Bulgaria, Italy, Lithuania, Malta, Portugal, Greece and Estonia. In these countries, SMEs account for more than three-quarters of employment of the ‘non-financial business economy’ in 2016. New information technologies have led to new ways of production and opportunities for self-employment. However, so far there is little evidence that the emergence of the so-called 'platform' or 'gig' economy, i.e. an economy characterised by the presence of many online platforms matching individuals wishing to offer particular services with individuals seeking these services, has had a considerable EU-wide impact on the self-employment rate. It should be noted, however, that this sector is intrinsically difficult to measure. The most important five SME sectors in terms of the number of people employed in the EU-28 were “accommodation and food”, “professional activities”, “construction”, “manufacturing” and “wholesale/retail trade”. Together these sectors account for 78 per cent of SME employment and 71 per centof SME value added in 2016. SMEs play an important role in the ‘non-financial business economy’ in the EU. The outlook for SMEs in the non-financial business economy is generally favourable. The European Commission estimated that in 2018 the value-added in the EU-28 is forecast to increase by 6.4 per cent compared to previous years. Overall, in the EU-28, around 1.8 million new jobs were expected to be generated in SMEs by 2018, although this figure may now be out-of-date.

Innovative companies such as start-ups and scale-ups are essential drivers of economic growth. According to the European Commission in 2016, on average 9.2 per cent of firms in the EU-28 business economy are in high-growth companies. In the United Kingdom, Sweden, Ireland and Malta, high-growth firms account for over 12 per cent of the economy, while the lowest shares are found in Cyprus and Romania, both below 3 per cent. In the EU-28, "information and communication" and "administrative and support services" are the sectors with the highest rates of fast-growing firms, with rates of 15 per cent and 12.7 per cent respectively, while. "Professional, scientific and technical activities" and "transportation and storage", each has 11 per cent. Since 2016, the EU has provided comprehensive support to ambitious start-ups and scale-ups. This initiative combines a range of existing and new actions to reduce existing barriers to growth to enable start-ups and scale-ups to expand their business both across Europe and outside of Europe. Investing in knowledge-generation activities, in particular on R&D but also on skills development and ICT, is crucial to support the development of inventions and commercialisation of new products and services. In addition, the quest for innovation is justified by the economic and social impacts that it brings about. Innovation can drive long term sustainable growth in European countries and generate high-quality jobs.

1.3 Definition of Innovation

The debate on the definition of R&D developed along two dimensions. The first dimension relates to the harmonization of definitions in order to minimise 'fiscal uncertainty' (that is the interpretation of R&D by fiscal authorities). The current trend is to move towards an internationally accepted definition, already practised by firms when they answer statistical offices. The main reference is the OECD's Frascati Manual (OECD, 2015). However, some countries have chosen wider definitions in order to support specific sectors or types of research (e.g. Belgium for green technology or China for high tech industries). However, the central debate is about the connection between R&D and innovation. A few countries have for instance included the acquisition of intangibles (patents, licenses, designs, etc.) in their definition (e.g. Spain). According to the Frascati Manual (2015) "Research and experimental development (R&D) comprise creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge". The terms of R&D cover three types of activities: basic research, applied research and experimental research:

- Basic research is driven purely by curiosity and a desire to expand knowledge. This type of research tends not to be directly applicable to the real world but enhances our understanding of the world around us. So, the real difference between the two types of research is what they

will be used for. Will the research be used to help us understand a real-world problem and solve it, or will the research further our general information? This kind of research is mostly undertaken in Universities and Research Centres.

- Applied research is used to answer a specific question that has direct applications to the world. This is the type of research that solves a problem. This kind of research is mostly undertaken at a private level (firms).

- Experimental research is commonly used in sciences such as sociology and psychology, physics, chemistry, biology and medicine, etc. It is a collection of research designs which use manipulation and controlled testing to understand causal processes. Generally, one or more variables are manipulated to determine their effect on a dependent variable (Firms and Universities).

The idea of innovation stemmed from the seminal work of Schumpeter in "The theory of economic innovation" (1934). Schumpeter argued that anyone seeking profits must innovate. He described development as a historical process of structural change, substantially driven by innovation divided into five categories:

- Launch of new products;
- Introduction of new methods of production, products and sales;
- Opening of new markets;
- Acquiring new sources for the supply of raw materials or semi-finished goods;
- New industry structures such as the creation or destruction of a monopoly position.

In Schumpeter's theory, the activity of entrepreneurs draws upon the discoveries of innovators and scientists, creating new opportunities for investment, growth and employment. Subsequently, he focuses more on the concept of creative destruction, which, in brief, means the ability to destroy old structures to give way to new ones, considered essential to innovation. Today, the Oslo Manual is considered the foremost international source which describes innovation and with the influential systemic factors. The Oslo Manual (2018) for measuring innovation takes account of the progress made in understanding the innovation process and the economic impact in the OECD member and non-member countries. According to the last edition, the Oslo Manual defines two types of innovation: Product innovation, process innovation, More specifically:

- Product innovation: A good or service that is new or significantly improved. This includes significant improvements in technical specifications, components and materials, software in the product, user-friendliness or other functional characteristics.

- Process innovation: A new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.

In the previous edition of the Oslo Manual other two types of innovation were included: marketing innovation and organisational innovation. More specifically:

- Marketing innovation: A new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.

- Organisational innovation: A new organisational method in business practices, workplace organisation or external relation.

In parallel to work on evolutionary Schumpeterian and neo-Schumpeterian approaches (Freeman,1982; Dosi,1982), Pavitt (1984) identified regularities and differences between firms and industries and is seen as a milestone in innovation and business studies. Pavitt's taxonomy consists of four categories of industrial firm without distinction by size:

- Supplier-dominated: Includes firms from mostly traditional manufacturing such as textiles and agriculture which rely on sources of innovation external to the firm.

- Scale-intensive: Characterized by mainly large firms producing basic materials and consumer durables, e.g. automotive sector. Sources of innovation may be both internal and external to the firm with a medium level of appropriability.

- Specialized suppliers: Smaller, more specialized firms producing technology to be sold onto other firms, e.g. specialized machinery production and high-tech instruments. There is a high level of appropriability due to the tacit nature of the knowledge.

- Science-based: High-tech firms which rely on R&D from both in-house sources and university research, including industries such as pharmaceuticals and electronics. Firms in this sector develop new products or processes and have a high degree of appropriability from patents, secrecy, and tacit know-how.

A large volume of literature has applied this taxonomy to an investigation of the source of heterogeneity in innovation and performance. The Pavitt taxonomies have also been combined with the CIS[1] data in order to explore various facets of innovative patterns. Moving from Pavitt's approach, more recent work has been carried out on the patterns of technology, which represent the dominant part of advanced economies (Bogliacino & Pianta, 2016). In fact, focusing only on R&D intensive SMEs in Europe, it can be seen that most are concentrated in high-tech sectors such as electronic and electrical equipment, pharmaceuticals and biotechnology, software and computer services, technology hardware and equipment, healthcare equipment and services (Kumbhakar, Ortega, Potters et al., 2012).

At the European level, the annual European Innovation Scoreboard (EIS) helps Member States to assess areas in which they need to concentrate their effort in order to improve their innovation performance. The EIS provides a comparative assessment of the innovation and research performance of the EU Member States, by focusing on the relative strengths and weakness of their research and innovation systems. The 2017 edition of the Scoreboard presents a redefined analytical framework. New indicators in the last edition capture investment in skills, digital readiness, entrepreneurship and public-private innovation. The new scoreboard reveals that EU innovation performance continues to grow, especially due to improvements in human resources, the innovation-friendly environment, in-house research, and attractive research systems. The new EIS measurement framework identifies four main types of indicators, capturing in total 27 different indicators.

The framework captures the main drivers of innovation performance external to the companies and covers three innovation dimensions: Human resources, investment, and an attractive research system; as well as a friendly environment. Investments are split into public and private investment in research and innovation and cover two dimensions: Finance support and firm investment. Innovation activities capture the innovation effort supported by companies, grouped in three different innovation dimensions: Innovators, linkages and intellectual assets. Impacts cover the effects of firm's innovation activities at employment and sales levels. The following is the full list of indicators from the EIS 2017 measurement framework:

Framework conditions:

Human resources

- New doctorate graduates

[1] "The Community Innovation Survey (CIS) based innovation statistics are part of the EU science and technology statistics. Surveys are carried out with two years' frequency by EU member states and number of ESS member countries. Compiling CIS data is voluntary to the countries, which means that in different surveys years different countries are involved".
http://ec.europa.eu/eurostat/web/microdata/community-innovation-survey

- Population aged 24-54 with tertiary education
- Lifelong learning

Attractive research system
- International scientific co-publications
- Top 10% cited publications
- Foreign doctorate students

Investment:

Finance and support
- R&D expenditure
- Venture Capital in the business sectors

Firm investments
- R&D expenditure in business sector
- Non-R&D innovation expenditures
- Enterprises providing training to develop or upgrade ICT skills of their personnel

Innovation activities:

Innovators
- SMEs with product or process innovations
- SMEs with marketing or organisational innovations
- SME innovating in-house

Linkages
- Innovative SME collaborating with others
- Public-private co-publications
- Private co-funding of public R&D expenditures

Intellectual assets
- PCT patent application
- Trademark application
- Design applications

Impacts:

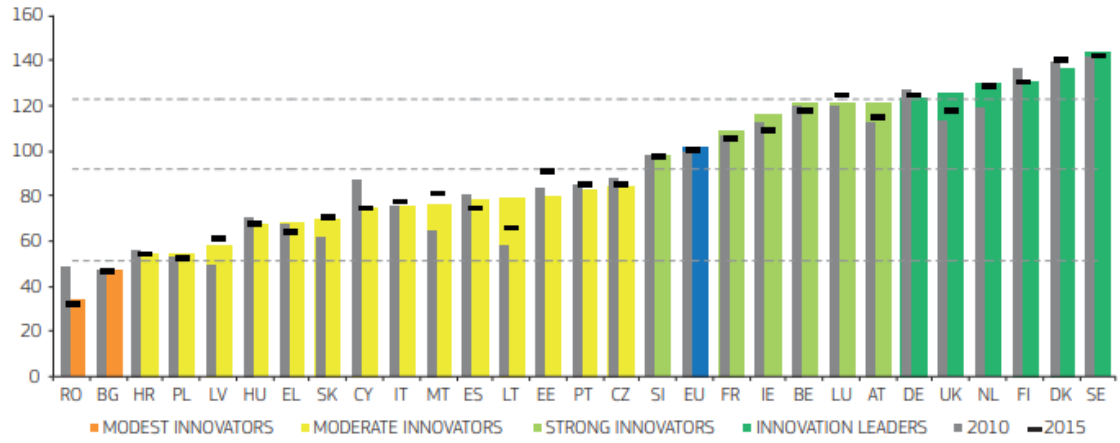
Employment impacts
- Employment Knowledge- intensive activities
- Employment fast-growing enterprises of innovative sectors

Sales impact
- Medium and high-tech product exports
- Knowledge-intensive services exports
- Sales of new to market and new to firm product innovation

As shown in Figure 1., based on their average performance scores as calculated by composite indicators mentioned above, the innovation index falls into four different performance groups:

Innovation leader countries, strong innovators, moderate innovators, and modest innovators. Sweden remains the EU innovation leader, followed by Denmark, Netherlands, Finland, UK and Germany, with the innovation performance well above the EU average. On the other hand, Romania and Bulgaria remain modest innovators in Europe with performance well below the EU average. Austria, UK, Netherlands and Lithuania were the fastest growing innovators in 2016/2017. Among the strong innovator countries are France, Ireland, Luxembourg, and Slovenia with performance above or close to the EU average. The performance of Croatia, Cyprus, the Czech Republic, Estonia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, and Spain is below that the EU average.

Figure 1: EU Member States' innovation performance



Source: European Innovation Scoreboard, 2017.

Table 2 explains the strengths and weakness of the research and innovation system for each country selected for our study.

Table 2. Innovation areas by countries

Country	Strengths	Weakness
Ireland	Innovation system Employment Impact Human resources	Finance and Support Intellectual asset Linkages
Greece	Innovation system are in Innovators Attractive research systems Human resources	Innovation-friendly environment Intellectual assets Finance and support
Spain	Human resources Innovation-friendly environment Attractive research systems	Innovators Linkages Finance and support
France	Human resources Attractive research systems Innovation-friendly environment.	Linkages Finance Support and Innovators.
Italy	Intellectual assets Attractive research systems Innovators	Linkages Finance and support Firm investments
Lithuania	Innovation-friendly environment Human resources Linkages	Sales impacts Attractive research systems Intellectual assets
Netherlands	Attractive research systems Human resources Linkages	Firm investments Sales impacts Intellectual assets
Romania	Innovation-friendly environment Sales impacts Human resources	Innovators Firm investments Finance and support
United Kingdom	Attractive research systems Human resources Employment impacts.	Innovators Finance and support Intellectual assets.

Source: European Innovation Scoreboard, 2017

1.4 Effectiveness of R&D Tax Incentives

Throughout the European Union, R&D incentives have become a popular policy instrument to boost research and development activities in companies. These incentives allow firms to reduce their tax burden and are also a useful tool to stimulate private R&D and raise the level of business R&D expenditure to a higher level. Existing R&D tax incentive schemes differ significantly in terms of their generosity, their design and the categories of firms or R&D areas they target. There are two types of R&D incentives structure: Volume-based, where the credit is based on the absolute volume of R&D expenditure; and incremental-based, where the credit is driven by the increase in R&D spending over a base. The expenditure-based tax incentives are:

- R&D tax credits
- R&D tax allowances
- Payroll withholding tax credit for R&D wages

Governments, when running an R&D tax incentive, have to decide on the R&D activities that should be covered by the scheme. The major options are to consider the costs of human resources only (and their act upon social taxes), all current costs of R&D activities, and total costs of R&D including equipment and machinery, and extramural R&D. Currently, four types of R&D tax incentives are applied:

- Accelerated depreciation schemes for investments (machinery, equipment, buildings, and intangibles) used for R&D activities. This has been the case in Italy, for example, which was one of the first to start such a scheme.
- Special R&D allowances enable firms to deduct more than 100 per cent of their current eligible R&D expenditures from their taxable income.
- Special exemptions of wage and/or social taxes for employees in R&D activities.
- Tax credits allow firms to directly deduct a specific share of their R&D expenses from the corporate tax liabilities (this type of R&D tax incentive is currently the most widespread). In some instances, tax credits allow a company to surrender some of their loss derived from their R&D expenditure for a cash payment.

- A further type of fiscal support to R&D that is closely related to R&D tax incentives is the so-called Patent Box[2]. A patent box grants a lower corporate tax rate on profits generated from patents that are held in a certain country.

Besides direct government R&D funding, another important source of R&D finance has come from European funds, in particular through EU Research Framework Programmes and EU Structural funds. The European Commission estimates that the 20 per cent increase in public R&D expenditure between 2007 and 2014 could be attributed to "funding from abroad", mainly from the European budget, which represents an important addition to national public spending (European Commission, 2016).

As mentioned above, R&D tax credits and incentives are a form of government intervention that aims to decrease the cost of qualifying R&D expenditure (Hall & Van Reenen, 2000). On a macro-economic level, R&D government incentives encourage a competitive and innovative economy nationally and internationally. The NESTA report (2012) expands on this regarding fiscal incentives and policy. NESTA, suggests R&D policy and fiscal incentives are established as a tool to improve the international attractiveness of countries as a hub for innovation. Furthermore, since the global financial crisis in 2007-2008, economies have been falling and uncertainty rife. To encourage economic growth and to minimise uncertainty, governments have invested heavily in providing innovative companies, especially SMEs, a stimulating environment. Therefore, a strong correlation between the current state of the economy and government investment in R&D is apparent.

For instance, Philip Hammond, the UK Chancellor of the Exchequer has recently announced a £2bn increase in spending in R&D for 2020 and 2021 in the build-up to Brexit (Smith & Williamson, 2018). This incentive is to strengthen UK enterprises during uncertainty. Fundamentally, this increases and improves the performance of the economy. As Mohnen and Lokshin (2008) proclaim, the emergence of the knowledge-driven economy has facilitated innovation to be the crux of competition and the source of future economic growth. Furthermore, Derregia & Crittenden's (2007) study, through interviewing finance directors and Chartered Accountants, conveys that R&D tax relief and incentives ignore the uncertainty and irreversibility of R&D expenditure. This is especially problematic for SMEs whom do not possess a wealth of funds. On the contrary, experience of receiving R&D is significantly related to the confidence a firm has in their application for R&D tax credits.

Market failure is the reason given by government to intervene in R&D funding. Market failure is defined as the moment in which price mechanism leads to an inefficient allocation of resources and a

[2] A patent box was first introduced by the governments of the Netherlands and Belgium in 2007, followed by Spain and Luxembourg in 2008.

deadweight loss of economic welfare (Riley, 2018). In terms of SMEs, it suggests that markets, although they equip positive private returns on R&D, lack private investment in non-appropriable, public goods (EC, 2014). Supporting this premise, MacCartan-Quinn and Carson (2003) coin SMEs as 'valuable yet vulnerable' which require government intervention to overcome high rates. Therefore, incentives are needed that are issued by the government to iron out this equitable imbalance. The mismatch of the coordination of R&D relief in Europe is conveyed as problematic. It is known that some regions prosper in R&D more than others.

Evidently, in Romania, qualitative and quantitative characteristics of the Romanian regions significantly influence R&D investment strategies such as high and medium-high technological level industry activities and knowledge initiative services (Goschin, 2014). With this, private investment in R&D is concentrated in certain regional areas. Similarly, in 2013, of 52 per cent on R&D took place in London, the South East or the East of England (National Audit Office, 2013). New data released this year, showed the same pictures with expenditures on R&D concerted in London, the South East or the East of England (National Audit Office, 2019). This suggests that R&D uptake differs across the UK. Therefore, there are discrepancies in funding. Adding to this line of thought, a certain time lag exists between the implementation of a policy measure and an assessment of its consequences (NESTA, 2012). NESTA highlights this is due to the inefficiency of collating information and administrative data from tax authorities on the use of R&D tax incentives, which must be merged with other firm data on R&D, innovation and performance.

Although these arguments are compelling, as Bernake (2011) writes, we must be mindful that R&D activity is only part of what the government can do to ignite and maintain innovation. Some countries have pronounced that R&D relief lacks certain incentives and that they should be paired with both direct and indirect approaches including tax incentives, grants, low taxes and also education. An outlining question arising from this indicates whether governments should use indirect and direct ways to intervene in R&D. However, predicting innovation is just that. Although, predicting can give a reasonable outlook into the causes and effects of innovation, to grapple with the openness and freeness of innovation is to cage it.

Statistically, Kao's (2017) research suggested that R&D tax credits contributed to better innovation quality and higher volatility in future earnings and returns but lower pre-tax profitability. Furthermore, it indicates that R&D tax credit provision encourages firms to induce R&D spending, enhance innovation quality and take risks. Fundamentally, this contributes to the competitiveness of countries. Supporting this premise, Mohnen and Lokshin (2012) found evidence to suggest that the R&D programme in the Netherlands was effective in stimulating a firm's investment in R&D. However,

SMEs benefited substantially more. They discussed the term 'deadweight'. Deadweight implies that the government might fund firms who would already have been considering investing in R&D and would do so anyway if the government did not facilitate the funds. Consequentially, deadweight R&D funding degrades some value to the government's programme.

Supporting this premise, NESTA (2012) argue in their report that there is a growing risk of a zero-sum game whereby, tax relief and incentives are no longer incentives. For example, 40 US states have announced R&D tax credits, yet public returns have minimised substantially. This suggests a prior reliance on government funding, and therefore the importance of funding. Moreover, Wang (2008) highlighted that industry innovation in Hong Kong is mainly self-financed and less directed by the government compared to Singapore. For example, the Singaporean government facilitated US$2.3 billion for R&D which accounted for 0.8 per cent of GDP, in comparison to Hong Kong whose government financed US$0.9 billion for R&D which contributed to 0.3 per cent of GDP. On the contrary, Appelt et al., (2016) discuss how the success of R&D programmes is contingent on the temporary or permanent nature of these incentives, and by their user's expectations of these support systems. Moreover, direct interventions like R&D programmes are not likely to facilitate impactful technology unless it is complemented by regulatory action (Abernathy & Chakravarthy, 1979).

It is somewhat difficult to aggregate and conduct a meta-analysis of the overall effectiveness of R&D tax incentives. Ientile and Mairesse (2009) make this the central argument of their theoretical paper. They state that, due to this, there is a lack of harmonisation and comparability between the empirical studies. Therefore, it is problematic when discussing the effectiveness of R&D tax credits as a whole and across samples.

The methodology in studying the effectiveness views research as being separate entities and not complementing material. Congruently, Rodríguez-Pose and Di Cataldo (2014) found that the reverse is true in Europe. Corrupt and ineffective governments dampen innovation potential. They therefore undermine the necessity of innovation in policy. The study reflects the need of a cooperative government funder, whose interest lies within its SMEs. In general terms, although R&D tax relief has a positive effect on innovation, as tax incentives constitute exemptions in the law, they complicate the tax system. Another disadvantage to the introduction of R&D tax incentives, specifically for volume-based schemes, is when they allow firms to deduct the tax payment even for R&D activities that would have been carried out anyway. Consequently, they provide lower additionality of business R&D.

1.5 A Cross-National Comparison of R&D Tax Incentives

One of the main aims of this study (WP 3.1) is to compare the R&D tax relief in 10 selected European countries. The countries have been selected with consideration of their different positions on the European Innovation Scoreboard. Denmark, UK and Netherlands, which are considered leading countries in innovation, and Romania, which is considered a modest innovator, have been selected among strong innovators, Ireland and France have been selected, whereas for the moderate innovators Italy, Lithuania and Spain have been selected. In addition, the countries selected come from northern, central and southern Europe have been included in order to represent the geographical and cultural diversity of the European Union. With reference to table 3.1, the different policies on R&D tax incentives have been summarised for each country involved in the research. As can be seen, the general information on SMEs, the type of incentives for small and medium enterprises, the eligibility costs and the process of receiving R&D credits have been summarized. The results presented in this section confirm that SMEs remain the backbone of the EU economy. As mentioned earlier, they represent 99 per cent of the total number of enterprises for all the selected countries. Considering R&D tax incentive schemes, volume-based is the most common across Europe with an exception being Spain which uses a hybrid scheme. Looking at the eligibility for R&D tax incentives, all the countries selected, with the exception of Ireland, do not present any restriction on the type of entities that may qualify for incentives. All industries are eligible for tax credits and incentives. In Ireland, four categories of activity generally qualify for the credit: Natural Sciences; Engineering and Technology; Medical science which includes Basic Medicine, Clinical Medicine, or Health Sciences; Agricultural Sciences.

Table 3. Policies Tables (WP 3.1)

Denmark

General Information on SMEs	Type of Incentive	Eligibility- Eligible Costs	Process of receiving R&D Credits
Small and Medium enterprises (SMEs) account for 99.7% of the total number of enterprises in Denmark and over 65% of employed persons work for SMEs in Denmark. SMEs generated about 60% of total turnover in the country's business economy. The direct support to R&D and innovation activities in firms has increased during the recession. It is aimed mainly at SMEs. According to the Innovation Scoreboard (2017), Denmark is considered a Leading Innovation country within the EU member state.	Volume-based tax credit., The Danish R&D credit was implemented in January 2012. Companies receive tax credit corresponding to 22% per year of any deficit related to R&D expenses, that means the entity must be loss-making to be eligible. If the company is part of a group, the consolidated taxable income must also be negative. The maximum tax credit that can be given is DKK 5.5 million per year (ceilings).	Companies from all sectors in Denmark can apply for funding and financial incentives for R&D. The reduction in the corporate tax rate will not apply to profits from oil and gas extraction. Eligible expenses include the following: the purchase price of machinery, equipment and ships acquired for R&D purposes may be deducted in full in the year of acquisition. A full deduction in the year of acquisition generally is available for patents and know-how, irrespective of the economic life or the amount of purchase price.	Firms were able to deduct their R&D expenses in the same year as they have occurred. Tax Authorities pay the tax credits every year in November, in the next year after the application has been received. The R&D tax credit can be used both by companies and those self-employed.

France

General Information on SMEs	Type of Incentive	Eligibility- Eligible Costs	Process of receiving R&D Credits
Small and Medium enterprises accounted for 99.9% of total number of enterprises in 2015 and 63% of all working persons in France were employed by SMEs. SMEs generated about 58% of total turnover in the country's business economy. According to the Innovation Scoreboard (2017), France is considered a strong innovator country within the EU member states.	Volume-base R&D TAX credit (Crédit d'Impôt-Recherche: CIR) which includes: Social security exemption for young innovative enterprises (JEI) and university enterprises (JEU). CIR credit rate: 30% (up to EUR 100 million of eligible R&D), 5% (above threshold) SSC exemption (JEI/JEU): 100% for a period of up to 8 years. Specific R&D tax credit for SMEs: Innovation Tax Credits: Offsetting a tax credit against CIT. equal to 20% of innovation expenses limited to €400,000 per year.	There is no restriction on the types of entities that may qualify for incentives. Generally, eligible expenses include the following: General and administrative expenses, R&D staff expenses, depreciation allowances for assets used for R&D activities in France, patent costs, contract research costs, and costs of technological monitoring.	A company shall file a special tax return form before the second business day following the 1st May. In principle, R&D tax credit is used to offset against CIT due by a company. However, if a company cannot offset the R&D tax credit against CIT, French tax law provides some attractive rules to obtain a reimbursement in cash: If after 3 fiscal years the tax credit cannot be offset against CIT (e.g. company at loss), the company may obtain its reimbursement in cash. SME's or YIC may immediately obtain a reimbursement in cash.

Greece

General Information on SMEs	Type of Incentive	Eligibility- Eligible Costs	Process of receiving R&D Credits
Small and Medium enterprises account for 99.9% of the total number of enterprises and over 87.3% of total employed persons in Greece. SMEs generated about the 72% of total turnover in the country's business economy. The area of skills and innovation has received substantial attention at policy level from 2008. In particular, the measures adopted aimed at the establishment of clusters and incubators, the development of SMEs' R&D competencies, the facilitation of their access to innovation and knowledge, the adaptation of vocational training to the requirements of the labour market and the creation of start-ups. According to the Innovation Scoreboard (2017), Greece is considered a moderate innovator country within EU member states.	Greece provides R&D tax relief through volume-based R&D tax allowances. In the case of insufficient tax liability, companies can carry forward 5 years unused credit. Greece offers a super deduction (130%) for eligible expenses incurred in scientific and technological research activities. Greece offers a host of other incentives aimed at encouraging the growth of R&D-intensive business including innovation grants and a series of researcher employment incentives (payroll subsidies), as well as a patent box.	Eligibility for the super deduction is broad and not limited to particular industries. Qualifying activities for the super-deduction include scientific research and technology-oriented research and development. Eligible expenses include the following: IP related costs (patent filing, etc.); Engineering and industrial design costs leading up to the production of non-commercial prototypes; Test and trial costs, production line configuration costs, costs of demonstration projects and new product market research costs. Contract research is allowed by General Secretariat of Research and Technology (GSRT) approved organizations, such as public institutes, labs and research organizations.	At the end of the fiscal year, the taxpayer submits a list of the R&D expenditures incurred to General Secretariat of Research and Technology (GSRT). The GSRT issues a certificate on the approved R&D expenses. If the certificate is not issued within six months of submission, then all submitted R&D expenses are considered approved.

Lithuania

General Information on SMEs	Type of Incentive	Eligibility- Eligible Costs	Process of receiving R&D Credits
Small and Medium enterprises account for 99.8% of the total number of enterprises in Lithuania and over 74% of employed persons. SMEs generated about 67% of total turnover in the country's business economy. The government is encouraging innovative SMEs through tax benefits, innovation loans and grants. According to the Innovation Scoreboard (2017), Lithuania is considered a moderate innovator country within EU member states.	Volume based tax-credit; the corporate income tax is 15%. The Lithuanian R&D tax credit becomes applicable for tax years beginning on or after the 1th January 2008. The following two tax incentives are available for companies conducting qualified research: 300% super deduction are available for expenses incurred by companies conducting research activities, and expenses incurred to acquire research technologies conducted within EEA countries or countries that have concluded a tax treaty with Lithuania. Accelerated depreciation: Certain capital assets used in R&D activities (e.g., plant, equipment, computers, communications equipment, and software) may benefit from accelerated depreciation. Depending on the type of capital asset, the depreciation period may be shortened from eight, five, four or three years to two years.	There is no restriction on the types of entities that may qualify for incentives, all industries are eligible for R&D tax credit. The aim of an R&D project must be scientific or technological progress and the results must be significant for entities that initiated and executed the project. Eligible expenses include the following: gross wages, social security and health insurance contributions, business trip expenses, expenses for purchased services, building and equipment leasing, maintenance expenses, warehousing, utility services, expenses for raw materials or other consumables used in the research activities.	A company applying for tax relief for R&D has to prepare R&D documentation. This documentation has to cover the performed project, substantiate conformity with certain tax requirements, and specify the amount of expenses for R&D activities. The R&D tax benefits are claimed on the taxpayer's annual corporate income tax return, which can be amended for the preceding 5 tax periods. The taxpayer must have documentation to substantiate eligible expenses and also, they may seek approval from the Lithuanian Agency for Science, Innovation and Technology that particular projects meet eligibility requirements.

Netherlands

General Information on SMEs	Type of Incentive	Eligibility- Eligible Costs	Process of receiving R&D Credits
Small and Medium enterprises accounted for 99.8% of the total number of enterprises in the Netherlands and over 65.2% of total persons employed in 2016. SMEs generated about 63% of total turnover in the country's business economy. The government is encouraging innovative SMEs through tax benefits, innovation loans and grants. Entrepreneurs make use of a Dutch government financing programme for Loans to Small and Medium enterprises (BMKB). According to the Innovation Scoreboard (2017) the Netherlands is considered an Innovation leader country within EU member states.	The Netherlands offers three types of incentives to taxpayers engaged in qualified research: WBSO: This incentive reduces wage tax and social security contributions for employees engaged in R&D activities. R&D allowance (RDA): The RDA is a super deduction of 160% of qualifying expenses directly attributable to qualified research activities. Innovation box: Qualifying income attributable to innovations is taxed at a 5% rate. In addition, the Government guarantees part of an SMEs loan. Also, the Innovation Fund for SMEs (MKB+) helps SMEs transform their ideas into profitable new products, services and processes.	WBSO, RDA and innovation box are open to all industries. In general R&D means: the development of technically new physical products, physical production processes, software, or components thereof; Scientific research seeking to explain phenomena in different fields, such as physics, chemistry, biotechnology and information and communication technology; Technical research aimed to enhancing physical production process or software.	Applications must be received one month before the start of the period for which this facility is required. Applications from self-employed entrepreneurs cover the period from the date of submission to the end of the calendar year.

Ireland

General Information on SMEs	Type of Incentive	Eligibility- Eligible Costs	Process of receiving R&D Credits
SMEs accounted for 99.8% of the total number of enterprises in 2016, and over 69% of all working persons in Ireland were employed by SMEs. Furthermore, SMEs generated 47.8% of total turnover in the country's business economy. In 2015, over 1,300 small enterprises were engaged in R&D. The R&D tax credit was first introduced in the Finance Act 2004. According to Innovation Scoreboard[3] (2017), Ireland is considered a strong innovating country within the EU member states. Relative strengths of the innovation system are in employment impacts, human resources, and attractive research systems. Relative weaknesses are in finance and support, and intellectual assets.	Expenditure based - the credit is calculated at 25% of qualifying expenditure and is used to reduce a company's Corporation Tax (CT).	Four categories of activity generally qualify for the credit: Natural sciences; Engineering and technology; Medical science, which includes basic medicine, clinical medicine, or health sciences; Agricultural sciences. Qualifying expenditure includes royalties, expenses deductible for trading purposes (wages and supplies), plant and machinery used for the purposes of R&D activity, revenue and capital expenditure on scientific research, and buildings subject to capital allowances.	A company uses the Revenue Online Service (ROS) to claim the credit on their CT return. A company must claim the R&D Tax Credit under Section 7661 of Research and Development Tax Credits Guidelines[4] (qualifying activities) within 12 months of the end of the accounted period in which it incurs the expenditures.

[3] The European Innovation Scoreboard provides a comparative analysis of innovation performance in EU countries, other European countries. It assesses relative strengths and weaknesses of national innovation systems and helps countries identify areas they need to address.

[4]https://www.revenue.ie/en/companies-and-charities/documents/research-and-development-tax-credit-guidelines.pdf

Italy

General Information on SMEs	Type of Incentive	Eligibility- Eligible Costs	Process of receiving R&D Credits
Small and Medium enterprises accounted for 99.9% of the total number of enterprises in 2016 and over 79.3% of people employed in Italy. SMEs generated about 68% of total turnover in the country's business economy. In terms of percentage composition, R&D expenditure has increased for large companies (from 62,5% in 2013 to 63%in 2014) but decreased for SMEs (respectively from 16.4% to 16% for medium and from 10.3% to 10.1% for small enterprises). According to the Innovation Scoreboard (2017), Italy is considered a moderate innovator country within EU member states.	Incremental R&D tax credit; In 2018 a new incremental tax credit scheme is available for fiscal years 2018, 2019, 2020[5]. The credit is calculated at 50% of qualifying expenditures. All persons/companies carrying on an entrepreneurial activity are eligible to claim in each FY up to EUR 5M tax credit (provided they make an annual minimum investment equal to EUR 30K). The R&D tax credit is a cash grant equivalent since it can be used to offset IRES (the Italian corporate tax income), IRAP (the regional production tax), VAT and withholding tax liabilities without any limitation.	There is no restriction on the types of entities that may qualify for incentives. Generally, eligible expenses include the following: Labour cost of employees participating in R&D activities (only highly qualified employees are eligible for R&D tax credit: PhD and Masters holders); Depreciation expenses and leasing costs for machinery and instruments used in qualified research; Fees paid for performing research on the taxpayer's behalf by universities, research institutions and innovative start-ups; Cost of purchased technical knowledge and patent.	R&D tax credits are provided at country level., In addition a wide range of regional cash grants are available for R&D-intensive entities, but the nature of the grants and their availability depends upon the region and the size of the company. Companies preparing the financial statement at the end of fiscal year, must indicate the R&D expenses incurred in the tax return.

[5] Launched with "Bilancio Law", 2018.

Romania

General Information on SMEs	Type of Incentive	Eligibility- Eligible Costs	Process of receiving R&D Credits
Small and Medium enterprises account for 99.7% of the total number of enterprises in Romania and over 67.5% of those employed. SMEs generated about 58% of total turnover in the country's business economy. Tax Allowances were introduced in Romania in 2010. There is an intersection between the Ministry of Public Finance and the Ministry of Education Research and Innovation. Romania is towards the lower end of total volume of central government support for business R&D which is equivalent to 0.04% of GDP. 25% of total public support for companies take the form of tax incentives. Romania is regarded as a modest innovator but compared to the EU in 2010, performance has reduced by 14.1%.	Romania invests in volume-based tax allowances at 50%. Unused credits can be carried-forward for 7 years. Salary income from carrying out R&D is not included in Romanian income tax regardless of whether the employer is Romanian or non-Romanian.	Research and Development activities such as engineering, automotive, and pharmaceutical industries are all eligible for R&D tax relief. Editing and modifying products, services and processes are not defined as R&D. Income tax exemption for salary has several requirements: 1st cycle of university education or a long-term period of certain higher education - They must hold a bachelor's degree from an institute in Romania or if abroad, recognised by the Ministry of National Education and Scientific Research. Also, if their posting is in the R&D department of a company, if their salary is included in the R&D budget for the company, and if the employer's activities comprise of R&D activities.	Taxpayers that exclusively perform innovation and R&D activities on scientific research and technological development and related activities are exempt from profit tax for the first ten years of activity. The application of the corporate tax deduction must be documented in a project, which includes minimum mandatory elements as detailed within the tax legislation.

Spain

General Information on SMEs	Type of Incentive	Eligibility- Eligible Costs	Process of receiving R&D Credits
Small and Medium enterprises accounted for 99.9% of the total number of enterprises and over 73% of those employed in Spain in 2017. SMEs generated about 61% of total turnover in the country's business economy. In Spain, development is the application of the results of research or of any other kind of scientific knowledge for the manufacture of new materials or products, or for the design of new production processes or methods, as well as for substantial technological improvement of materials, products, processes, or previously existing methods. According to the Innovation Scoreboard (2017), Spain is considered a moderate innovator country within EU member states.	Hybrid (volume-based and incremental). The volume-based tax credit is equal to 25% of R&D expenditures incurred in the fiscal year. Incremental credit equals 42% of the amount of the current year expenditure exceeding the average of such expenditure incurred in the preceding two tax years. If the taxpayer's current year spend exceeds the average of the prior two years, the company receives a credit equal to 25% of the current expenses plus 42% of the excess over the base. The incremental credit is in addition to the volume-based scheme. Personnel credit is equal to 17% for wages paid to qualified researchers.	There is no restriction on the types of entities that may qualify for incentives., All industries are eligible for R&D tax credit. Generally, eligible expenses include labour costs of employees participating in R&D activities, and the cost of investments in fixed assets that are exclusively dedicated to R&D activities.	In Spain, R&D tax credits apply to the annual corporate income tax return which is due 6 months and 25 days following the end of the fiscal year. In Spain the fiscal year starts on the 1 January and ends on the 31 December.

United Kingdom

General Information on SMEs	Type of Incentive	Eligibility- Eligible Costs	Process of receiving R&D Credits
Small and Medium enterprises account for 99.3% of the total number of enterprises in the United Kingdom and over 60% of those employed. The combined annual turnover of SMEs was 51% of all private sector turnover in the UK. In 2000 the scheme was introduced to advance overall knowledge or capability in the field of science or technology. Examples of this include making new processes, products or services, and improvements to existing products or services. A company can still redeem R&D incentives if they are loss making. R&D varies within the UK as per the Royal Society article 2017. For instance, R&D investment from government and research councils is spent more in London (9%) than North Wales (2%).	Volume-based: SME's are considered for SME R&D relief if they have under 500 staff members, and a turnover of less than €100m or balance sheet total under €86m. It usually takes 28 days to process a claim. The scheme decreases an extra 130% of qualifying costs from yearly profit, or 230% depending on profit or loss figures. If loss making, a company can claim a tax credit worth 14.5% of the surrenderable loss or the loss can be carried forward to the following years. If profit making, the company use these enhanced R&D costs to reduce their corporation tax liability.	Work carried out relating to R&D activity to resolve technological and/or scientific uncertainty are considered qualifying R&D projects. Fundamentally, employees (on payroll), subcontractors and consumables are eligible expenditure a company can claim. Employees: Direct employee costs related to the R&D are considered as qualifying costs (salaries, wages, pensions and Class 1 NIC). This is then dependent on the proportion of time these employees spend on the R&D activity. Some staff could be external, making them subcontractors. Subcontractors: Subcontractors can be connected or unconnected. If unconnected, 65% of the costs are regarded as qualifying expenditure. Consumables: Consumable items are defined as the products directly used and consumed throughout the R&D project.	The focus is on 'how' products are produced. To gain R&D Incentives, an SME must have looked for an advance in science and technology whereby their project aimed to progress the field. Unfortunately, arts, humanities and social sciences are not considered. Through this, the team could have had to battle and overcome uncertainty. The R&D claim must state how these uncertainties were created and how they were concluded. Therefore, the project starts when the company sets out to resolve these uncertainties and the project ends when these uncertainties are solved. It is these methods that should be outlined in the claim. Furthermore, this advancement could not have easily been configured by a specialist in this field. Evidence for these conditions need to be provided when requested. The focus is on the technicalities of the product, not the design.

2. Our Empirical Studies

Understanding Perspectives Surrounding the R&D Tax Relief & Incentives Scheme

2.1 Study of Governance of R&D Tax Incentives

The aim of the research at this stage (WP3.2) is to examine the effects of Research and Development tax relief on Small and Medium Enterprises through the perspective of integral stakeholders such as accountants and/or consultants, universities/research centres, government agencies and SME representative organisations in ten selected countries. The focus has been on organisations which have a key role in either providing support for R&D grants and/or delivering R&D tax credit schemes, and representative bodies for small businesses which give a voice to SMEs in the respective member's state. Individuals were invited to participate in the survey via email and social media channels. The qualitative research provided background for the much larger, quantitative research conducted in accordance with WP3.3.

Conventional qualitative research methods include interviews, focus groups and observations. What is unconventional, is to use an open-ended survey to gather qualitative data. However, our reasons will be outlined as to why we chose this design to fit our research questions and highlighting some limitations of this method.

Although each question within the survey was standardised and followed a guide, it was hard to predict the next question. With this the participant was engaged for longer opposed to the classic quantitative Likert scale measure, where participants build on previous knowledge and can go through each question dependently on the last (Leppink, 2017). With the complexity of the R&D tax relief/incentives scheme we were looking for participants who would encounter this scheme and provide fruitful answers to the questions. Open-ended surveys provided participants the opportunity to explain their reasonings for a given answer. The given answer was elaborated and expanded, providing a reflection of personal ideas (Labuschagne, 2003). The un-restraining nature of an open-ended survey allowed the chance for the participants to explore and explain, which served as a motivator previously discussed. They also allowed the participants to agree or disagree, or even show that they did not possess an opinion at all (Sandelowski, 2000). Therefore, the context in which the question was asked was considered within the research. Some may argue that an open-ended survey is time consuming as more cognitive effort was required (Lacity & Janson,1994).

However, when a topic is niche, and the research serves to be exploratory, time is needed to fully understand a topic. As the reason for asking the questions through the qualitative stance, was because knowledge surrounding the topic was limited. When asked to explain a perspective, participants required time too, they needed to

elaborate their answers. As the response was open, they were able to answer a question without pressure that the answer was neither right nor wrong.

The countries have been selected according to their different positions on the European Innovation Scoreboard 2017. The Innovation Scoreboard ranked countries from Innovation Leaders (highest rank), Strong Innovators, Moderate Innovators to Modest Innovators (lowest rank). Respectively we chose countries that belonged to each of these categories. Denmark, UK and Netherlands were considered Innovation Leaders. In fact, as mentioned previously, Denmark, UK and the Netherlands, which are considered leading countries in term of innovation, and Romania which is considered a modest innovator, have been included. Among strong innovators, Ireland and France have been included, whereas for the moderate innovators Italy, Lithuania and Spain have been selected. In addition, countries from northern, central and southern Europe have been included to respect the geographical and cultural diversity of the European Union. Using the snowball sample, (Goodman, 1961), an exploratory questionnaire has been designed to gather knowledge on issue and barriers to innovation and expectation in terms of future policy in R&D tax relief.

The qualitative drew on a realist method which reported experiences and meaning. Fundamentally, this method was concerned in how participants constructed their reality, and most importantly their perspectives. As we were exploring perspectives of these integral stakeholders, we found it fitting to use this methodology. Questions with the purpose of asking '*how*' or '*why*' are best answered through qualitative methods (Ritchie, Lewis, Nicholls & Ormston, 2013). The stakeholders were able to speak, within their own terminology, and understandings, without an opinion from the researchers pre-supposed. This way, we were able to 'explore' the very essence of their perspectives. We were allowed to assess the current climate for R&D tax relief/incentives by those that were exposed to the schemes. Evident, as the qualitative has been reputed for being the 'time-honoured' technique (Marecek, 2003). Participants, through this qualitative method were given the opportunity to develop their ideas and thoughts, providing in-depth and rich answers. There was no-word limit as to how participants were to respond. They were able to elaborate on reasons they sought fit to answer questions. Through this, participants were able to champion and take ownership of their ideas, which in return gave a form of empowerment to these organisations.

Furthermore, although the participants were incentivised, having their say came to be a more important motivator than the incentives. Able to discuss their ideas and have their ideas pitched to higher governmental power, participants could be fully immersed, if they chose to, within the research. Therefore, moving the research away from pure, descriptive research, but to '*action research*' that informs policy makers and governments on SME innovation (Denscombe, 2014).

The thematic analysis[6] has been used as a framework method; this methodology gives the possibility to identify, analyse and report patterns (themes) within the data. The thematic analysis involves searching across a data set to find repeated patterns of meaning. This methodology is a realist method, which reports experiences, meaning and reality of participants. Using a semantic approach, the themes are identified within the explicit meaning of the data, and the analysis is not looking for anything beyond what a participant has declared or has written (Braun & Clarke, 2006). The first step of the analysis is the coding phase: Codes identify a feature of the data that appears interesting to the analysis and refer the basic segment of the information useful to read the research's phenomena. When all data are coded and collected across the data set, they are involved within identified themes. For each individual theme, it is necessary to identify the 'story' that each theme tells relating to research questions and aims (Denzin & Lincoln, 2011). To summarise, thematic analysis refers to the process of identifying themes in the data which capture meaning that is relevant to the research question, and perhaps also to making links between such themes.

2.2 Steps of the Research and Questionnaire

The first step of the research was to design an exploratory questionnaire[7] aimed at government agencies, interested stakeholders such as consultants/accountants, university and research centres, and SMEs representative organisations. The questionnaire was divided into the following sections:

1. Basic information about the organisation;
2. Knowledge based on Research and Development tax incentives;
3. Stakeholders aspiration;

In the first section, we asked the participants to summarize basic information about their organisations; The second section aimed to test whether the participants were aware of R&D policy in their respective countries. In addition, questions regarding the barriers to innovation and to claiming R&D tax relief were asked. In the

[6] Phases of thematic analysis:
Transcription: the data should be transcribed to an appropriate level of details or reviewed if the data was gathered though a survey.
Coding: collecting data relevant to each code.
Researching for themes: collating code into potential themes (remember the themes should be internally coherent, consistent and distinctive).
Reviewing themes: Check if the codes that we have individualised are embedded with the themes.
Defining and naming the themes is necessary a clear definition and name for each theme (Braun, Clarke, & Terry, 2014).

[7] An online survey was created using Survey-Monkey. A Survey-Monkey account was created to host versions of the survey. Translators were used to translate the survey from English to French, Italian and Spanish and back for the analysis (please see Appendix II). Participants would require an internet connection and an online link to access the survey.

Stakeholder's Aspiration section, participants were asked about their aspirations, for suggestions they might have to improve the governance of R&D and about the strengths/weaknesses of R&D tax incentives policy and innovation in their respective countries. Following the questionnaire design, the main SME representative organisations, government agencies and interested stakeholders were selected for each country involved in the research. The selected participants were invited by email, LinkedIn or phone, to take part in the research and were asked to sign an interest form. In addition, in order to accommodate the participants, the questionnaire was submitted in 4 different official European languages.[8] A draft survey was pilot tested on two SME organisations, in order to improve the final version of questionnaire. 30 valid questionnaires, from 10 different European countries, were collected, with 25 per cent representing SME representative organisations, 17.8 per cent government agencies, 25 per cent stakeholders, and 32 per cent other organisations such as Universities, Spin-off and Innovative foundations. Table 4 shows the participants which have engaged in the research, listed by country and job title, and who have given permission to be identified.

[8] English, French, Italian and Spanish versions have been distributed.

Table 4. Organisations involved by country and participants' job title

Name of organisation	Job title	Country
Links S.A.	Accounting and tax services	Greece
Grant Thornton	Innovation Tax specialist	Ireland
Grant Thornton	Assistant Manager	Ireland
Ernst & Young	Partner	Ireland
Perform Industria	Consultant	Italy
CNR, Italian National Research Council	Researcher	Italy
Vilnius University, Innovation Office	Innovation Manager	Lithuania
Agency for Science, Innovation and Technology	Head at Global Grant Department	Lithuania
Health-Holland	Operation Director	Netherlands
Netherlands Organisation for Applied Scientific Research TNO	Manager EU affairs	Netherlands
Dunarea de Jos University of Galati	Full Professor PhD habilitated in Finance	Romania
Dilersur Andalucia	Manager legal department	Spain
CETAM	Project Manager	Spain
NESTA	Head of new Technology & Start-up research	United Kingdom
ForrestBrown, LTD	Director	United Kingdom
EIS Association	Director General	United Kingdom
Ardor Business Solutions Limited	Tax Accountant	United Kingdom
Ardor Business Solutions Limited	Accountants	United Kingdom
EIS association	Accountants	United Kingdom

Most of the participants (88.5%) declared that they are aware of Government R&D tax credit and financial incentive relief schemes. 73 per cent of them are active in providing R&D advice to SMEs. 46 per cent of participants, mainly accountants and consultants, provide R&D support to SMEs to claim back R&D tax credits and 60 per cent of them have planned events aimed at raising awareness and promoting SME R&D tax incentives. When participants were asked to expand on their versions of the R&D tax incentives programme, the replies were mixed. Some outlined the scheme in great detail whilst others were unsure or faced confusion, yet 70 per cent were active in providing R&D advice, and whereby 48 per cent of participants provided support in claiming R&D tax relief.

2.3 Barriers to Innovation

In the literature, two types of barriers to innovation, external and internal, are considered. This classification of barriers is made by Piatier (1984). External barriers can be further divided into supply, demand and environmental related. Supply barriers are characterised by difficulties in obtaining technological information, raw material and financial support. Demand barriers are related to customer needs, their perception of the risk innovation and domestic or foreign limitation. At the same time, environmental barriers include government regulations, anti-trust measures and policy actions. Internal barriers have their origin in the surrounding environment and cannot be influenced (Hadjimanolis, 2003). Internal barriers are easier to identify and to deal with than external ones. According to Rush and Bessant (1992), internal barriers can be further subdivided into resource related, e.g. lack of internal funds, technical expertise or management time; culture and systems related, e.g. out of date accountancy systems; and human nature related, e.g. the attitude of the top manager to risk or employee resistance to innovation. On a national level, it is important to identify barriers in order to boost innovation-based competition and to prevent failures in innovation. In addition, on a company level, an identification of barriers can assist in fostering an innovative culture in firms by supporting new ideas or promoting innovation management (Chaminade et al., 2009). According to Corsten (1989) and Klein (2002) the innovation barrier can be individual, or organisation related. Ability and motivation are the two most important groups of personal and individual barriers. Ability refers to the lack of knowledge inside companies. Knowledge barriers arise due to lack of knowledge or poor absorptive capacity[9] among personnel. On the other hand, organizational barriers may arise from ineffective structure or culture. Another type of internal barrier is related to weak management commitment, which does not support innovation culture. Simpson et al. (2006) point out that the ability to innovate and the acceptance of innovation require commitment from the employees but also from the management.

Going deeper, according to Pol at al. (1999), lack of efficient government support is a frequent barrier to innovation. The Piatier study focused on Small and Medium Enterprises, carried out for the Commission of European Communities under the title “Barriers to innovation in SME” identifies some major barriers to innovation common among the countries involved. These include the effect of education and training upon employment in enterprises, the effect of action by banks upon the financing of innovation and the effect of action by venture capital companies upon the financing of innovations. On the other hand, Piater pointed out that the third most important barrier to innovation in European countries is the lack of government assistance. In fact, bureaucratic procedures, lack of a settled national strategy and problems in policy communication may cause massive external barriers for the innovation process. Related to Pietar’s classification, other types of barriers are present in the literature such as

[9] Absorptive capacity has been defined as "a firm's or individual ability to recognize the value of new information, assimilate it, and apply it to commercial ends" (Cohen and Levinthal, 1990).

formal barriers related to a high level of taxation present in a country*, informal barriers* such as implementation of regulation and corruption, and institutional barriers such as lack of financing (Hash, 2001; Barlett and Bukvic, 2001; Pissarides et al.,2003). In addition, Zhu and Wittiman (2011) show how the lack of efficient government support combined with tax burden and lack of information are identified as the first obstacles to claiming R&D tax credits.

2.4 Main results

There is a long debate in the literature review regarding the main barriers which act as obstacles to innovation in Europe and in the world. The authors consider that this is a crucial point to investigate because some barriers could slow down the success of innovation in Europe. In analysing the questionnaire data, three principal themes emerged which will be discussed in this section. 33 codes were grouped into three main themes identified as internal, external and informal barriers. Among the data identified, environmental barriers, which are classified as an external barrier, and resource related barriers, which are identified as an internal barrier by Patier (1984). The data reveals that the main barrier to innovation is the lack of government funding. The results showed 36 per cent of the participants declared that *lack of government funding* which supports a radical innovation is the main barrier in their respective country. An external barrier pointed out by participants is the *lack of qualified personnel* (20%) to be involved in R&D activities, along with *lack of awareness* (12%) regarding R&D tax incentives. In addition, the *lack of private* funding which could help SMEs to invest in R&D activities has been revealed. Foremost among the internal barriers identified is the lack of internal funding along with financial constraints. These last internal barriers could be a consequence of the credit crunch following the 2008 financial crisis and related austerity measures which effected SMEs more than large companies, especially in southern European countries (Wehinger, 2014). In fact, in response to question, 'Please identify the main barriers to the development of innovation in your country' participants declared:

'Lack of awareness of support available, administrative burden on claiming R&D incentives, lack of collaboration between public and private sector and need to increase public and private investment in research'

'Lack of awareness of innovation incentives, lack of access to skilled resource […] lack of government funding'

'Due to the crisis, government budget for R&D was decreased, long process for having result and not good coordination with public organisation'.

There is a sense of deficiency of the schemes across Europe, emphasised by the repetition of 'lack'. This code was present in 96 per cent of responses. There is a blame put on the authorities for the level of support they offer within the R&D tax relief space. Participants from Italy, unlike other participants, have experienced difficulties linked to informal barriers such as *lack of implementation of regulation or political obstacles*. A participant from Italy responded: *'Poor research funding from private individuals, cultural and political obstacles.'* Related to the question regarding barriers to innovation, the questionnaire investigated the weakness of R&D and innovation policy in the participant's respective countries. For this topic, 30 codes were grouped into 3 main themes identified as *weakness of policy*, *weakness of funding*, and *weakness of the surrounding environment* such as SME support, limited knowledge of R&D tax relief opportunity for SMEs, and long-term results of R&D leading to long term profit. Regarding weakness of policy, the data shows that the main weakness is the complexity of bureaucracy together with a lack of *ex-post* evaluation of research projects financed by public bodies. Participants declared:

'Low fund, high bureaucracy, slow progress'

'Hard to navigate the range of supports/programme available'

'[…] Perceived technical complexity of claiming, poor guidance and support from tax authorities'.

'The absence of scientific evaluation of project submitted under European fund'; '[…] no control about the impact and the results of project financed by public fund'.

As with the barriers to innovation, the lack of both private and public funding was highlighted by participants. The lack of funding to support R&D policies, in the participant's respective countries is a repeated theme throughout the results. The last theme, on the weakness of the surrounding environment, shows how low investments in R&D by SMEs is due to uncertain results and to limited support from public institutions. In addition, the data shows limited knowledge of R&D tax relief by SMEs. In fact, participants declared:

'Lack of awareness of existence of tax incentives. Perceived technical complexity of claiming and poor guidance support from tax authorities and public services'.

'Research can take time to achieve results'

'Lack of awareness of knowledge of the subject, by the official responsible for the measures in the bodies in charge. Required requirement obsolete and far from company realities'

'Few investments long period of time to get results'

'Low business activity investment in R&D few links between research institution and businesses'

'There is a lack of critical mass of human resources for the development of promising areas and for interdisciplinary research and innovation'

'The number of researchers in business environment is declining, and large companies with subsidiaries in Romania are reluctant to develop local research centres and to include specific activities as research and development activities. Intra-and inter-sectoral mobility is limited, having an unintended impact on the circulation of technical knowledge and innovation. Private sector access to public research infrastructures is difficult, services are limited and, consequently, the degree of use of these facilities is low. The country's R&D sector is therefore under-sized due to low funding and low demand for research and development (research is not stimulated sufficiently and does not sufficiently stimulate other economic sectors). The R&D sector proves to be poorly connected, both with the business community and with the general public'

'Slow progress to get result'.

To summarise, the qualitative data shows how the lack of efficient government support, combined with tax burden and lack of information, are identified as the main obstacles to claiming R&D tax incentives. In addition, according to the participants, SMEs often view R&D investment as a drag on profit and it can be very hard to measure the long-term impact of R&D investment. The questionnaire investigated the suggestions and expectations that participants have to improve future R&D tax incentives and innovation policy in their respective countries. With regards to this topic, three main themes have emerged; expectations in terms of increased investment by SMEs and expansion of the R&D tax incentives schemes; expectations in terms of simplifying the administrative procedures; and expectations in terms of clarification of the definition of innovation and coverage of more sectors, such as the creative sector. Participants declared:

'My expectations are to maintain the R&D tax incentives and to increase the founds granted for research and transfer the research results to private environment for economic growth; the increase of governmental support for private investments in R&D and Innovation'

'I expect to see a continued investment in R&D both for companies and government agencies'

There is an emphasis and hope that more governmental support will provide a benefit compared to a damage for innovative SMEs, highlighted through the iteration of 'increase'. Furthermore, this provides a reliance on the government scheme for funding.

[…] We need more clarification on the definition of innovation and more financial help from the government'

'Look to encourage more investments in rural areas'

'The government will be proved more clarify in term of document and what they consider innovations'

'I hope that it really starts to talk about development, making the bureaucratic procedures more transparent and simpler'

'Simplified administrative procedures'

Some participants believe that the scheme is complicated and rigid and needs to be eased for those utilising the scheme. Clarification here, suggests a lack of trust in the guidelines set. Also, the definition of innovation, like argued in the literature review, is ambiguous. From the literature then, this vagueness has transpired to the implementation of the policy.

This is reinstated in this participant's view on the expectations for the scheme:

'Clarify concept of R&D and extent the concept, which will expand the investments, tax incentives not only in corporate income tax but in personal income tax for researcher'

The participants suggest that the scheme should benefit not only companies but lone researchers in general. Suggesting, that the scheme has potential to benefit anyone who believes in pushing the boundaries of research and development. This is echoed again in the following statements:

'Nesta has to argue that R&D tax relief should be extant to the other sectors, in particular, to encompass the creativity industries. We also believe that additional incentives may be needed in order to encourage corporate R&D'.

'Include arts activities as a sector able to make claims; Speed up the application and approval process, increase the enhancement percentage'

The second participant believes that art activities should also be catered for the scheme, highlighting the sense that certain sectors are underfunded compared to other more conventional R&D sectors such as Engineering.

The Intertwining between R&D Tax relief & Incentives and SME innovation

2.5 Study on the Impact of R&D Tax Incentives on SME innovation

The aim of the research at this stage (WP3.3) is to gather primary data on the implementation and impact of R&D tax incentives on SME innovation, in order to provide information and guidance about innovative SMEs and to identify key lessons to influence future programmes. Prior to presenting WP 3.3, it is essential to define what is considered innovation. As already mentioned in the previous paragraphs, economics has used several measures of innovative activity in the past, which generally fall in two categories:

- Those that measure inputs of innovation activity (e.g. R&D expenditure).
- Those that measure the outputs of innovative activity (e.g. new products or services).

Another important distinction is the difference between innovation and invention. According to Schumpeter (1926), an invention is an idea or model for a new or improved product, process or technology. Innovation is a new product, process or technology which is commercially successful in the market. Therefore, commercial success is a

necessary condition for an invention to be considered an innovation. Cozijnsen and Vrakking (1992), argue a broader definition; an innovation is a development and successful implementation of a new or improved product, service, work process or market condition, aiming to gain a competitive advantage. In the aftermath of the fiscal crisis, R&D tax credits and incentives have become more generous in many European countries. Many governments have started to use tax incentives to stimulate private expenditures on research, development and encouraging long-run economic growth and helping SMEs and start-ups to invest in research and development. The popularity of the R&D tax incentives was followed by a wave in the number of descriptive studies that have shown a strong correlation between R&D tax incentives and increased R&D spending in the private sector (Guaceri & Liu, 2015).

The effect of R&D tax relief on Innovation has been uncovered by certain empirical work. Firm innovation is based on the firm's inclination to engage in R&D paired with government systems that help incubate innovation (d'Andria, Pontikakis & Skonieczna, 2018). Traditionally R&D projects are undertaken by larger companies as they require financial support to yield a high return. With this, SME innovation can be squashed or usurped by larger companies (Godin, 2002). However, there is some excellent literature surrounding the impact of R&D tax incentives, including subsidies, on innovation. For instance, Bellucci, Pennacchio and Zazzaro (2019) sought to understand the effectiveness of two regional programmes in the Marche region in Italy that were designed to facilitate innovation in SMEs through direct government financial support. One subsidy targeted SME investment in individual research projects, whilst the other subsidy focused on collaborative research projects between SMEs and educational institutes. The research revealed that both programmes had a positive impact on firms' R&D activities; however, the individual firms had an increase in profitability and patent applications over similar non-subsidized firms. The study highlights how the governmental intervention is allowing these firms to become more innovative by providing them some financial backing for riskier projects.

Likewise, Cowling (2016) conducted a cross-sectional survey on 5,723 UK SMEs that comprised of retrospective questionnaires to assess whether the R&D tax relief scheme benefitted innovation. It was found that there was no significant effect of the scheme on innovation. However, there was a small impact of the scheme on process

innovation. Another factor to consider is the sector in which R&D tax receiving SMEs belong. Castellacci and Lie (2015) argue that sectors play a role in R&D tax credits than previously concluded from micro-econometrics studies. They suggest that previous micro-econometric studies have been fixated on sub-samples of high-tech industries and therefore have underestimated the effect of R&D tax credits. Incongruently, some work has argued that R&D tax relief alongside other forms of incentives provides SMEs greater aid in innovation. For instance, Busom, Corchuelo and Martínez-Ros (2014) research found that financiering constraints were negatively associated with the use of tax of credits; however, there was a positive correlation between tax credits and the likelihood of receiving a subsidy. The research also found that tax credits were not helpful for firms that were experiencing market failures. Most importantly, they argued that subsidies, compared to R&D tax credits allowed young knowledge-based firms to initiate R&D.

This line of thought was further supported by Bérubé and Mohnen (2009) who conducted non-parametric matching estimator analyses on 2,785 manufacturing Canadian companies in total. They found that both R&D tax credits and R&D grants were more effective than just utilising the R&D tax credits as those plants introduced more world-first innovations and commercialised their innovations more successfully. At the European level, one of the most recent surveys for the innovation is the Community Innovation Survey (CIS). The Community Innovation Survey was born in 1992, when the European Commission, in a joint action with Eurostat implemented it. These survey-based innovation statistics are part of the EU member science and technology statistics. The CIS survey, whose completion is voluntary among the Member States, is designed to provide information on the innovativeness of sectors by the type of enterprises. The survey is carried out every two years and is focused on different types of innovation, objectives, source information and public funding. In summary, the survey provides statistics broken down by countries, types of Innovator, economic activities and size classes. More deeply, the study explores expenditure on activities related to: Innovation of new products such as training, design and market exploration; outputs of incrementally and radically changed products; sources of information relevant to innovation; technological

collaboration; perceptions of obstacles to innovation; and factors promoting innovation such as government grants, incentives and R&D tax credits.

2.6 Steps of the Research and Questionnaire

The first step of the research was to design an exploratory survey[10] aimed at SMEs in ten selected countries. In order to be consistent with the previous work packages, the study was administered in the same states of the WP 3.1 and 3.2, according to their different position on the European Scoreboard 2017. Building on the CIS survey, the questionnaire has investigated on the output and input of innovation of Innovative SMEs. Although our questionnaire was designed using the CIS structure, what that makes a big difference is a session in which we investigated the awareness and use of SMEs about the R&D tax incentives opportunities in the selected countries. One of our principles is that a survey to measure the innovation must be universally applicable. Therefore, our measurement scale questionnaire does not contain any question items that are sector related.

The questionnaire was divided into the following sections:

- General Company information
- General financial information
- R&D investment and tax incentives
- Awareness of R&D tax schemes
- Output of Innovation

In the first section, we asked the participants to summarize basic information about their organisations, which included the year of incorporation, headquarter, size and sector of the company.

[10] An online survey was created using Survey-Monkey. A Survey-Monkey account was created to host versions of the survey (please, see the appendix II for survey). Participants would require an internet connection and an online link to access the survey. Participants were presented with a detailed Information Sheet (Appendix III) prior to signing a Consent Form (Appendix III). Obtaining Informed Consent was a prerequisite for conducting the research. Once consent was attained, participants were able to progress onto the research study. Participants who did not agree to any of the consent questions were not able to complete the study, as our ethics would have been compromised. There was no penalty for potential participants who did not wish to join this research. Those participants who did partake had the right to withdraw at any given time. All data received was kept with the upmost confidentiality. All data collected was anonymised.

The sector variable has been selected according to the statistical classification of the economic activities in the European Community (NACE), which covers the managerial, strategic and organisational functions of head offices in addition to management consultancy activities. The size respects the European Commission's definition for 1which a micro is a company with <10 employees, small with <50 and medium with <250. In addition, the business life cycle is the progression of a business and its phases over time and is most commonly divided into four stages: Launch, growth, maturing, expanding and decline. For this study, we only focused on the first 4 stages. In addition, we have asked our participants whether they received or not received R&D tax incentives to carry out their research and development activities. This variable could be considered a control variable as it can influence other variables such as the level of R&D expenditures and the turnover.

The second section aimed to gather primary data on financial information about the level of turnover in the last three year (2015-2017), investment in R&D and the amounts of their R&D expenditures, which is considered the input of innovation, and if they received or not received R&D tax incentives. The variables turnover and R&D expenditures respect the Commission Regulation (EC) No 2700/98 concerning the definitions of characteristics for structural business statistics. In addition, questions regarding the level of education of employees and how they became aware of the R&D incentives opportunity were asked. In the last section, according to Cozijnsen and Vrakking definition, our questionnaire investigated the output of innovation such as the introduction in the SME of a new standalone product/service; a new complementary product/service that improves the experience of previous product/service; an enhanced version of an existing product/service; an improved methods of manufacturing or producing goods and services; a patent. Answers regarding the commercialisation of the innovation and the profit following the commercialisation were also collected. Table 5 below summarises the full list of 21 indicators selected to measure the impact of R&D tax incentives on innovative SMEs.

Table 5. List of variables collected and analysed

General information	• Sector • Location • Age • Size • Life-cycle business • Received an R&D tax credit
Financial Information	• Turnover[11] • R&D expenditures[12] • Investment in R&D • Acquirement of equipment/software • Received an R&D tax credit
Input of innovation	• Number of employees • Number of highly qualified personnel • Training regularity
Awareness of R&D	• Awareness of R&D funding • Motivation for applying
Output of innovation	• New standalone product/service • New complementary product/service that improves the experience of previous product/service • An enhanced version of an existing product/service • Improved methods of manufacturing or producing goods and services • Patent • The commercialisation of all the last elements

A pilot study and sampling method

A draft survey was pilot tested on Innovative SMEs at the end of August 2018, in order to improve the final version of the questionnaire. The pilot survey was created using Focus Vision Decipher[13]. The sampling method, for the pilot study, was the stratified random sample from the ORBIS[14] database. This method was selected as the study involves a large population (Innovative SMEs in Europe), and it has given us the possibility to divide it into a smaller group, that usually don not overlap but represent the entire population together. The sample was stratified

[11] Most participants skipped all the questions regarding the turnover, R&D expenditures and level of investment; therefore, these variables have not been considered for statistical analysis.

12 R&D expenditures, investment in R&D and acquirement of equipment/software could be considered as input of innovation.

[13] Focus Vision Decipher is a professional survey and reporting solution platform. The access to this tool was provided by Inventya, Ltd which is our partners in this project.

[14] ORBIS Database contain firm level data for the most major economies. The access to this database was provided by LSE, which is a partner in this project.

by country, innovative sectors and size. The pilot study was run for three months. The selected participants were invited via email; regular reminder was also sent every week. After three months, we collected only twenty responses in the face of 10,000 emails posted. Due to the low response rate (0.002%) a new questionnaire was released at the end of January 2019 using the Survey Monkey platform, in addition, the questionnaire was simplified through reducing the number of questions. The platform gave us the possibility to reach participants through their audience[15]. The participants have been recruited using the following segmentation profiled by countries, company size, occupation and primary role in your organization. Occupation and primary role in the organization were selected to reach key people who make a decision in the Innovative SMEs.

Table 6. Segment and sub-segment profiles

Company size	• From 0 to 250 employees
Occupation	• Part-time work • Full-time work • Own Business
Primary role in the organisation	• Director, Owner or Partner • President/CEO/Chairperson • Chief Financial Officer (CFO) • Middle Management, Senior Management • Technical Staff, Chief Technical Officer (CTO) • Product Manager
Country	• Denmark • France • Greece • Ireland • Italy • Lithuania • Netherlands • Romania • Spain • United Kingdom

The questionnaire was sent in two rounds. As previously mentioned, we focused on the 10 selected countries in accordance with the previous work packages. In order to have a homogeneous sample, we set for each country fifty responses. In the second round, we decided to focus only on four countries among the ten selected.

[15] Survey Monkey Audience platform automatically calculates feasibility and estimated completion date based on: Number of respondents requested; The length of survey measured in minutes or number of questions; Typical demographics being sought (e.g. age, gender, regions); Balancing requirements (e.g. age and gender census balancing); Any non-demographic targeting or behavioural criteria necessary to qualify; The incidence or qualifying rate of the target population (if applicable); Selecting High Priority Status.

Considering the difficulties to gather primary data, the decision to focus only on four countries was made in order to maximise the number of responses which allow us to have a better understanding of how R&D tax relief works. The selection of the four countries was made capturing in a trustworthily and efficient way the geographical diversity of Europe and the rank made by the Innovation Scoreboard. In fact, we chose the UK among the leading countries in innovation, France among strong innovators, Spain among moderate innovators and Romania among modest innovators. In addition, countries from northern, central, southern and east Europe have been included in order to represent the geographical and cultural diversity of the European Union. For the four countries, we set for one hundred responses that in addition to the first round, totalled one hundred and fifty answers per country

2.7 Descriptive Statistics

Eight- hundred and nineteen valid questionnaires were collected. All the data collected were cleaned, and results were omitted based on whether they were inappropriate answers, and those whose company's HQ's were not based in our selected countries.

General information on SMSs

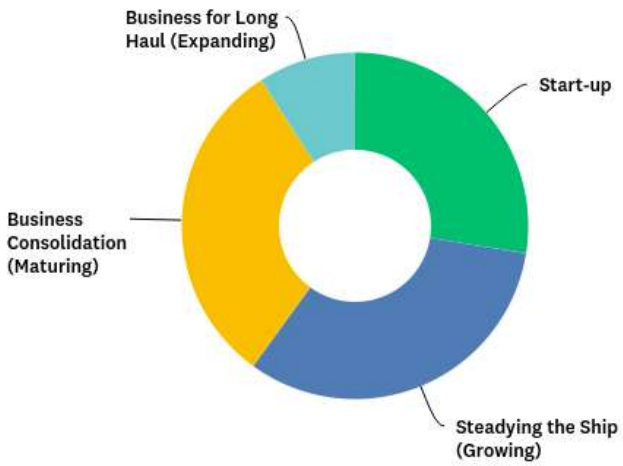
Regarding the age, most of the companies involved in our research are placed in the 0-5 years range (31 per cent) followed by 6-10 range (17 per cent) and 16-20 years range (13 per cent). Table 7 shows the absolute frequency and percentage of the companies grouped by age.

Table 7. Companies grouped by age

Range years	Absolute frequency	%
0-5	255	31
6-10	142	17
11-15	101	12
16-20	108	13
21-25	49	6
26-30	34	4
31-35	16	2
36-40	21	3
41-45	12	1
46-50	15	2
51-55	8	1
56-60	2	0
61-65	4	0
66-70	2	0
70+	50	6
TOT.	819	100

We found that 56.8 per cent of our participants have employees holding a postgraduate education, such as a master's degree or PhD. The 31.9 per cent have an undergraduate education, and 11.4 per cent do not have a university education. The high level of education of employees is not a surprise as innovative companies require high human capital, creative and innovative thinking. In relation to the size, data shows that the majority were micro-companies 41.5 per cent, 31.3 per cent small and 27.2 per cent were medium.

Figure 2. The business cycle of the companies

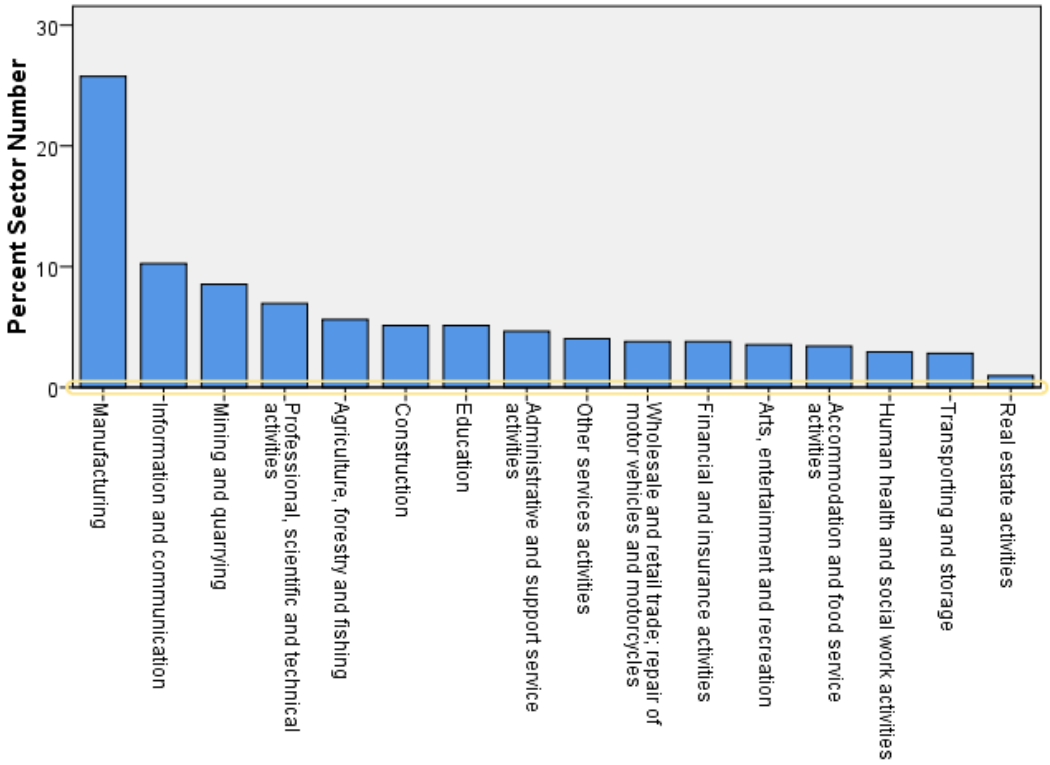


Regarding the business cycle, as seen above with the age of the companies, most of the companies identified themselves as growing, followed by a maturing business and start-up - please see figure 2-.

It is interesting to compare that 64.41 per cent of companies had a male CEO, compared to 34.7 per cent companies that had a female CEO. This result is in line with other research; in fact, women still are fewer than 5 per cent of a chief executive position in the US, UK and Europe. Women's low representation in leadership roles has attracted growing attention from policymakers, with some countries setting targets to increase their share of female directors (Heidrick & Struggles, 2019).

From our data, the most common sector that completed our survey was Manufacturing (25.8 per cent), followed by Information and Communication (10.3 per cent), then Mining and Quarrying (8.5 per cent) and professional Scientific and Technical Activities (7 per cent). Figure 3 below shows the percentage of the main sectors which represented SME participants in our research.

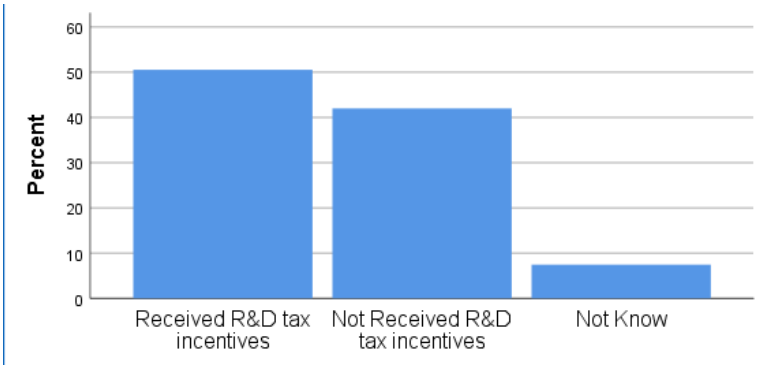
Figure 3. Sectors of the companies



R&D investment and tax incentives and awareness of R&D tax schemes

50.5 per cent of the companies in our sample have received R&D tax relief during the years 2015-2017, and the 42 per cent have not received any incentives. However, 7.4 per cent were unsure whether they had received the benefit - please see figure 4 below-.

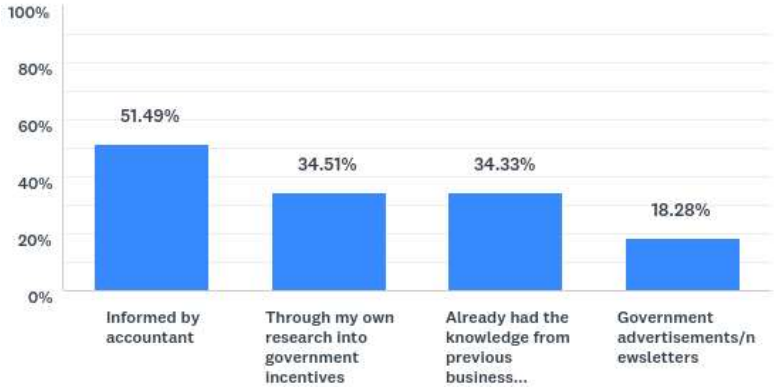
Figure 4. Companies who received or not received R&D tax incentives



From those who did receive the governmental incentive, the type of incentive received was mixed whereby 51.95 per cent were provided deductions in assets used for R&D, such as machinery, equipment, building and intangibles, used to minimize taxable income. 39.54 per cent received tax credits that allowed firms to directly deduct a specific share of their R&D expenses from the corporate tax liabilities. 21.61 per cent were given special exemptions of wage and/or social taxes for employees in R&D activities alongside 17 per cent who were able to save on corporation tax by carrying forward/backwards losses. A smaller number of companies received Patent Boxes (7.59 per cent) whilst 12.41 per cent were unsure of the type of incentive they received.

From those companies who did not receive R&D tax relief and incentives : 28.82 per cent believed that there was a complicated process, 23.87 per cent not enough time, 17.42 per cent guidelines were not clear, 22.80 per cent unsure what it was about, 20 per cent argued that the incentives did not cover the firm's R&D activities, 15.48 per cent R&D did not qualify, 9.89 per cent believed that R&D consultants were too expensive. Figure 5[16] below, shows that 51.49 per cent of our participants became aware of the R&D tax incentives through accountants, followed by their own research and knowledge from previous business ventures. Only 18 per cent of our participants were informed by government advertisement or government newsletters.

Figure 5. Awareness of R&D tax incentives



It is noteworthy to mention the level of satisfaction companies have with governmental support with R&D funding. Reviews are mixed, with 12.78 per cent of companies Very Dissatisfied, 19.89 per cent Somewhat Dissatisfied, 27.77 per cent Neither Satisfied Not Dissatisfied, 26.83 per cent Somewhat Satisfied, and finally 12.76 per cent Very Satisfied.

Output of Innovation

Regarding the output of Innovation 18.48 per cent of our participants developed a new standalone product/service followed by 25 per cent who established a new complementary product and service that improves the experience of the previous one. Most of our participants developed an enhanced version of an existing product/service. Only 10 per cent have created a patent; this result is in line with the general literature review which shows how the large companies account for the lion's share of patent applications (Blind et al. 2006; Frietsch 2007; Frietsch/Jung 2009; Hingley/Bas 2009; Mogee 2005).

[16] Figure 5 shows result of a 'tick all that apply' question, this is the reason why the final sum is not 100.

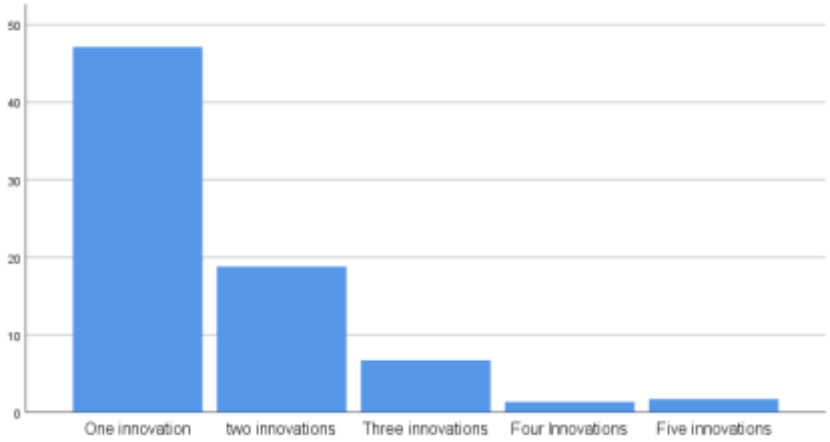
Table 8. Companies grouped by type of Innovation

Type of innovation	Absolute frequencies	%
New standalone product/service	179	18.47
New complementary product/service	243	25.08
The enhanced version of an existing product/service	287	29.62
Improved methods of manufacturing	161	16.62
Patent	99	10.22
TOT.	969	100

Moreover, figure 6 shows the percentage of companies who developed one, two or more innovations as a result of their R&D process. Results show that most companies created only one type of innovation. As indicated above, the innovations include:

- New standalone product/service
- New complementary product/service that improves the experience of previous product/service
- An enhanced version of an existing product/service
- Improved methods of manufacturing or producing goods and services
- Patent

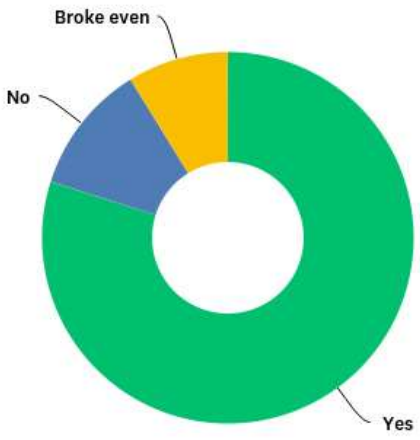
Figure 6. Number of innovations developed by companies



Among the companies who developed and improved product/services or created a patent, the 60.71 per cent produced their innovation in house, 31.46 outsourced which means that goods or services have been obtained by contract from an outside supplier. 19.50 per cent produced their innovation through collaboration with another company (e.g. Joint venture) only the 13.88 per cent through a partnership with a higher education or government institution (e.g. spin-off, university). The rest, 5 per cent were unsure.

The commercialisation of the innovation took place for 54 per cent of companies, 33 per cent did not commercialise their innovation, and 13 per cent have partly commercialised. As shown in figure 7, 9,8 per cent of the companies who developed and improved product/services or improved method of manufacturing declared

Figure 7. Profit following the innovations



that have made a profit after the commercialisation of innovation. A small part of them, respectively 12 per cent and 9 per cent, have reported that the company did not make any profit or broke even after the commercialisation of the innovation. Completely different results have been found for patents; in fact, as already mentioned above, only a few small and medium enterprises have the financial capacity to attain. In our sample, only 34 per cent of companies have obtained an inventor certificate or patent between 2015-2017.

2.8 Empirical Hypothesis and Results

Several studies have formally examined the effectiveness of R&D tax incentives or direct support measures made by the Government. Investment in R&D is an essential indicator of the innovation performance of a country (Bérubé & Mohen,2009). In many situations, without government intervention, the business sector would not invest in research and development. Financial constraints such as lack of private fund, informal asymmetries such non-awareness of R&D tax incentives opportunities and positive R&D spill-over are market failures that can lead the SMEs to under-invest in R&D. In Europe, most countries have decided to correct these market failures by supporting SMEs via R&D tax incentives. Before presenting the inferential results, it is necessary to explain underlying assumptions. Let us assume a society with m-SMEs, where each eligible SME has the possibility to apply for R&D tax incentives; a generic support from Government to the SMEs who invest in research and development[17]. The "R&D tax incentives" is a categorical variable split according to the "Yes, I received R&D tax incentives" which takes value 1; "No, I don't receive R&D tax incentives" which makes value 2. The final innovation is a scale variable which counts the total number of innovations implemented by SMEs. The final innovation includes:

[17] There has been not distinction made between the SMEs who received a deduction in asset or tax credit that allows firms to deduct a specific share of their R&D expense directly, or special exemption on wage or social taxes for employees, corporation tax saving or patent box. We have grouped SMEs which have received any of the R&D incentives listed above.

- New standalone product/service
- New complementary product/service that improves the experience of previous product/service
- An enhanced version of an existing product/service
- Improved methods of manufacturing or producing goods and services
- Patent

The empirical hypothesis tested is the following:

The hypothesis tested: *Examine whether differences exist between SMEs who have received R&D tax incentives and SMEs who have not received R&D tax incentives in terms of final innovation.*

The final innovation was not normally distributed for both "I received R&D tax credit and "I don't receive R&D tax credit", as demonstrated by Shapiro-Wail's test ($p<.05$) and Kolmogorov-Smirnov's test ($p<.05$). Therefore, a non-parametric test (Mann-Whitney U test) was conducted to determinate whether differences exist between SMEs who have received R&D tax incentives and SMEs who have not received R&D tax incentives in term of final innovation. The difference in the two groups is statistically significant with *U=44577, Z=-9.506 and, p=.00*, please see table 9. These results supported our hypothesis tested, we can conclude that according to our empirical study, SMEs who have received R&D incentives seem to be more involved in innovation.

Table 9. Mann-Whitney test, Ranks

Ranks

	Received/not received	N	Mean Rank	Sum of Ranks
Final Innovation	Received R&D tax incentives	414	443.83	183744.00
	Not Received R&D tax incentives	344	302.08	103917.00
	Total	758		

The Ranks table is the first table that provides information regarding the output of the actual Mann-Whitney U test. It shows mean rank and sum of ranks for the two groups tested (Received R&D tax incentives and Not Received R&D tax incentives). The table 9 above is very useful because it indicates which group can be considered as having the higher Innovation concentrations, overall; namely, the group with the highest mean rank. In this case, the first group had the highest Innovation concentrations.

Table 10. Mann-Whitney Test Statistics grouping by variables received/not_ received R&D tax incentives

Test Statistics[a]

	Final Innovation
Mann-Whitney U	44577.000
Wilcoxon W	103917.000
Z	-9.506
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Received/not received

Moreover, the crosstabulation Table 11 below shows the number of innovations implemented by SMEs grouped by who received and not received R&D tax incentives. Data show that companies who received R&D tax incentives are more involved in R&D activities investing more in the creation of new products/services or improved and enhanced versions of them.

Table 11. Innovation grouped by SMEs who have received R&D tax incentives and not received R&D tax incentives

		Final Innovation						
		No innovations	One innovation	Two innovations	Three innovations	Four Innovations	Five innovations	Total
Received/not received	Received R&D tax incentives	46	208	104	40	6	10	414
	Not Received R&D tax incentives	135	153	39	11	3	3	344
	Not Know	18	25	11	4	2	1	61
Total		199	386	154	55	11	14	819

3.Conclusions

3.1 Conclusion and Policy Recommendations

The Watson project aimed to evaluate the impact of R&D tax incentives on SME-led innovation in Europe and to explore the perceptions and expectations for the future of R&D polices. In order to do so, two empirical studies have been carried out, providing better insight into R&D tax incentives in Europe. An exploratory questionnaire was designed to gather primary qualitative data through an open-ended survey. The survey was aimed at government agencies, interested stakeholders such as consultants/accountants, university and research centres, and SMEs representative organisations in order to gain knowledge on issues and barriers to innovation and stakeholder aspiration for the future of R&D tax incentives in ten selected European countries. Using a snowball sample, 30 valid questionnaires were collected.

Key findings- Qualitative

Governmental Funding

Governmental funding emerged as a prominent issue for stakeholders, specifically the *lack* of funding available for innovative SMEs. This was emphasised with nearly all participants who agreed that governments need to fund innovation; creating an expectation for R&D funding. This was matched in feeling by the lack of private funding too, highlighting that innovative SMEs are underwhelmed with the options available for their technically-challenging endeavours. With the lack of funding, SMEs struggle to carry out R&D, with its risk of working and being a '*question-mark product*' that may or may not reap a financial return. Moreover, as the literature suggests, creating innovative products and processes require heavy investment and time, something that little SMEs harbour, or can access. R&D truly does constrain SMEs' finance's, especially if relief is given in retrospect. As it is costly to carry out R&D, a trade-off needs to be executed, where only larger companies have the capacity to float. Grants are considered niche with their requirements, not practical relief that is for the 'many'. Governments have the power to enhance the R&D funds, and the relief currently given. A higher percentage of relief will allow the SMEs to be motivated and carry out R&D. It is beneficial that both profit-making and loss-making companies can use this scheme. However, money has to be spent before any relief is given as opposed to specific grants. Budget cuts are lessening the chance of innovative culture, and this overall remains a point of contention.

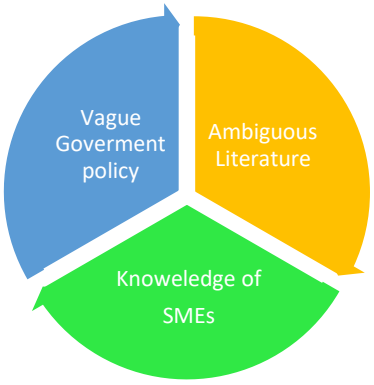
The quality of funding is another layer of R&D tax relief. Although enhancement and tax credit rates could become high, the support surrounding the funding and its availability to aid SMEs in R&D are debatable. SMEs require networking and forming connections alongside the financial relief, so it would be helpful to build a bridge between industries and universities through networking and creating relationships on top of the help already provided. This could also facilitate innovation. Although all stakeholders argued that they were familiar with R&D tax relief, they proclaim that there is a lack of awareness from SMEs regarding what R&D tax relief entails. Therefore, an emptiness exists between the information the government wants stakeholders to use and work with and what is actually being retained by SMEs needing the service. To summarise our qualitative survey has brought forward the fact that many SMEs are not sufficiently aware of the benefits they can get from tax incentives.

Policy as a Cycle

The definition of innovation is ambiguous as told through the literature review but also through our own data, whereby it is understanding is contentious and confusing across SMEs, nationally and on a European level. As the definition of innovation is vague, it translates to the SME R&D scheme, whereby governments have to create

a scheme that provides the base for SMEs. This confusion is fed into how the scheme is then used by SMEs. The SMEs then do not understand whether their innovation is classified as innovative, causing a cyclical effect

Figure 8.Depicting the cyclical and intersectional impact of the R&D policy



The Claiming Process

The bureaucracy of the R&D tax relief scheme prevents innovative SMEs who could qualify from applying to the scheme across Europe; this includes the quality personnel assisting the claim, followed by the process of applying for the relief. Quality of personnel aiding the scheme plays a paramount role in companies applying for incentives. How these interactions are played can determine how companies navigate themselves in the future with their R&D. With this, the information currently provided across Europe needs to de-bunk the jargon that accompanies the useful, solid guides that already exist. Although some guides currently exist in specific countries which outline the relief, we struggled to find legitimate and synthesised 'how-to' documents provided by the states. This makes it very hard for stakeholders to understand the scheme, and point known to SMEs towards the correct, coherent and SME friendly information. Therefore, governments could do better by providing how-to guides without using technical and financial jargon on how to complete an R&D tax relief claim effectively. They can point this information to SMEs themselves, or accountants or SME representatives.

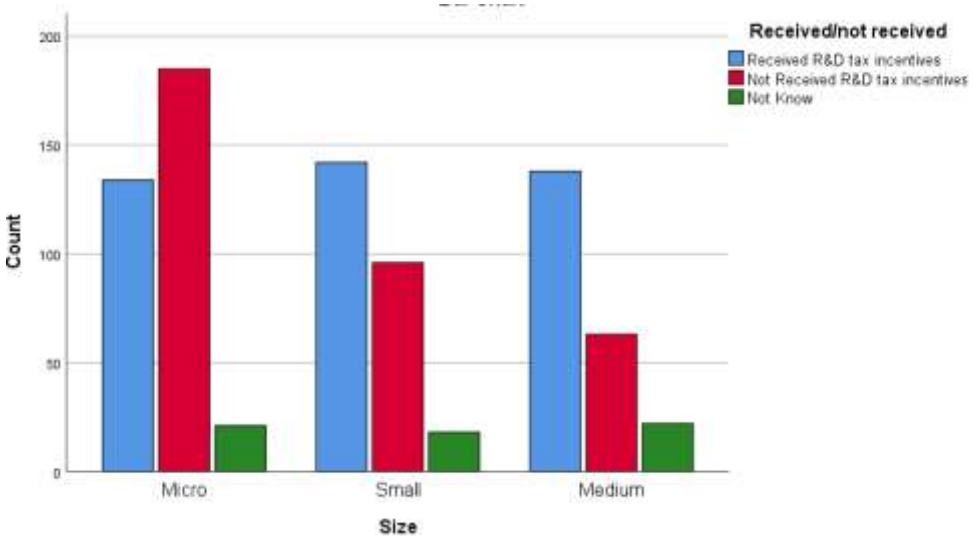
Key findings- Quantitative

Consistent with these findings, a second empirical study has been carried out in order to investigate the impact of R&D tax incentives on SMEs-led innovation. The survey was aimed at innovative SMEs. In order to be consistent with the first empirical study, the research was administered in the same states, according to their different position on the European Scoreboard 2018. Building on the CIS survey, the questionnaire has investigated on the awareness and use of the R&D tax incentives, and on the output and input of innovation of Innovative SMEs.

Using a segmentation profiled by countries, company size, occupation and primary role in the company, eight hundred and nineteen valid questionnaires were collected.

In our sample, most of the participant were young companies with highly educated employees. This result is in line with the current literature that shows how Young Innovative Company's (YIC) are small and highly insensitively engaged in innovation activities. In fact, young companies are more inclined to exploit a newly concept and to be more productive (Czarnitzki & Delanote, 2013). In addition, the high level of education of employees is not a surprise as innovative companies require high human capital, creative and innovative thinking. From our data, the most common sector that completed our survey was Manufacturing (25.8 per cent), followed by Information and Communication (10.3 per cent), then Mining and Quarrying (8.5 per cent) and professional Scientific and Technical Activities (7 per cent). Regarding R&D incentives awareness, only 18 per cent of our participants were informed by governments advertisement or government newsletters. This result is particularly interesting has shown how Governments do not invest in promoting R&D incentives opportunities, losing a driver for economic growth.
During the years 2015-2017, 50.5 per cent of SMEs in our sample, declared that they had received R&D tax relief. If we fragment the data, we can see that Micro enterprises compared to Small and Medium have benefited less on R&D tax incentives. Specifically, 3.8 per cent of Micro companies did not receive R&D tax incentives compared to 28 per cent of Small and the 18 per cent of Medium enterprises, please see figure 9 below.

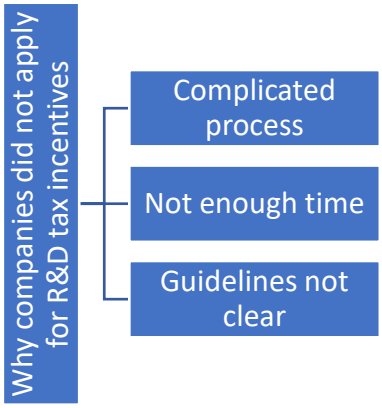
Figure 9. Companies who received and did not receive R&D tax incentives grouped by size



From those companies who did not receive R&D tax relief and incentives, 28.82 per cent believed that there was a complicated process, 23.87 per cent not enough time, 17.42 per cent guidelines were not clear, 22.80 per cent unsure what it was about, 20 per cent argued that the incentives did not cover the firm's R&D activities, 15.48 per cent R&D did not qualify, and 9.89 per cent believed that R&D consultants were too expensive. In addition,

62 per cent of participants declared that they would carry out R&D activities even if they did not receive incentives.

Figure 10. Reasons why companies did not apply for R&D tax incentives



Most European countries start to support SMEs in their political agenda in order to lead SMEs to invest in innovation. As emerged from the qualitative study (WP. 3.2), financial constraints such as lack of private fund, informal asymmetries such non-awareness of R&D tax incentives opportunities and positive R&D spill-over are market failures that can lead the SMEs to under-invest in R&D. In Europe, most countries have decided to correct these market failures by supporting SMEs via R&D tax incentives. Although several studies have examined the effect of these policies, measure the effectiveness of R&D tax incentives on innovation is not an easy job. A fundamental issue when trying to evaluate the R&D tax incentives is the absence of a directly observable counterfactual since the implementation of an experiment would imply that only some randomly selected firms receive the tax credit. In order to circumvent this limitation, the researcher relies on various methods[18]; one of these is the use of the survey used in this study. According to Ientile and Mariesse (2009), the surveys can construct a contractual by asking the beneficiary firm directly "What if you did not benefit from tax incentives?", and vice versa. Considering this, the central hypothesis tested in study WP. 3.3, was to examine whether differences exist between companies who have received R&D tax incentives and who do not receive it in term of final innovation implemented by companies. After running non-parametric test of SMEs who have received R&D tax incentives and SMEs who did not receive them in term of final innovation, the result confirms that there is a statistical difference between the two groups of companies, in respect to final innovation. To summarise, companies who have received R&D tax

[18] Other methods: Quasi natural experiment which compare R&D expenditures or growth rates of similar firms (preferably the same firms) before and after the introduction of the tax credit. Dummy variables regression which basically rely on the comparison between the firms that receive the tax credit and the firms that do not. The dummy-variable approach is the simpler one, consisting of econometric regressions of a dependent variable such as R&D expenditures, R&D growth rates or intensity ratios on 0/1- variables indicating whether or not firms have benefited from the R&D tax credit and on a set of other relevant explanatory and control variables.

incentives in our sample have developed more innovative products/service or an improved version of the previous one compare to companies who did not receive the incentives. Although we found a positive correlation between innovation and benefitting from tax incentives, we have not established the direction of causality. It could be that innovation is spurred by tax incentives, but it could also be that firms that innovate spend more on R&D and are therefore more inclined to apply for tax incentives.

3.2 Limitation of the survey and analysis

The survey-based approach relies on the straightforward idea that firms themselves know best what their R&D expenditures would have been in the absence of the tax credit. The first limitation of the survey approach is the small sample size due to the high cost of implementation; this means that studies which use of surveys may not have a representative sample. The second weakness is limited reliability of the answers. Participants may ignore the answers or give incorrect ones because of the intrinsic difficulty to assess the relative weight of all other factors that motivate their R&D decisions. They may also bias the answers for marketing and strategic reasons. Moreover, participants may exaggerate the effect strategically, anticipating that their opinion would be of some influence in future public-policy decisions. On the other hand, although, they might not be very reliable to evaluate the overall impact of the tax credit on R&D expenditures, surveys may often appear the best way to bring complementary insights on specific features of the policy. In addition, surveys can also inform policymakers by providing a better understanding and detailed feedback on companies concerns. In order to measure the effects of the R&D tax incentives, the original idea was to run a dummy variables regression, which basically relies on the comparison between the firm that receives the tax credit and the firms that do not. The dummy-variable approach is the simpler one, consisting of econometric regressions of a dependent variable such as R&D expenditures, R&D growth rates, or turnover variables, indicating whether or not firms have benefited from the R&D tax credit and on a set of other relevant explanatory and control variables. As most of our participant skipped questions regarding the level of turnover and R&D expenditures, we have not been could proceed with this regression analysis.

4. Appendix

4.1 Appendix I. Descriptive Statistic Tables Qualitative Research

Q. What best describes who you are?

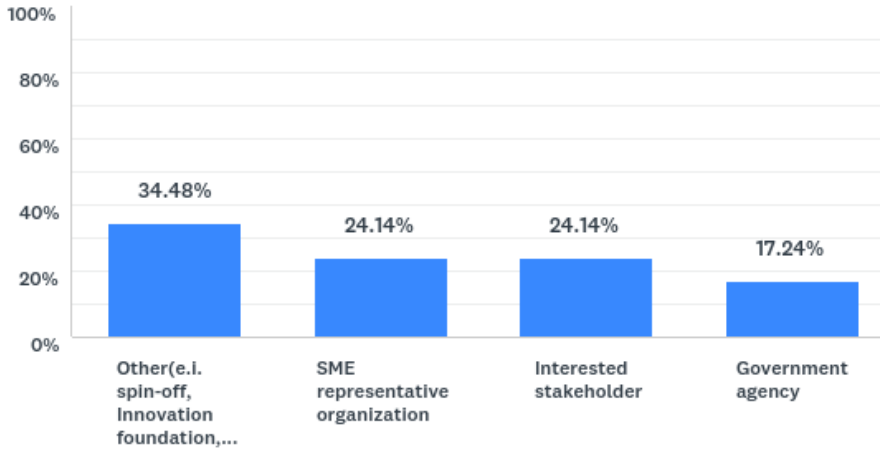


Figure 11.Percentage of participants by the organisation.

Q. Are you aware of R&D tax credits and financial incentives issued by your government?

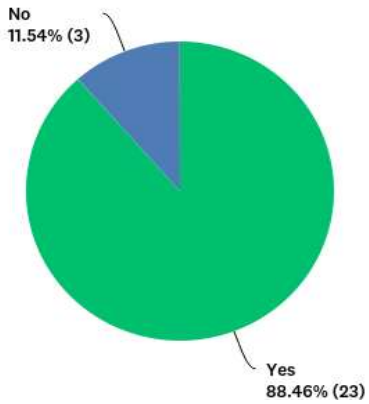


Figure 12.Percentage of participants by the organisation

Q. Does your organisation plan, or has your organisation planned to hold events aimed to raise awareness and promote SME R&D tax incentives?

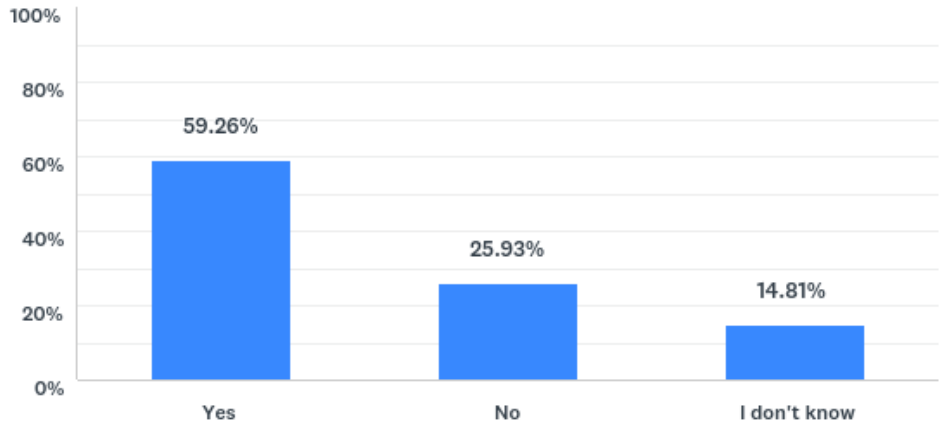


Figure 13.Percentage of participants who organize events to encourage R&D tax incentives

Q. Please identify the main barriers to the development of innovation in your country?

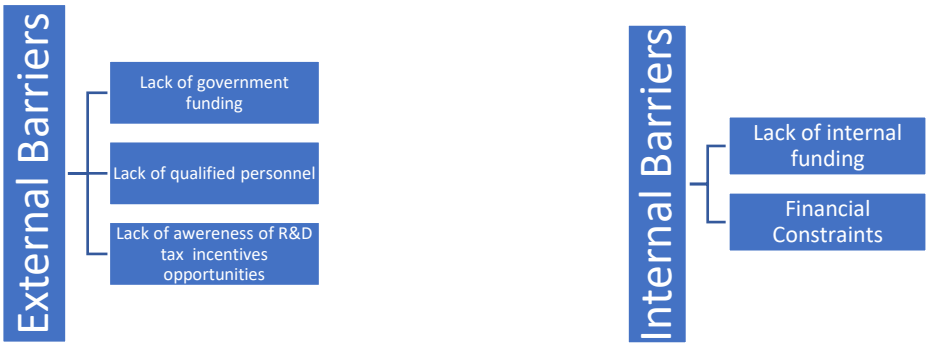


Figure 14.The main external and internal barriers identified by participants

Q. What are the weaknesses of R&D and Innovation policy in your country?

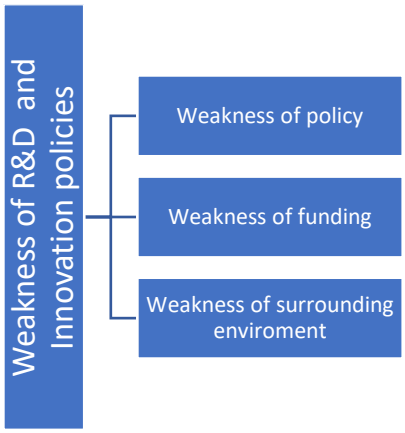


Figure 15.The main weakness of R&D and innovation policy identified by participants

Q. What are your expectations for the next years in terms of new R&D tax incentives and innovation policies?

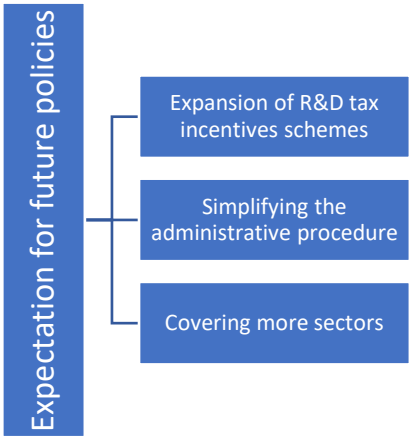


Figure 16.The expectation for improving future R&D tax incentives identified by participants

4.2 Appendix II. Survey (WP. 3.2)

You are being invited to take part in our research study examining the governance of Research and Development (R&D) Tax Incentives, from the perspective of integral stakeholders.
Before deciding to participate, it is essential for you to understand why the research is being done and what it will involve. Please take time to read the following information. Should you have any questions after reading this information, please do contact us on the details given at the end of this

1. Information Sheet

Research Project Title

From the perspectives of SME representative organisations, government agencies and interested stakeholders: The governance of Research and Development Tax Incentives in selected European countries.

Purpose of the Research

The general objective of the WATSON project is to develop and demonstrate a framework methodology for studying the impact of R&D Tax Incentives and other financial incentives on SME-led innovation in Europe. The framework and the results of this project will be integrated into an ICT platform to perform data analytics on innovation funding, identifying funding gaps and allowing the consortium partners to advise stakeholders (public governing bodies, SMEs, private investors) on the management of innovation and funding schemes. This stage of research aims to gather qualitative data through an open-ended questionnaire. Participants will be from SME representative organisations, government agencies and interested stakeholders. These organisations have key roles in providing support to accessing R&D public funding. For instance, government agencies deliver the R&D Tax Incentives schemes and the European Enterprise Network, or business federations such as the Federation of Small and Medium Business and Chambers of Commerce are the voices of SMEs in their respective member states.

Participant Selection

You are being invited to take part in this research because your experience as a SME representative organisation / government agency / interested stakeholder can contribute much to our understanding and knowledge on the effectiveness of R&D Tax Incentives
and other financial incentives on SME-led innovation in Europe.

Procedure

Your participation in this study is voluntary. If you decide to take part in this study, you will be asked to sign a consent form. After signing the consent form, you are still free to withdraw at any time and without giving a reason. Withdrawing from this study will not affect the relationship you have, if any, with the researcher. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed. If you do decide to take part, you will be able to keep a copy of this information sheet. Participants willing to take part in the research will be asked to commit: (1) to fill an online questionnaire and (2) share it with other similar organisations, if they wish. The online open-ended survey will ask questions relating to current practises and barriers in harnessing R&D Tax Incentives
and other financial incentives. There are no other commitments or lifestyle restrictions associated with participating.

Duration
Participants will be asked to complete a web-based open-ended questionnaire, which we estimate will take 20/30 minutes.

Potential Risks to Research Participants
Participating in the research is not anticipated to cause any economic disadvantages or discomfort.

Participant Selection
You are being invited to take part in this research because your experience as an SME representative organisations / government agencies / interested stakeholder can contribute much to our understanding and knowledge on the effectiveness of R&D Tax Incentives and incentives on SME-led innovation in Europe.

Potential Benefits to Research Participants
Participants will be included in a mailing list if they wish, which will keep them updated on the progress and results of the project. Whilst there are no immediate benefits for those people participating in the project, this work will have a beneficial impact on R&D Tax
Incentives and incentives in contributing to the funding of SME activities.

Confidentiality and storage of data
The data collected is confidential and will be used for analytical and statistical purposes only by the WATSON research team. The research will adhere to the "Data Protection Act 1998" and the Data Protection Directive (EC 95/46) and 2018's GDPR. The information that is collected from this research project will be anonymised and treated with utmost confidentiality. These anonymised datasets will not allow any individual or their institution to be identified or identifiable. All data stored and managed on computers will be password protected. We will use appropriate procedures and security features to process and protect your data.

Results of the Research
Results of this research will be published. Participants will not be identified in any report nor publication without prior consent. Anonymised data will be stored and archived and may be used for secondary analysis in the future.

Funding and Organization of Research
The project is in partnership with the following organisations: Kapitalise Ltd, Exodus Anonymos Etairei Pliroforikis, Imperial College of Sciences and Technology and Medicine, Inventya Ventures (EU) Limited, Universiteit Maastricht and London School of Economics.
The project is financed through the European Commission's, Horizon 2020 initiative.

Contact Details
If you would like further information or you have any questions. Please do not hesitate to contact us at research@watson-h2020.eu or paola@kapitalise.co.uk

If you would like to participate, then please continue.
If you would like to participate in our WATSON project, please complete the Consent Form. You will not be able to progress to our study if you do not agree with the terms of participating in our research. Thank You.

2. Consent Form

1. I have read and understood the information about the project, as provided in the * Information Sheet.
   - Yes
   - No

2. I have been given the opportunity to ask questions about the project and my participation.
   - Yes
   - No

3. I understand I can withdraw at any time without giving reasons and that I will not be penalised for withdrawing, nor will I be questioned on why I have withdrawn.
   - Yes
   - No

4. I understand the data collected will be stored anonymously and may be used for secondary analytical purposes in the future.
   - Yes
   - No

5. The use of the data in research, publications, sharing and archiving has been explained to me.
   - Yes
   - No

6. I have read and understood the consent I have provided to this Horizon 2020 project. I hereby enter this submission upon behalf of my organisation.
   - Yes
   - No

7. Name
MM/DD/YYYY

Date / Time

3.Basic information about your organization

In this section, we will ask you to summarise some basic information about your organisation.

9. Name of Organization

10. What best describes who you are?

- SME representative organization
- Government agency
- Interested stakeholder
- Other (please specify)

11. Where is your organization based/headquartered?

- Denmark
- France
- Greece
- Ireland
- Italy
- Lithuania
- Netherlands
- Romania
- Spain
- United Kingdom
- Other European Country (please specify)

12. In what year was your organization incorporated?

13. Please briefly describe the activities of your organization

14. What is your role/title in the organization?

4. Knowledge-based on Research and Development tax incentives

In this section, we would like to know about your knowledge of R&D tax incentives and how your organization is involved in R&D policy. If you are unsure, please write 'unsure'.

15. Are you aware of R&D tax credits and financial incentives issued by your government?
    - Yes
    - No
    - I don't know

16. Please tell us a little about the R&D tax incentive programme in your country.

17. Is your organization active in providing R&D advice?
    - Yes
    - No

- I don't know

18. Do you provide support for claiming R&D tax incentives?
    - Yes
    - No
    - I don't know

If your answer is yes, please could you tell us about the support your organization provides for its members? If your answer is no, please could do tell us why your organization does not offer assistance in claiming R&D tax incentives?

19. If any, what experience do your clients /members have with applying for R&D relief? (e.g. whether your member was happy about the outcome of an R&D Tax incentive application?)

20. Do R&D tax incentives cover all sectors of the economy in your country?
    - Yes
    - No
    - I don't know

21. Please identify the main barriers to the development of innovation in your country?

22. What do you think about the process of applying for R&D tax incentives?

23. What are your sources when searching for R&D/ Innovation policy information? Please rank them from most used to least used.

5. Stakeholder Aspiration

In this section, we would like to know what your suggestions are to improve the governance of R&D and innovation in your country.

24. What are the strengths of the R&D and Innovation policy in your country?

25. What are the weaknesses of R&D and Innovation policy in your county?

26. Could you please tell us three components which you would like to change in R&D tax incentives and innovation policy?

27. What are your expectations for the next years in terms of new R&D tax incentives and innovation policies?

28. Do you think government funding is needed in R&D and Innovation?
    - Yes
    - No

29. Why do you think government intervention is needed/not needed in R&D and Innovation?

6. Strategy Content

In this section, we would like to know the strategies pursued by your organization

30. How important is promoting Innovation and R&D to your members?

1. Not at all important
2. Slightly important
3. Important
4. Fairly important
5. Very important

31. Is promoting Innovation and R&D part of your business policy?
- Yes
- No

32. What are your strategies to involve SMEs in your organization?

33. Does your organisation plan, or has your organisation planned to hold events aimed to raise awareness and promote SME R&D tax incentives?
- Yes
- No
- I don't know

If your answer yes, could please tell us which kind of event you are planning? If your answer is no, please could you tell us why?

Final session

In this section, we would like to know if you wish to give your consent to be mentioned in the final report.

34. Please let us know if your organization wants to be mentioned in the acknowledgement page of the final report.
- Yes
- No

35. If you would like a copy of the final research report, please provide your email address:

36. Would you like to be included in our mailing list?
- Yes
- No

37. Do you have any concluding remarks?

4.3 Appendix III. Survey (WP. 3.3)

Participant Information Sheet- Quantitative

You are being invited to take part in our research study examining the effect of Research and Development (R&D) Tax Relief, on Small and Medium sized Enterprises (SMEs)' Innovation in European countries. Before deciding to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information. Should you have any questions after reading this information, please do contact us on the details given at the end of this Information Sheet.

Research Project Title

The effect of Research and Development (R&D) tax relief and incentives on Small and Medium Sized Enterprises (SMEs)' Innovation in Selected European Countries.

Purpose of the Research

The general objective of the WATSON project is to develop and demonstrate a framework methodology for studying the impact of R&D tax relief and incentives on SME-led innovation in Europe. The framework and the results of this project will be integrated into an ICT platform to perform data analytics on innovation funding, identifying funding gaps and allowing the consortium partners to advise stakeholders (public governing bodies, SMEs, private investors) on the management of innovation and funding schemes. This stage of research aims to gather quantitative data through an online survey. Participants will be from SMEs across selected European states who have or have not received R&D tax relief.

Participant Selection

You are being invited to take part in this research as we believe you are an innovative SME who can further our understanding on the impact of R&D tax relief incentives on innovation in your country.

Procedure

Your participation in this study is voluntary. If you decide to take part in this study, you will be asked to sign a consent form. After signing the consent form, you are still free to withdraw at any time and without giving a reason. Withdrawing from this study will not affect the relationship you have, if any, with the researcher. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed. If you do decide to take part, you will be able to keep a copy of this information sheet. Participants willing to take part in the research will be asked to commit: (1) to fill an online questionnaire and (2) share it with other similar organisations, if they wish. The online survey will ask questions relating to current practises and barriers in harnessing R&D tax incentives and other financial incentives. There are no other commitments or lifestyle restrictions associated with participating.

Duration

Participants will be asked to complete a web-based questionnaire which we estimate will take 20-30 minutes.

Potential Risks to Research Participants

Participating in the research is not anticipated to cause any economic disadvantages or discomfort.

Potential Benefits to Research Participants

Participants will be included in a mailing list, if they wish, which will keep them updated on the progress and results of the project, whilst also being able to have some access to the results of their data. Moreover, you will have the opportunity to be entered into a prize draw to win one of two Amazon Echo Spots, worth over €100. If you wish, you can have your organisation mentioned on our acknowledgement page in our final report. Overall, this work will have a beneficial impact on R&D tax relief and incentives in contributing to the funding of SME activities.

Confidentiality and Storage of Data

The data collected is confidential and will be used for analytical and statistical purposes only by the WATSON research team. Research will adhere to the "Data Protection Act 1998" and the Data Protection Directive (EC 95/46) and 2018's GDPR. The information that is collected from this research project will be anonymised and treated with utmost confidentiality. These anonymised datasets will not allow any individual or their institution to be identified or identifiable. All data stored and managed on computers will be password protected. We will use appropriate procedures and security features to process and protect your data.

Results of the Research

Results of this research will be published. Participants will not be identified in any report nor publication without prior consent. Anonymised data will be stored and archived and may be used for secondary analysis in the future.

Funding and Organization of Research

The project is in partnership with the following organisations: Kapitalise Ltd, Exodus Anonymos Etairei Pliroforikis, Imperial College of Sciences and Technology and Medicine, Inventya Ventures (EU) Limited, Universiteit Maastricht and London School of Economics.

The project is financed through the European Commission's, Horizon 2020 initiative.

Contact Details

If you would like further information or you have any questions. Please do not hesitate to contact us.

Paola De Pascali: paola@ kapitalise.co.uk Zahra Shah: zahra@kapitalise.co.uk

If you would like to participate, then please continue.

Consent Form

If you would like to participate in our survey, please agree to all conditions of the research. Unfortunately, you will not be able to progress to the survey if you do not agree with the terms of participating in our study.

1. I have read and understood the information about the project, as provided in the * Information Sheet.
   - Yes
   - No

2. I have been given the opportunity to ask questions about the project and my participation.
   - Yes
   - No

3. I understand I can withdraw at any time without giving reasons and that I will not be penalised for withdrawing nor will I be questioned on why I have withdrawn.
   - Yes
   - No

4. I understand the data collected will be stored anonymously and may be used for secondary analytical purposes in the future.
   - Yes
   - No

5. The use of the data in research, publications, sharing and archiving has been explained to me.
   - Yes
   - No

6. I have read and understood the consent I have provided to this Horizon 2020 project. I hereby enter this submission upon behalf of my organisation.
   - Yes
   - No

7. Name

MM/DD/YYYY

Date / Time

-

General Company Information

In this section, we will ask you to summarise some general information about your organisation.

2. Year of incorporation of the company: ……..

3. Base/Headquarters of the company: ……..

4. Size of the company

- Micro < 10 employees
- Small < 50 employees
- Medium < 250 employees

5. Gender of the CEO in your company

- Female
- Male
- Other

6. What industry best describes your company? (please choose the best option)

- A1 - Crop and animal production, hunting and related service activities
- A2 - Forestry and logging
- A3 - Fishing and aquaculture
- B4 - Mining of coal and lignite
- B5 - Extraction of crude petroleum and natural gas
- B6 - Mining of metal ores
- B7 - Other mining and quarrying
- B8 - Mining support service activities
- C9 - Manufacture of food products
- C10 - Manufacture of beverages
- C11 - Manufacture of tobacco products
- C12 - Manufacture of textiles
- C13 - Manufacture of wearing apparel
- C14 - Manufacture of leather and related products
- C15 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
- C16 - Manufacture of paper and paper products
- C17 - Printing and reproduction of recorded media
- C18 - Manufacture of coke and refined petroleum products
- C19 - Manufacture of chemicals and chemical products
- C20 - Manufacture of basic pharmaceutical products and pharmaceutical preparations
- C21 - Manufacture of rubber and plastic products
- C22 - Manufacture of other non-metallic mineral products
- C23 - Manufacture of basic metals
- C24 - Manufacture of fabricated metal products, except machinery and equipment

- C25 - Manufacture of computer, electronic and optical products
- C26 - Manufacture of electrical equipment
- C27 - Manufacture of machinery and equipment n.e.c
- C28 - Manufacture of motor vehicles, trailers and semi-trailer
- C29 - Manufacture of other transport equipment
- C30 - Manufacture of furniture
- C31 - Other manufacturing
- C32 - Repair and installation of machinery and equipment
- D33 - Electricity, gas, steam and air conditioning supply
- E34 - Water collection, treatment and supply
- E35 - Sewerage
- E36 - Waste collection, treatment and disposal activities; materials recovery
- E37 - Remediation activities and other waste management services
- F38 - Construction of buildings
- F39 - Civil engineering
- F40 - Specialized construction activities
- G41 - Wholesale and retail trade and repair of motor vehicles and motorcycles
- G42 - Wholesale trade, except of motor vehicles and motorcycles
- G43 - Retail trade, except of motor vehicles and motorcycles
- H44 - Land transport and transport via pipelines
- H45 - Water transport
- H46 - Air transport
- H47 - Warehousing and support activities for transportation
- H48 - Postal and courier activities
- I49 - Accommodation
- I50 - Food and beverage service activities
- J51 - Publishing activities
- J52 - Motion picture, video and television programme production, sound recording and music publishing activities
- J53 - Programming and broadcasting activities
- J54 - Telecommunications
- J55 - Computer programming, consultancy and related activities
- J56 - Information service activities
- K57 - Financial service activities, except insurance and pension funding
- K58 - Insurance, reinsurance and pension funding, except compulsory social security
- K59 - Activities auxiliary to financial services and insurance activities
- L60 - Real estate activities
- M61 - Legal and accounting activities
- M62 - Activities of head offices; management consultancy activities
- M63 - Architectural and engineering activities; technical testing and analysis
- M64 - Scientific research and development
- M65 - Advertising and market research
- M66 - Other professional, scientific and technical activities

- M67 - Veterinary activities
- N68 - Rental and leasing activities
- N69 - Employment activities
- N70 - Travel agency, tour operator and other reservation service and related activities
- N71 - Security and investigation activities
- N72 - Services to buildings and landscape activities
- N73 - Office administrative, office support and other business support activities
- O74 - Public administration and defense; compulsory social security
- P75 - Education
- Q76 - Human health activities
- Q77 - Residential care activities
- Q78 - Social work activities without accommodation
- R79 - Creative, arts and entertainment activities
- R80 - Libraries, archives, museums and other cultural activities
- R81 - Gambling and betting activities
- R82 - Sports activities and amusement and recreation activities
- S83 - Activities of membership organisations
- S84 - Repair of computers and personal and household goods
- S85 - Other personal service activities
- T86 - Activities of households as employers of domestic personnel
- T87 - Undifferentiated goods- and services-producing activities of private households for own use
- U88 - Activities of extraterritorial organisations and bodies

Section 2. General Economic Information

In this section, we will ask you to summarise some financial information relating to your company.

7.What was your estimated turnover in 2015, 2016 and 2017?

Please state in Euros €.

Turnover is defined as the net sales of goods and services generated by a business (Include all taxes except VAT)

2015, please state ……

2016, please state ……

2017, please state……

8. Where would you categorise yourself in the business life-cycle?

- Start-Up
- Steadying the Ship (Growing)
- Business Consolidation (Maturing)
- Business for Long Haul (Expanding)

9. What is the highest level of education of your employees?

- Undergraduate
- Postgraduate (master's degree/PhD)
- None of the above

Section 3. R&D Investment & Tax Incentives

R&D Definition- Research and Development (R&D) refers to the investigative activities a business conducts to improve existing products and procedures or to lead to the development of new products, patents and procedures.

10. During the years 2015-2017, did your firm invest in R&D? **Logic: If No skip to Q13**

- Yes
- No
- Don't know

11. How much would you estimate you spent on R&D in 2015, 2016 and 2017? Please state in Euros €.

2015, please state……

2016, please state……

2017, please state……

12. Is your R&D activity and investment ongoing?

- Yes
- No

General R&D Funding- Question(s) relating to overall awareness of R&D funding schemes.

13. Are you aware of R&D funding opportunities provided by your government? **Logic: if No, skip to Q16.**

- Yes
- No
- Partly

14. How did you become aware of the existence of R&D funding schemes?

- ☐ Informed by accountant
- ☐ Already had the knowledge from previous business ventures
- ☐ Through my own research into government incentives
- ☐ Government advertisements/newsletters

- ☐ Other, please state……

15. How satisfied are you with governmental support in R&D funding?

5 Point Likert Scale	Very satisfied	Somewhat satisfied	Neither satisfied nor dissatisfied	Somewhat dissatisfied	Very dissatisfied

16. Have you received R&D tax relief/incentives to carry out your Research and Development? **Logic: If No, skip to Q20.**

- Yes
- No

17. Which type of R&D tax relief/incentive (s) did you receive?

- ☐ Deductions in asset used for R&D, such as machinery, equipment, building and intangibles, used to minimize taxable income.
- ☐ Tax credits that allow firms to directly deduct a specific share of their R&D expenses from the corporate tax liabilities.
- ☐ Special exemptions of wage and/or social taxes for employees in R&D activities.
- ☐ Corporation tax savings from carrying forward/backwards your loss
- ☐ Patent Box
- ☐ Unsure

18. Please state the estimated amount of funding per year, derived from R&D tax relief/incentives received from Central government and/or Regional authorities. Please state in Euros €.

2015, please state…….

2016, please state……

2017, please state……

19. Would you still have carried out the R&D activities if you did not receive tax relief/incentives? **Logic: If Yes, No, and Partly, go onto Q21**

- Yes
- No
- Partly

20. Why have you not yet utilised R&D tax incentives?

- ☐ Complicated Process
- ☐ Not enough time
- ☐ Guidelines are not clear
- ☐ Unsure what it is about

- ☐ The incentives do not cover my R&D activities
- ☐ R&D does not qualify
- ☐ R&D consultants too expensive
- ☐ Other, please state……

21. Has your company received any of the following 'other', non-tax-related, public financial support?

- ☐ Horizon 2020 funding
- ☐ Government Loan
- ☐ Subsides such as grant provided by local or European authority
- ☐ None of the above

22. Which of the following non-public (private) financial support have you received? **Logic: if None of the above, skip to Q24.**

- ☐ Venture Capital
- ☐ Angel Investors
- ☐ Business Incubators
- ☐ Bank Loan
- ☐ None of the above
- ☐ Other, please state….

23. Please state the estimated amount of funding derived from private financial support since 2015. Please state in Euros €.

please state…….

Section 4. Output of Innovation

Product, service and process innovation

Product innovation definition: Product innovation is the creation and subsequent introduction of a good or service that is either new, or an improved version of a previous good or service.

Process innovation definition. Process innovation means the implementation of a new or significantly improved production or delivery method (including significant changes in techniques, equipment and/or software). Process innovations must be new to your company, but they do not need to be new to your market. The innovation could have been originally developed by your company or by other companies or institutions.

24. During the years 2015-2017, did your company introduce: **Logic: If No, skip to Q28.**

- ☐ A new standalone product/service
- ☐ A new complementary product/service that improves the experience of your other products/services

- ☐ An improved version of an existing product/service
- ☐ New methods of manufacturing or producing goods or services
- ☐ Improved methods of manufacturing or producing goods or services
- ☐ None of the above

25. If applicable, how has your company developed and improved the method of producing the innovation?

- ☐ Inhouse. (In-house refers to conducting an activity or operation within a company, instead of relying on outsourcing. A firm uses its own employees and time to keep a division or business activity, such as financing or brokering, in-house)
- ☐ Outsourced. (Goods or services are obtained by contract from an outside supplier)
- ☐ Collaborations with another company (i.e. Joint venture)
- ☐ Collaboration with a higher education or government institution
- ☐ Not applicable

26. Was your innovation commercialised? **Logic: if No, skip to q28.**

- Yes
- No
- Partly

27. Did your company profit from the commercialisation of your innovation?

- Yes
- No
- Broke Even

Intellectual Property and Patents

Patents definition: According to the OECD, a patent is a right granted by a government to an inventor for the publication of the invention; it entitles the inventor to prevent any third party from using the invention in any way, for an agreed period.

Intellectual Property definition: According to the OECD definition, intellectual property rights refers to the general term for the assignment of property rights through patents, copyrights and trademarks. These property rights allow the holder to exercise a monopoly on the use of the item for a specified period.

28. During the years 2015-2017, did you obtain inventor certificates or patents - granted or pending? **Logic: If No, Skip to Q32.**

- Yes
- No

29. Did your company commercialise the invention/patent?

- Yes
- No
- Intend to do in the future

30. Did your company sell, or is it attempting to sell, the patent?

- Yes
- No

31. Did your company profit from the development of the invention/patent?

- Yes
- No
- Broke Even

Acknowledgement

By filling in the online survey, you are contributing to research that will shape the future of innovation policy

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