



Study on the potential of servitisation and other forms of product-service provision for EU SMEs



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(EASME/ COSME/2016/015)

Final report - Part A: main report

May 2018

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Catalogue number EA-01-18-518-EN-N

ISBN 978-92-9202-355-3

doi: 10.2826/558915

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The study team would like to acknowledge and kindly thank Sumesh Viswanathan and his colleagues at **GDCC** (our partner for the survey), Ugo Scaiella and his colleagues at **SpazioDati** (our partner for the webscraping exercise) and the **members of our expert panel:** Jannis Angelis (KTH Royal Institute of Technology, Stockholm, Sweden), Kimmo Halme (4FRONT, Helsinki, Finland), Iain McKechnie (Aston Business School, Birmingham, UK), Maria Savona (University of Sussex, Science Policy Research Unit (SPRU), UK), Marja Toivonen (University of Helsinki, Finland).

Abstract

The objective of this study was to provide an evidence base to the European Commission allowing to support SMEs in seizing the opportunities of servitisation and moving towards other forms of product-service provision, notably, by adopting digital service-based business models. The study also aimed at developing tools for the European Commission to monitor developments in this field, by building on an in-depth analysis of the existing and potential market for servitisation and other forms of product-service provision. A combination of methods were used to triangulate the results such as a literature review, text mining of the Capital IQ database, webscraping of company websites, Input-Output analysis, an SME survey and case studies. As the study found, the interaction between services and manufacturing industries increased between 2000 and 2014 for all EU28 countries. However, the extent to which small and medium-sized firms are servitised is diverse across these countries. The analysis provided further insights about the servitisation level across five selected archetypes, three cross-cutting services and across manufacturing industries. The study analyses in detail the drivers and barriers to servitisation and concludes with policy recommendations in five important areas.

Résumé

L'objectif de cette étude était de fournir des éléments de base à la Commission Européenne permettant de soutenir les PME à saisir les opportunités de la servitisation et à passer à d'autres formes de prestation de produits-services, notamment, en adoptant des modèles commerciaux basés sur des services numériques. L'étude vise aussi à l'élaboration d'instruments permettant à la Commission Européenne de suivre l'évolution dans ce domaine, en s'appuyant sur une analyse approfondie du marché existant et potentiel de la servitisation et d'autres formes de prestation de produit-service. Différentes méthodes ont été utilisées afin de trianguler les résultats par exemple, une revue de littérature, l'extraction de textes de la base de données Capital IQ, la revue des sites web des petites et moyennes entreprises, une analyse input-output, une enquête auprès des PME et des études de cas. Comme l'étude l'a révélé, l'interaction entre les services et les secteurs industriels a augmenté entre 2000 et 2014 dans tous les pays de l'UE28. Cependant, on observe une tendance différente au sein des pays en ce qui concerne le recours à la servitisation par les petites et moyennes entreprises. L'analyse a permis de mieux comprendre le niveau de servitisation à travers la sélection de cinq archétypes, de trois services transversaux et à travers des industries manufacturières. L'étude analyse en détails les catalyseurs et les obstacles de la servitisation et se conclut par des recommandations politiques dans cinq domaines importants.

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Executive summary

Objectives of the study

The **general objectives** of this study are the following:

1. To provide an evidence base to the European Commission that allows supporting SMEs in the right way to seize the opportunities from servitisation and move towards other forms of product-service provision, notably, by adopting digital service-based business models;
2. To develop tools for the European Commission to monitor development in this field, by building on an in-depth analysis of the existing and potential market for servitisation and other forms of product-service provision.

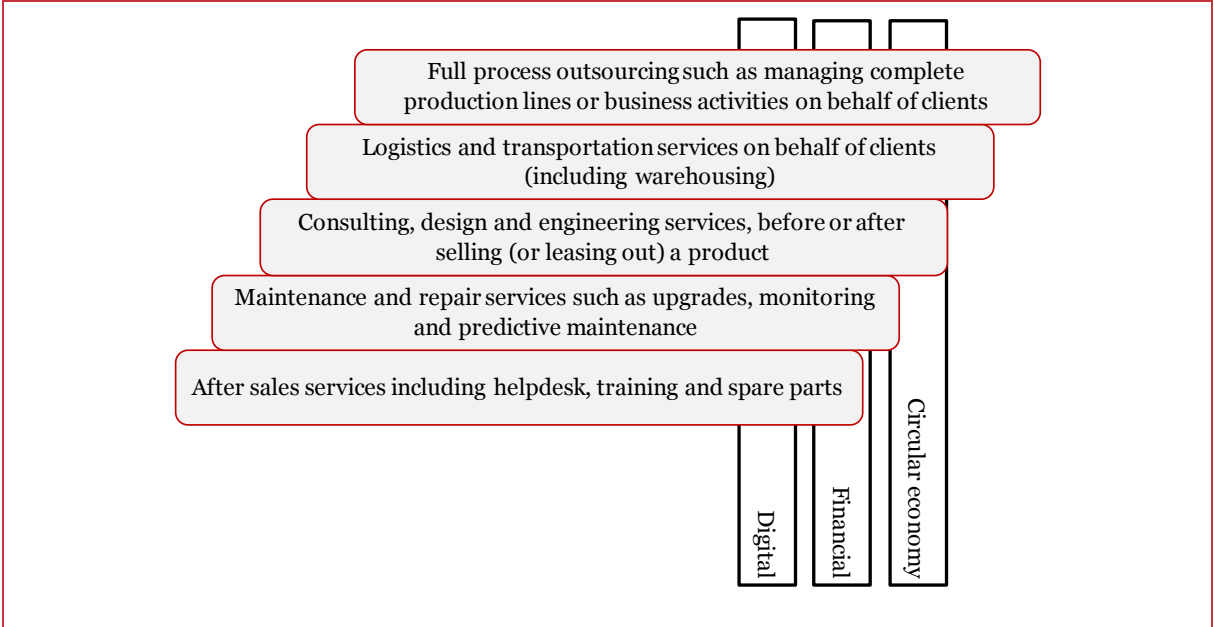
Specific objectives of the study are to analyse the servitisation market (the extent to which manufacturing sectors provide services); understand the process of introducing digital and other innovative product-service combinations (including the drivers, success factors and barriers); and propose policy recommendations to exploit the success factors and address any barriers identified.

This study about **servitisation by SMEs** fills a gap in the evidence base. Existing studies mostly address large firms, while only touching on value chains of large firms and SMEs.

Five types of product-service combinations

This study refers to the provision of **product-service combinations** and the **process of servitisation** (manufacturing companies and sectors that add (more) services to their products). The study differentiates between five types of product-service combinations (Figure 1).

Figure 1 Five archetypes of product-service combinations



Source: adapted from Urmetzer, Neely and Martinez (2016)

The 'ladder' with five archetypes clarifies how specific types of services can be linked to products and how this influences the extent to which manufacturers **engage with their clients**. Whereas after sales services and maintenance/repair services can be quite standard and provided frequently, consulting, design and engineering services are more complex and require collaboration between a manufacturer

and its clients. Taking care of logistics services and, especially, managing production lines on behalf of clients, requires very close collaboration between a manufacturer and its clients.

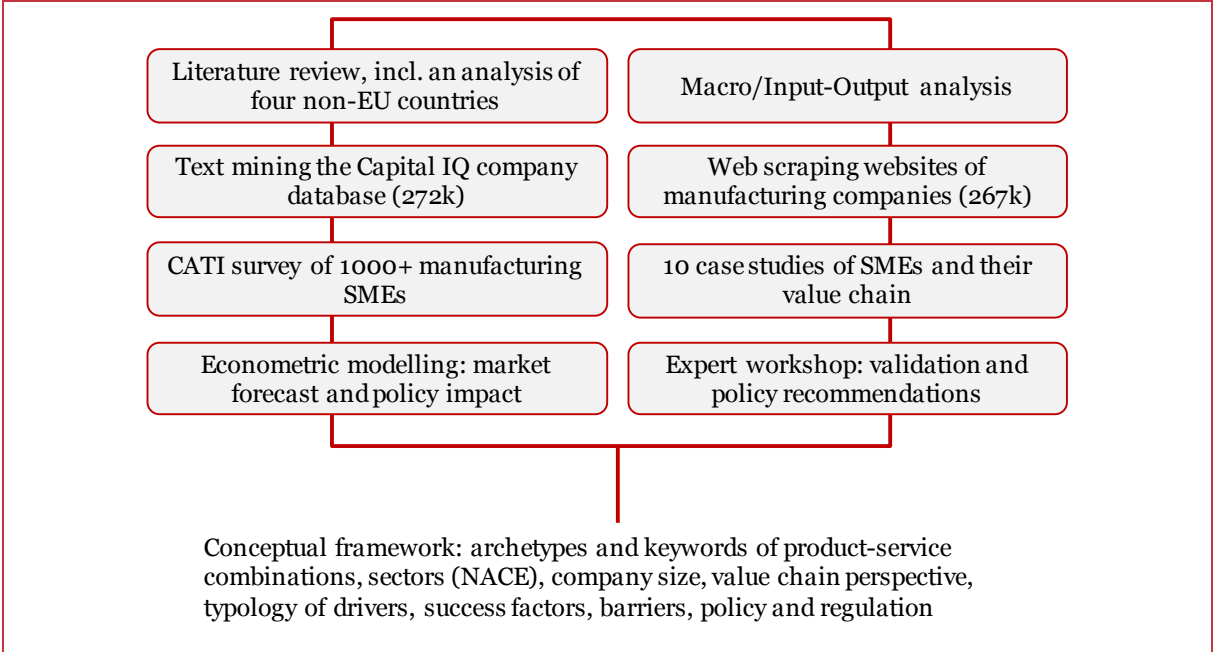
Three cross-cutting aspects

Three cross-cutting services or aspects of services are digital services, circular economy-related services and financial services. Examples of **digital services** are remote operating of logistics and production processes (within companies and across value chains), enabled by sensors, connectivity, increased computing power and data analytics. The digital aspect of servitisation is one of the reasons for industry and policy makers to position servitisation in the context of Industry 4.0 and digitalisation of manufacturing industries. **Financial services** include leasing, insurance and other financial services as well as any legal services that are linked to products. **Circular economy** is most relevant as a driver of servitisation. For example, using sensors and other digital components for remote maintenance, could lead to better and more stable performance of production lines. This can increase the material/energy efficiency of machines and production lines.

Mixed-method approach

Figure 2 introduces the methods used to understand and measure servitisation.

Figure 2 Mixed-method approach



Source: Technopolis Group, Dialogic and Cambridge Service Alliance

The **literature review** was most relevant to identify the main factors to be addressed in the SME survey and in the case studies. **Text mining the Capital IQ database** consisted of a search for servitisation/services keywords in the business descriptions of manufacturing companies (SMEs). A similar keyword-driven approach was taken when **web scraping** company websites (SMEs and large firms). Together with the **Input-Output analysis**, this allowed for estimating the extent to which manufacturing companies and sectors in European countries provide services.

The **SME survey** was most relevant for exploring servitisation drivers, success factors and barriers. The survey also addressed the role of policy and regulation as well as the impact of introducing services on the turnover, employment levels and profit margins. Survey results were used as input for **econometric modelling**, including a forecast of servitisation in the coming years. **Case studies** and

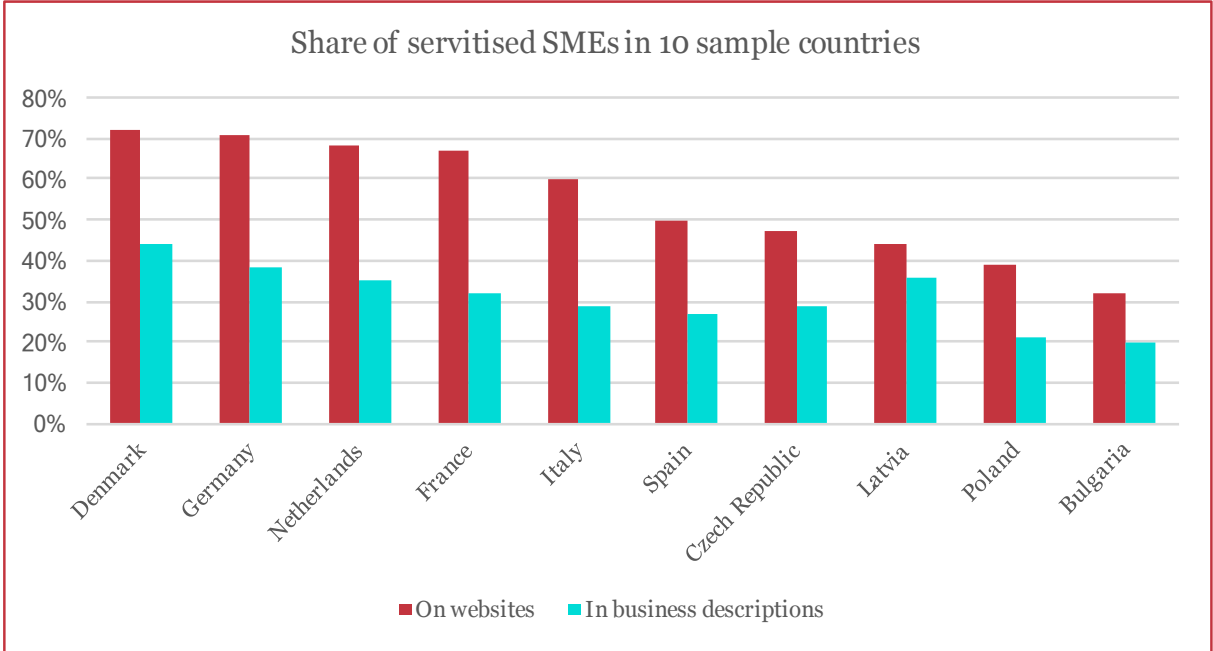
an **expert workshop** were organised to fully understand the process of servitisation and to develop policy recommendations.

The survey and the webscraping analysis covered **ten EU Member States**: Bulgaria, Czech Republic, Denmark, France, Germany, Italy, Latvia, Poland, Spain and The Netherlands. A larger number of EU and COSME countries was covered in the Capital IQ analysis and the Input-Output analysis. One of the 10 case studies concerned an SME in **Iceland**. By means of desk research, the study also explored servitisation trends and relevant policies in Australia, China, India, US.

Servitisation: large differences between European countries

Webscraping indicates that in **Denmark, Germany, Netherlands and France**, around **70%** of manufacturing SMEs provide product-service combinations (Figure 3). In contrast, in **Latvia and Poland 40%** and in **Bulgaria 30%** of SMEs are servitised. **Italy, Spain and the Czech Republic** are in the middle of the group with around **50%** of companies being servitised.

Figure 3 Share of servitised SMEs in 10 selected countries in the EU



Source: Technopolis Group, Dialogic and Cambridge Service Alliance (based on the tool of SpazioDati)

Text mining of business descriptions in the Capital IQ database indicates low levels of servitisation, which is partly due to the (very) short business descriptions. **Webscraping is a more robust approach**, mostly because company websites are ever more informative and up-to-date. However, the results of the webscraping exercise may overestimate the level of servitisation because manufacturing SMEs with websites may not be fully representative of the total population of manufacturing SMEs. To shed light on the macroeconomic context behind service-manufacturing co-production we applied Input-Output analysis, based on measurement of three indicators - the share of services inputs in manufacturing, the service value added content of manufacturing final demand, and the service content of manufacturing output. These indicators are used as proxy for measuring servitisation and have two caveats, notably, using publicly available supply tables, it is not possible to disentangle if the secondary (service) products are used internally to the firm or if they are sold on the market, and there is no intermediate data that allows to examine what share of those secondary service products are categorized as service intermediate inputs in manufacturing. The results of the Input-Output analysis indicate that **the level of servitisation increased between 2000 and 2014**.

The cross-country pattern seems to **reflect the national economic development levels** and the industrial structure. For instance, Denmark and Germany that lead in the number of servitised firms (as

captured by the webscraping analysis) are countries with a high GDP and with the highest innovation performance as measured with the indicator ‘Product innovation by manufacturing SMEs’ (with data from the Community Innovation Survey). The same applies to Finland, Sweden, UK and Ireland that have a high level of servitisation, according to the text mining of business descriptions.

The experiences of using Input-Output analysis, webscraping and other methods in the study, was used to propose a set of **KPIs and data collection tools** to monitor servitisation.

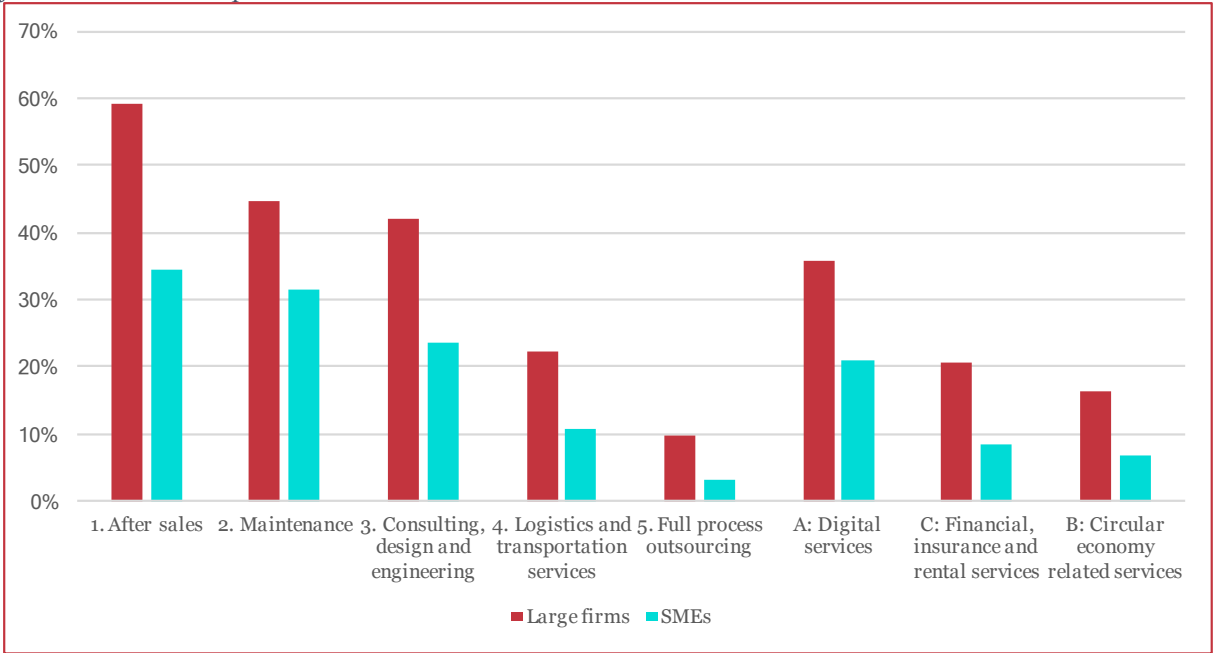
Differences between manufacturing sectors

According to the webscraping analysis, the most servitised sectors are: Machinery and equipment, Repair and installation of machinery and equipment, Computer, electronic and optical products, Electrical equipment, Motor vehicles and trailers. In these sectors, the share of servitised companies (large firms and SMEs combined) is above 60%. At the lower end of the spectrum (below 40%) are Textiles, Furniture, Food, Beverages and Tobacco, Fabricated metal and Wood. These differences between sectors are substantial but not huge, which is partly due to the broad scope of product-service combinations (‘from after sales services to full process outsourcing’).

Types of product-service combinations offered, by large firms and SMEs

Advanced product-service combinations are provided by less companies than basic product-service combinations (Figure 4). There is a **gap between large firms and SMEs**. Moreover, micro companies score lower than small firms; small firms score lower than medium-sized companies.

Figure 4 Level of servitisation according to archetypes and company size class, as the average share of servitised firms in the total sample



Source: Technopolis Group, Dialogic and Cambridge Service Alliance (based on the tool of SpazioDati)

Clear yet realistic indications about the positive impact of servitisation

Over 60% of the manufacturing SMEs that responded to the survey and that provide services, **employed additional people** as a result of starting to offer services (Detailed results of the survey are included in Appendix K of the report). For manufacturing SMEs that introduced services thirty years ago (or more) the figure is as high as 87%. The results regarding the number of additional people employed, are consistent, positive and realistic: 45% of SMEs report between 1 and 10 additional people

so far. Calculations in this study indicate that **around 10% of persons employed in manufacturing SMEs in the EU are involved in providing product-service offerings**. This figure will increase. Over 70% of respondents expect to hire between 1 and 10 new employees, per year, as a result of providing services.

Survey respondents also indicated that servitisation led to **new clients inside and outside Europe**. Along the same lines, the large majority of manufacturing SMEs, report an **increase of revenues** as a result of introducing services. The service component of product-service combinations was **around 12% of the turnover of EU manufacturing SMEs**. For the period between 2018 and 2021, it is expected that the service share of manufacturing SME's turnover will grow another 5%. Moreover, 50% of SMEs reported an **increase of their profit margin** of 1-10%, over the last two years, as a result of providing services, while expecting a similar increase the coming two years.

Barriers

A broad range of barriers is perceived as (very) important for servitisation. The main barriers are not unique for servitisation but also emerged in studies about other types of innovation by SMEs:

- Skills of current staff;
- Not being able to recruit people with the right skills;
- Product regulation, market regulation and standardisation;
- Access to financial resources;
- Availability of partners and suppliers;
- Uncertainty about demand from clients and other market trends; and
- ICT infrastructures.

The relevance of barriers hardly differs between countries or sectors. To some extent, manufacturing SMEs address barriers by participating in public R&D or innovation programmes, receiving financial support for R&D&I (e.g. grants) and joining government-supported training programmes. To a lesser extent, SMEs mention clusters/networking and government-sponsored advice.

Policy recommendations in five key areas

Following the analysis, case studies and survey results, this study formulated several policy recommendations related to five factors that have been identified as the most important enabling (or hindering) the servitisation endeavors of SMEs. We present them below:

1. Assess skills gaps and adapt skills development initiatives

This study shed light on the **skills** that are important for servitisation, pointing out that some of the necessary skills are too scarce inside SMEs as well as hardly available on the labour market. Examples are digital skills, data science, engineering skills, process operations, business process (re)design, collaboration across departments and with clients. As such, SMEs refer to intellectual *and* social skills.

Recommendations:

- Initiatives taken by the EU, within the **New Skills Agenda for Europe**, should explicitly address servitisation and **servitisation should be embedded in existing and planned skills programmes**. The attention for skills related to servitisation could be addressed via the recently created **EU Industry 4.0 platform (EUI4.0)** and the **Sectoral Cooperations on Skills**.
- The level of priority of SME skills development should be increased not just through EU programmes, but also through public-private partnership. **Regional and national initiatives for Industry 4.0 and digitization of industry should put also more emphasis on skills** and address servitisation specifically.

- The efforts to **analyse which types of skills and at which level are relevant** for servitisation and Industry 4.0 should be continued. For instance, skills needs may differ not only between sectors but also between micro, small, medium-sized and large enterprises.

2. Clusters and crossovers: facilitate SMEs in meeting innovation and business partners

Manufacturing SMEs use a combination of in-house production and external partners for developing and providing product-service combinations. **Finding business partners with the right skills, knowledge and activities** is one of the main barriers. SMEs that succeed in effective partnering, mention this as an important success factor, e.g. having national or international partners for IT and maintenance, but also partners from the same sector as a means to increase scale and market access.

- Clusters that operate within and between sectors can foster servitisation. The **European Observatory for Clusters and Industrial Change** (and especially its policy support tools) and the **European Cluster Collaboration Platform** should continue embracing the concept of servitisation with a stronger focus. For example, the platform could support exchange of experience among European cluster managers (e.g. awareness raising, training, advice and match-making).
- The European Cluster Collaboration Platform could also launch a **dedicated European Strategic Cluster Partnership** to support innovation in product-service combinations. Other recommendations are to launch a call about servitisation, similar to the **INNOSUP-Cluster facilitated projects for new industrial value chains**.
- The **Enterprise Europe Network** could take up servitisation as a specific element and organise match-making events around this topic or even targeted to digital/ circular economy services. The **Horizon 2020 programme** and especially its strand on 'Innovation in SMEs' could include specific calls that target collaboration in the area of servitisation.
- Servitisation could be more explicitly embedded into the **EIT Knowledge and Innovation Communities**, which provide an open platform and international meeting point for the development of innovations. For instance the EIT Digital's Digital Industry action line could target servitisation projects in the area of digital services offered in the manufacturing sector or the Climate KIC could have an even more targeted focus on sustainable product-service offers.

3. Increase access to finance for innovation in product-service combinations

Access to finance is an important barrier for servitisation, even though some SMEs received financial support from public agencies at regional, national and EU level. SMEs and experts stressed that both private and public investors are relevant, for developing as well as providing product-service combinations. Investments are needed for (new) machines, IT systems, processes, skills and partnerships. A very specific point is that manufacturing companies that migrate to a leasing model, temporarily, have less turnover. In the long term, turnover is more stable and higher.

- **Private and public investors must increase their understanding of servitisation.** Although investors have a clear self-interest in understanding opportunities, EU and national policy should support this process. Instruments can include studies, monitors and a specific guide to highlight the main aspects of investing in companies, value chains and sectors that add more (advanced) services to their products.
- A second line of action is to **ensure that public support programmes for R&D and innovation address or, at least, are flexible enough to support servitisation.** For example, most programmes that are financed under the European Structural and Investment Funds currently lack attention for servitisation, as it is not included as an innovative approach for business and economic development. Other programmes, such as the European Fund for Strategic and the SME Instrument executed by EASME, do not address servitisation in their guidelines or calls.

- Public support such as enterprise development schemes financed through the **European Structural and Investment Funds** currently lack an attention on servitisation. Servitisation could be imbedded in the priorities by drawing the attention of Managing Authorities for the potential in the development of product-service concepts.
- Another financial scheme, which could embrace servitisation is the '**SME Instrument**' operated by EASME as part of the **Horizon 2020** programme and which is part of the European Innovation Council pilot.
- Access to finance for servitising companies could be improved by **reviewing the eligibility and award criteria** and the focus of financial measures. It is often the type of projects that are expected and approved that hinders SMEs to submit applications in the area of new service offerings. Another practical issue is that the eligible costs of the support schemes does not allow accounting for the costs linked to servitisation, which could be easily changed and adapted.
- Improving **tax policy** is another avenue for supporting servitisation. Several Member States offer R&D and innovation related tax credits which could be extended to account for the costs of companies developing new and innovative service in addition to their manufactured products. The tax credit could finance the costs of hiring new skilled employees or the access to testing facilities.
- Besides the traditional financial schemes, the potential in using **alternative financial sources such as crowd-sourcing** or business angel networks could be also explored and addressed at national and regional level specifically supporting servitisation projects.

4. Facilitate the European single market for product-service combinations

When referring to product regulation, market regulation and standardisation, SMEs mostly addressed **shortcomings in the EU single market**. For example: insufficient European harmonisation of eco-labels, safety and quality standards, and technical standards of components, equipment and systems. A related matter is the multiplicity of national systems for registrations, licenses and permits. In short: providers of product-service combinations face the shortcoming of the EU single market for products *and* services. The study also found that SMEs, because of launching services, won clients in more countries, which further underlines the importance of EU single market issues.

- The European Commission should **address product-service combinations** in planned peer reviews, monitors and evaluations of the EU single market, no matter whether these exercises have an emphasis on products or services.
- Along the same lines, the European Commission could assess whether servitisation (e.g. integrated solutions) is effectively addressed in **standardisation** fora for products and/or services, and in policy debates about sharing non-personal data. For instance, one could explore whether standards for integrated solutions (e.g. advanced types of servitisation) are discussed, or should be discussed in fora that focus on products and/or in fora that focus on services. The risk is that integrated solutions are discussed neither in fora that address products, nor in fora that address services.
- Initiatives at the national policy level are essential for facilitating the EU single market for product-service combinations. For example, the **Points of Single Contact** for (foreign) companies should not create any difficult procedures or impossibilities for companies that provide products as well as services, or that provide integrated solutions that fit in neither of the two categories. More broadly, Member States should step up their efforts to implement the Services Directive in an ambitious way in order to remove or reduce the many remaining obstacles to the single market for services and, hence, product-service combinations. Moreover, collaboration between the EU and national policy level is essential for peer reviews and monitors of the EU single market as well as European standardisation processes.

5. Increase awareness of the potential of servitisation

In addition to increasing the servitisation awareness of investors and cluster managers (see above), an important challenge is to **increase awareness among SMEs**. There are large differences between countries in terms of the share of manufacturing SMEs and large firms that provide services. This holds for basic as well as advanced types of product-service combinations.

- To increase SME's awareness of the potential of servitisation, **existing regional and national platforms** are likely to be most effective and efficient. It is recommended to identify which national and regional policy initiatives lend themselves for being extended with a training, workshop track, test facility devoted to servitisation. Examples are cluster organisations, industry associations and initiatives to support Industry 4.0 or the circular economy.
- Awareness raising initiatives should not only focus on the potential of servitisation in general but shall dive into **specific aspects such as digital services, specific business models, the contribution to the circular economy and specificities existing in certain sectors**. The set of instruments can include good practices, workshops and tools for co-creating services with clients, for developing new business models and mitigating risks. The European Commission, for example by using EU wide platforms such as the EU14.0 platform, the Digital Cities Challenge, the European Resource Efficiency Knowledge Centre, the European Cluster Collaboration Platform can ensure that good practices and tools are shared between countries.

Résumé de l'étude

Objectifs de l'étude

Les **objectifs généraux** de cette étude sont les suivants :

1. Fournir à la Commission européenne une étude basée sur des données scientifiques qui permet de soutenir les PME de la bonne manière, de leur permettre de saisir les opportunités de la servitisation et d'évoluer vers d'autres formes de fourniture de produits et de services, notamment en adoptant des modèles commerciaux basés sur l'offre de services numériques ;
2. Mettre au point des outils permettant à la Commission européenne de suivre l'évolution dans ce domaine, en s'appuyant sur une analyse approfondie du marché existant et potentiel de la servitisation et d'autres formes de fourniture de produits et de services.

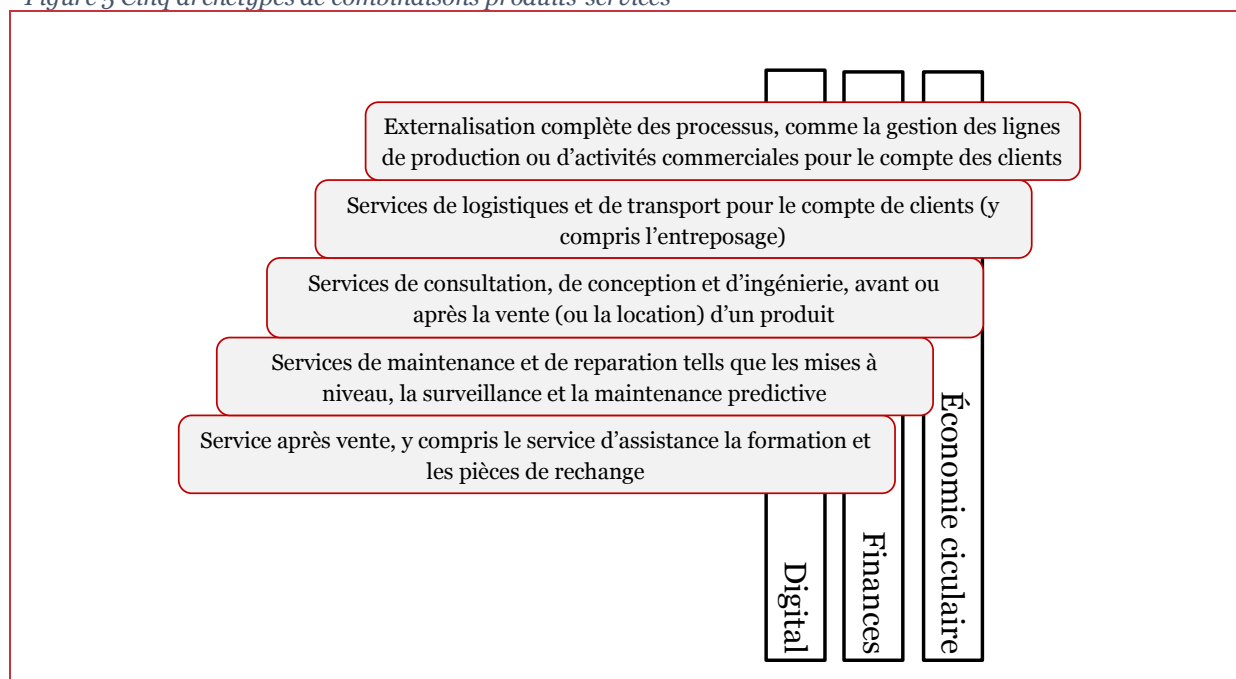
Les **objectifs spécifiques** de l'étude sont d'analyser le marché de la servitisation (la mesure dans laquelle les secteurs manufacturiers fournissent des services), de comprendre le processus d'introduction de combinaisons de produits et de services numériques et d'autres combinaisons innovantes (y compris les facteurs de succès et les obstacles) et de proposer des recommandations politiques pour exploiter les facteurs de succès et s'attaquer aux obstacles identifiés.

Cette étude sur la **servitisation par les PME** comble une lacune dans la littérature existante. Les études existantes s'adressent principalement aux grandes entreprises, alors qu'elles ne concernent que les chaînes de valeur des grandes entreprises et des PME.

Cinq types de combinaisons produits-services

Cette étude se réfère à la fourniture de **combinaisons produits-services et au processus de servitisation** (entreprises manufacturières et secteurs qui ajoutent (plus) de services à leurs produits). L'étude distingue cinq types de combinaisons produits-services (figure 1).

Figure 5 Cinq archétypes de combinaisons produits-services



Source : adapté de Urmetzer, Neely et Martinez (2016)

L'«échelle» ci-dessus (figure 1) aux cinq archétypes clarifie comment des types spécifiques de services peuvent être liés aux produits et comment cela influence la mesure dans laquelle **les fabricants s'engagent avec leurs clients**. Alors que les services après-vente et les services d'entretien/réparation peuvent être assez standard et fournis fréquemment, les services de consultation, de conception et d'ingénierie sont plus complexes et nécessitent une collaboration entre un fabricant et ses clients. La prise en charge des services logistiques et, en particulier, la gestion des lignes de production pour le compte des clients, nécessite une collaboration très étroite entre un fabricant et ses clients.

Trois aspects transversaux

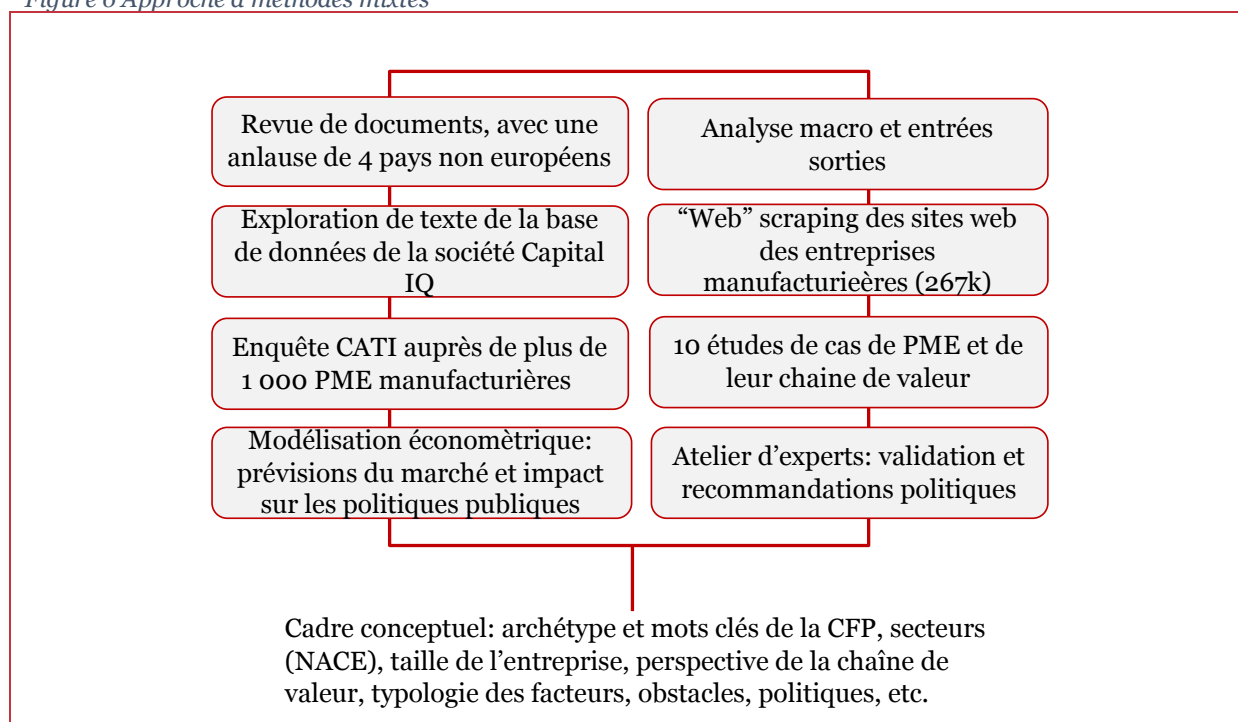
Trois services transversaux ou aspects des services sont les services numériques, les services liés à l'économie circulaire et les services financiers. Des exemples **de services numériques** sont l'exploitation à distance de la logistique et des processus de production (au sein des entreprises et à travers les chaînes de valeur), rendue possible par les capteurs, la connectivité, l'augmentation de la puissance de calcul et l'analyse des données.

Le caractère numérique de la servitisation est l'une des raisons pour laquelle l'industrie et les décideurs politiques décident de positionner la servitisation dans le contexte de l'industrie 4.0 et de la numérisation des industries manufacturières. Les services financiers comprennent le crédit-bail, l'assurance et d'autres **services financiers** ainsi que tout service juridique lié aux produits. **L'économie circulaire** est le secteur le plus pertinent en tant que secteur moteur de la servitisation. Par exemple, l'utilisation de capteurs et d'autres composants numériques pour la télémaintenance pourrait conduire à une performance meilleure et plus stable des lignes de production. Cela peut augmenter l'efficacité matérielle/énergétique des machines et des lignes de production.

Approche à méthodes mixtes

La figure 2 présente les méthodes utilisées pour comprendre et mesurer la servitisation.

Figure 6 Approche à méthodes mixtes



Source : Technopolis Group, Dialogic et Cambridge Service Alliance.

L'analyse documentaire était particulièrement pertinente pour déterminer les principaux facteurs à prendre en compte dans l'enquête auprès des PME et dans les études de cas. Le **Text Mining de la base de données Capital IQ** consistait en une recherche de mots-clés servitisation/services dans les descriptions d'affaires des entreprises manufacturières (PME). Une approche similaire, axée sur les mots clés, a été adoptée lors de la phase « web scraping¹ » de sites Web d'entreprises (PME et grandes entreprises). Avec **l'analyse des entrées-sorties**, cela a permis d'estimer dans quelle mesure les entreprises et les secteurs manufacturiers des pays européens fournissent ou non des services.

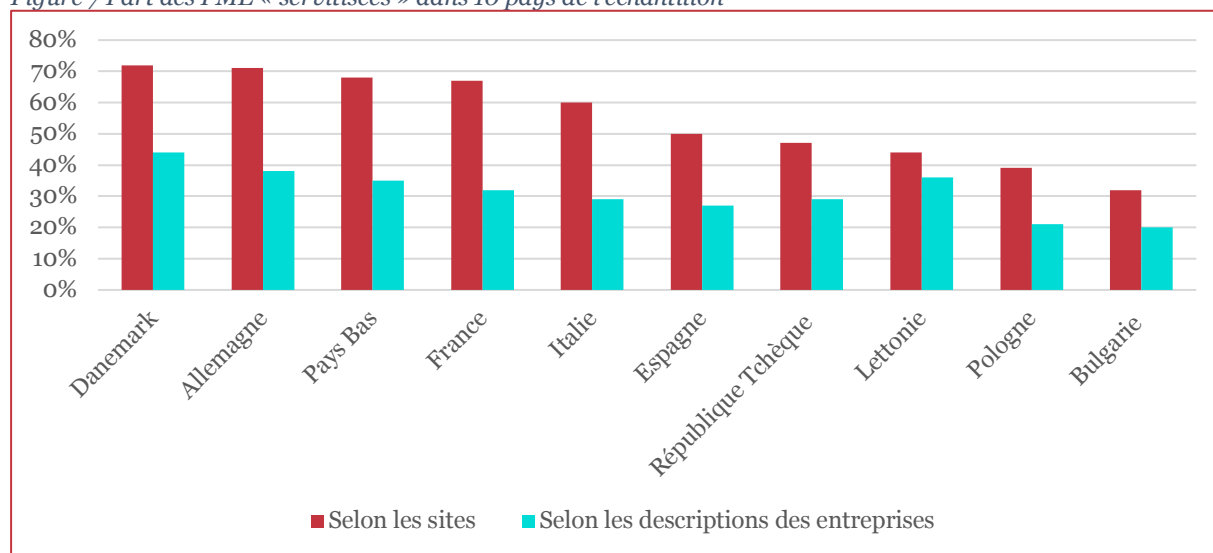
L'enquête sur les PME était particulièrement pertinente pour explorer les facteurs de servitisation, les facteurs de succès et les obstacles. L'enquête a également porté sur le rôle de la politique et de la réglementation ainsi que sur l'impact de l'introduction des services sur le chiffre d'affaires, les niveaux d'emploi et les marges bénéficiaires. Les résultats de l'enquête ont servi de base à la **modélisation économétrique**, y compris une prévision de la servitisation dans les années à venir. Des **études de cas** et un atelier d'experts ont été organisés afin de bien comprendre le processus de servitisation et d'élaborer des recommandations politiques.

L'enquête et l'analyse du « webscraping » ont couvert dix États membres de l'UE : Bulgarie, République tchèque, Danemark, France, Allemagne, Italie, Lettonie, Pologne, Espagne et Pays-Bas. Un plus grand nombre de pays de l'UE et du COSME ont été couverts par l'analyse Capital IQ et l'analyse des entrées-sorties. L'une des 10 études de cas concernait une PME islandaise. Au moyen d'une recherche documentaire, l'étude a également exploré les tendances de la servitisation et les politiques pertinentes en Australie, en Chine, en Inde et aux États-Unis.

Servitisation : de grandes différences entre les pays européens

Le « Webscraping » indique qu'**au Danemark, en Allemagne, aux Pays-Bas et en France**, environ 70% des PME manufacturières fournissent des combinaisons produits-services (Figure 3). En revanche, en **Lettonie et en Pologne, 40 % et en Bulgarie, 30 %** des PME sont servies. **L'Italie, l'Espagne et la République tchèque** se situent au milieu du groupe avec environ **50% des entreprises « servitisées »**.

Figure 7 Part des PME « servitisées » dans 10 pays de l'échantillon



Source : Technopolis Group, Dialogic et Cambridge Service Alliance (basé sur l'outil de SpazioDati)

¹ Le web scraping est une technique d'extraction du contenu de sites Web, via un script ou un programme, dans le but de le transformer pour permettre son utilisation dans un autre contexte, par exemple le référencement.

L'exploration de texte des descriptions d'affaires dans la base de données Capital IQ indique de faibles niveaux de servitisation, ce qui est en partie dû aux (très) courtes descriptions des entreprises. Le **Webscraping est une approche plus robuste**, principalement parce que les sites Web des entreprises sont de plus en plus informatifs et à jour. Toutefois, les résultats de l'exercice de webscraping peuvent surestimer le niveau de servitisation, car les PME manufacturières disposant de sites web peuvent ne pas être pleinement représentatives de la population totale des PME manufacturières.

Pour apporter un éclairage sur le contexte macroéconomique qui sous-tend la coproduction de la fabrication de services, nous avons appliqué l'analyse des entrées-sorties, basée sur la mesure de trois indicateurs - la part des intrants de services dans la fabrication, le contenu en valeur ajoutée des services de la demande finale de fabrication et le contenu en services de la production manufacturière. Ces indicateurs sont utilisés comme indicateurs indirects pour mesurer la servitisation et comportent deux mises en garde, notamment, en utilisant des tableaux des ressources accessibles au public, il n'est pas possible de distinguer si les produits secondaires (de service) sont utilisés en interne par l'entreprise ou s'ils sont vendus sur le marché, et il n'existe pas de données intermédiaires qui permettent d'examiner quelle part de ces produits secondaires de service sont classés comme intrants intermédiaires de service dans l'industrie manufacturière. **Les résultats de l'analyse des entrées-sorties indiquent que le niveau de servitisation a augmenté entre 2000 et 2014.**

Le modèle interpays **semble bien refléter les niveaux de développement économique et la structure industrielle des pays**. Par exemple, le Danemark et l'Allemagne qui arrivent en tête pour le nombre d'entreprises servitisées (tel qu'il ressort de l'analyse de la mise en ligne) sont des pays dont le PIB est élevé et dont les performances en matière d'innovation sont les plus élevées, comme le montre l'indicateur "Innovation de produits par les PME manufacturières" (avec des données provenant de l'enquête communautaire sur l'innovation). Il en va de même pour la Finlande, la Suède, le Royaume-Uni et l'Irlande qui ont un niveau élevé de servitisation, selon le texte des descriptions d'entreprises.

L'utilisation de l'analyse des entrées-sorties, du webscraping et d'autres méthodes dans l'étude, ont permis de proposer un **ensemble d'indicateurs de performance clé et d'outils de collecte de données** pour le suivi de la servitisation.

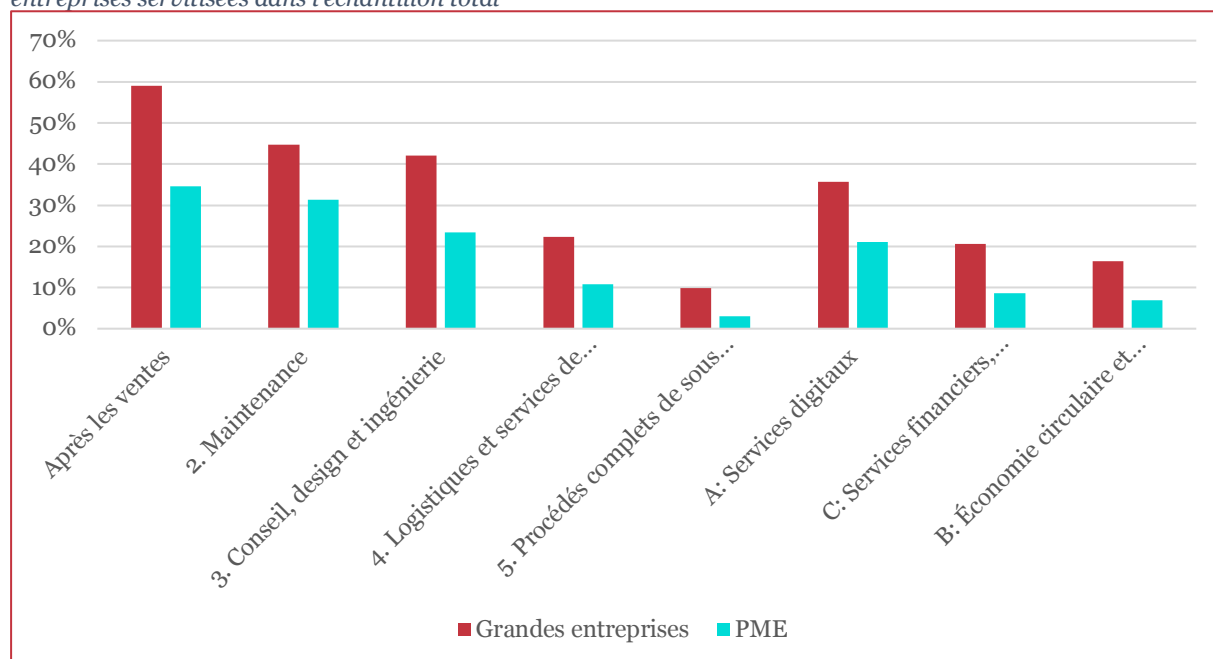
Différences entre les secteurs manufacturiers

Selon l'analyse webscraping, les secteurs les plus servitisés sont : les secteurs des Machines et équipements, Réparation et installation de machines et d'équipements, Produits informatiques, électroniques et optiques, Matériel électrique, Véhicules à moteur et remorques. Dans ces secteurs, la part des entreprises servitisées (grandes entreprises et PME combinées) est supérieure à 60%. Au bas de l'échelle (moins de 40 %) se trouvent les textiles, l'ameublement, l'alimentation, les boissons et le tabac, le métal fabriqué et le bois. Ces différences entre les secteurs sont importantes mais pas énormes, ce qui s'explique en partie par le large éventail de combinaisons produits/services ("des services après-vente à l'externalisation complète des processus").

Types de combinaisons produits-services offerts par les grandes entreprises et les PME.

Les combinaisons produit-service avancées sont fournies par moins d'entreprises que les combinaisons produit-service de base (Figure 4). **Il existe un écart entre les grandes entreprises et les PME.** De plus, les micro-entreprises obtiennent un score inférieur à celui des petites entreprises ; les petites entreprises obtiennent un score inférieur à celui des entreprises de taille moyenne.

Figure 8 Niveau de servitisation selon les archétypes et les tailles des entreprises, sur la part moyenne des entreprises servitisées dans l'échantillon total



Source : Technopolis Group, Dialogic et Cambridge Service Alliance (basé sur l'outil de SpazioDati)

Des indications claires mais réalistes sur l'impact positif de la servitisation.

Plus de 60 % des PME manufacturières qui ont répondu à l'enquête et qui fournissent des services ont **employé des personnes supplémentaires** après avoir commencé à offrir des services (les résultats détaillés de l'enquête figurent à l'annexe K du rapport). Pour les PME manufacturières qui ont introduit des services il y a trente ans (ou plus), ce chiffre peut atteindre 87 %. Les résultats concernant le nombre de personnes supplémentaires employées sont cohérents, positifs et réalistes : 45% des PME rapportent entre 1 et 10 personnes supplémentaires à ce jour. Les calculs de cette étude indiquent **qu'environ 10 % des personnes employées dans les PME manufacturières de l'UE participent à l'offre de produits et de services**. Ce chiffre est prévu d'augmenter. Plus de 70 % des répondants s'attendent à embaucher entre 1 et 10 nouveaux employés, par année, à la suite de la prestation de services.

Les répondants de l'enquête ont également indiqué que la servitisation a conduit à de **nouveaux clients en Europe et en dehors de l'Europe**. Dans le même ordre d'idées, la grande majorité des PME manufacturières font état d'une augmentation des revenus à la suite de l'introduction des services dans leur modèle économique. La composante services des combinaisons produits-services représentait environ **12 % du chiffre d'affaires des PME manufacturières de l'UE**. Pour la période comprise entre 2018 et 2021, on s'attend à ce que la part des services dans le chiffre d'affaires des PME manufacturières augmente encore de 5 %. De plus, 50 % des PME ont signalé une **augmentation de leur marge bénéficiaire de 1 à 10 %** au cours des deux dernières années, en raison de la prestation de services, tout en s'attendant à une augmentation similaire au cours des deux prochaines années.

Barrières à l'entrée de la servitisation

Un large éventail de barrière à l'entrée est perçu comme étant (très) important pour commencer à offrir des services. Les principaux obstacles ne sont pas uniquement liés à la servitisation, mais sont également apparus dans les études sur d'autres types de nouvelles débouchées innovantes par les PME :

- Compétences du personnel actuel ;
- Ne pas être en mesure de recruter des personnes possédant les bonnes compétences ;
- Réglementation des produits, réglementation du marché et normalisation ;

- Accès aux ressources financières ;
- Disponibilité des partenaires et des fournisseurs ;
- l'incertitude quant à la demande des clients et aux autres tendances du marché ; et
- Infrastructures TIC.

Ces obstacles ne diffèrent guère d'un pays ou d'un secteur à l'autre. Dans une certaine mesure, les PME manufacturières s'attaquent aux obstacles en participant à des programmes publics de R&D ou d'innovation, en recevant un soutien financier pour la R&D&I (par exemple, des subventions) et en participant à des programmes de formation soutenus par le gouvernement. Dans une moindre mesure, les PME mentionnent les grappes et le réseautage et les conseils parrainés par le gouvernement.

Recommandations politiques dans cinq domaines clés

Suite à l'analyse, aux études de cas et aux résultats de l'enquête, cette étude a formulé plusieurs recommandations politiques liées à cinq facteurs qui ont été identifiés comme étant les plus importants pour permettre (ou entraver) les efforts de servitisation des PME. Nous les présentons ci-dessous :

1. Évaluer les lacunes en matière de compétences et adapter les initiatives de développement des compétences.

Cette étude a mis en lumière les **compétences importantes** pour la servitisation, en soulignant que certaines des compétences nécessaires sont trop rares au sein des PME et à peine disponibles sur le marché du travail. Il s'agit par exemple des compétences numériques, de la science des données, des compétences en ingénierie, des opérations de processus, de la (re)conception des processus opérationnels, de la collaboration entre les départements et avec les clients. Les PME ont besoin de compétences à la fois intellectuelles et sociales.

Recommandations :

- Les initiatives prises par l'UE, dans le cadre du **New Skills Agenda for Europe** (nouvel agenda des compétences pour l'Europe), devraient porter explicitement sur la servitisation, et la **servitisation devrait être intégrée dans les programmes de compétences existants et prévus**. L'attention portée aux compétences liées à la servitisation pourrait être abordée par le biais de la plateforme **EU Industry 4.0 récemment créée (EUI4.0)** et des **Coopérations sectorielles sur les compétences (Sectoral Cooperations on Skills)**.
 - Le développement des compétences des employés des PME devrait être augmenté non seulement par le biais des programmes de l'UE, mais aussi par le biais de **partenariats public-privé**. **Les initiatives régionales et nationales pour l'industrie 4.0 et la numérisation de l'industrie devraient également mettre davantage l'accent sur les compétences et traiter spécifiquement de la servitisation.**
 - Les efforts visant à analyser **quels types de compétences et à quel niveau sont pertinents** pour la servitisation et l'industrie 4.0 devraient être poursuivis. Par exemple, les besoins en compétences peuvent différer non seulement d'un secteur à l'autre, mais aussi entre les micro, petites, moyennes et grandes entreprises.
2. Clusters et « crossovers » (croisement sectoriels) : aider les PME à développer l'innovation et rencontrer des partenaires commerciaux.

Les PME manufacturières utilisent une combinaison de production interne et de partenaires externes pour développer et fournir des combinaisons produits-services. **Trouver des partenaires commerciaux possédant les compétences, les connaissances et les activités appropriées** est l'un des principaux obstacles cités par les PME. Les PME qui réussissent à établir des partenariats efficaces développent des partenariats nationaux ou internationaux pour l'informatique et la maintenance, mais aussi des partenaires du même secteur comme moyen d'augmenter l'échelle et l'accès au marché.

- Les pôles de compétitivités et clusters qui opèrent dans des secteurs semblables et différents peuvent favoriser la servitisation. L'Observatoire européen des clusters et des mutations industrielles (**European Observatory for Clusters and Industrial Change**) (et en particulier ses outils de soutien politique) et la Plateforme européenne de collaboration des clusters (**European Cluster Collaboration Platform**) devraient mettre davantage l'accent sur le concept de servitisation. Par exemple, la plate-forme pourrait soutenir l'échange d'expériences entre les gestionnaires de clusters européens (par exemple, sensibilisation, formation, conseils et mise en relation).
- La plateforme de collaboration des clusters européens (**European Cluster Collaboration Platform**) pourrait également lancer un partenariat européen dédié aux clusters stratégiques afin de soutenir l'innovation dans les combinaisons produits-services. D'autres recommandations sont de lancer un appel à la servitisation, similaire aux projets facilités par le Cluster INNOSUP pour les nouvelles chaînes de valeur industrielle.
- Le réseau **Enterprise Europe Network** pourrait faire de la servitisation un élément spécifique et organiser des événements de mise en relation autour de ce thème ou même cibler les services de l'économie numérique et circulaire. Le programme Horizon 2020 et en particulier son volet "Innovation dans les PME" pourrait inclure des appels spécifiques qui ciblent la collaboration dans le domaine de la servitisation.
- La servitisation pourrait être plus explicitement intégrée dans les **EIT Knowledge and Innovation Communities** (communautés de la connaissance et de l'innovation, IET), qui fournissent une plate-forme ouverte et un point de rencontre international pour le développement des innovations. Par exemple, la ligne d'action de l'EIT Digital Industry pourrait cibler des projets de servitisation dans le domaine des services numériques offerts dans le secteur manufacturier ou la CCI Climat pourrait se concentrer encore plus sur les offres de produits et services durables.

3. Accroître l'accès au financement pour l'innovation dans les combinaisons produits-services.

L'accès au financement est un obstacle important au développement de la servitisation, même si certaines PME ont reçu un soutien financier d'agences publiques au niveau régional, national et européen. Les PME et les experts ont souligné que les investisseurs privés et publics sont pertinents, tant pour le développement que pour la fourniture de combinaisons produits-services. Des investissements sont nécessaires pour les (nouvelles) machines, les systèmes informatiques, les processus, les compétences et les partenariats. Un point très spécifique est que les entreprises manufacturières qui migrent vers un modèle de location, temporairement, ont moins de chiffre d'affaires. A long terme, le chiffre d'affaires est plus stable et plus élevé.

- **Les investisseurs privés et publics doivent accroître leur compréhension de la servitisation.** Bien que les investisseurs aient un intérêt évident à comprendre les opportunités, les politiques européennes et nationales devraient soutenir ce processus. Les instruments peuvent inclure des études, des moniteurs et un guide spécifique pour mettre en évidence les principaux aspects de l'investissement dans les entreprises, les chaînes de valeur et les secteurs qui ajoutent plus de services (avancés) à leurs produits.
- Une deuxième ligne d'action consiste à veiller à ce que **les programmes de soutien public à la R&D et à l'innovation abordent ou, au moins, soient suffisamment souples pour soutenir la servitisation.** Par exemple, la plupart des programmes financés par les Fonds structurels et d'investissement européens manquent actuellement d'attention pour la servitisation, car elle n'est pas incluse en tant qu'approche innovante pour le développement économique et commercial. D'autres programmes, tels que le Fonds européen pour la stratégie et l'instrument PME exécuté par l'EASME, ne traitent pas de la servitisation dans leurs lignes directrices ou appels à propositions.
- Les aides publiques, telles que les programmes de développement des entreprises financés par les **Fonds structurels et d'investissement européens**, n'accordent actuellement pas

suffisamment d'attention à la servitisation. La servitisation pourrait être intégrée dans les priorités en attirant l'attention des autorités de gestion sur le potentiel de développement de concepts produits-services.

- Un autre système financier qui pourrait englober la servitisation, est l'"instrument PME" (**SME Instrument**) **géré par EASME dans le cadre du programme Horizon 2020** et qui fait partie du projet pilote du European Innovation Council.
- L'accès au financement pour les entreprises prestataires de services pourrait être amélioré en **réexaminant les critères d'éligibilité et d'attribution et l'orientation des mesures financières**. C'est souvent le type de projets attendus et approuvés qui empêche les PME de soumettre des demandes dans le domaine des nouvelles offres de services. Un autre problème pratique est que les coûts éligibles des régimes de soutien ne permettent pas de comptabiliser les coûts liés à la servitisation, qui pourraient être facilement modifiés et adaptés.
- **L'amélioration de la politique fiscale** est un autre moyen de soutenir la servitisation. Plusieurs États membres offrent des crédits d'impôt pour la R&D et l'innovation qui pourraient être étendus pour tenir compte des coûts des entreprises qui développent des services nouveaux et innovants en plus de leurs produits manufacturés. Le crédit d'impôt pourrait financer les coûts d'embauche de nouveaux employés qualifiés ou l'accès à des installations d'essais.
- Outre les schémas financiers traditionnels, la possibilité **d'utiliser d'autres sources de financement telles que le crowd-sourcing** ou les réseaux d'investisseurs providentiels pourrait également être explorée et traitée au niveau national et régional en soutenant spécifiquement les projets de servitisation.

4. Faciliter le marché unique européen pour les combinaisons produits-services.

En ce qui concerne la réglementation des produits, la réglementation du marché et la normalisation, les **PME se sont surtout penchées sur les lacunes du marché unique de l'UE**. Par exemple : harmonisation européenne insuffisante des labels écologiques, des normes de sécurité et de qualité et des normes techniques des composants, équipements et systèmes. Une question connexe est la multiplicité des systèmes nationaux d'enregistrement, de licences et de permis. En bref : les fournisseurs de combinaisons produits/services sont confrontés à l'insuffisance du marché unique de l'UE pour les produits et les services. L'étude a également révélé que les PME, en raison du lancement de services, ont gagné des clients dans un plus grand nombre de pays, ce qui souligne encore davantage l'importance des questions liées au marché unique de l'UE.

- La Commission européenne devrait aborder les **combinaisons produit-service** plus fréquemment lors de séances d'examen par les pairs, de contrôles et d'évaluations du marché unique de l'UE, que ces exercices mettent l'accent sur les produits ou les services ou non.
- Dans le même ordre d'idées, la Commission européenne pourrait évaluer si la servitisation (par exemple, les solutions intégrées) est effectivement abordée dans les forums de **normalisation** pour les produits et/ou les services, et dans les débats politiques sur le partage des données non personnelles. Par exemple, on pourrait explorer si les normes pour les solutions intégrées (par exemple, les types avancés de servitisation) sont discutées, ou devraient être discutées dans des forums qui se concentrent sur les produits et/ou dans des forums qui se concentrent sur les services. Le risque est que les solutions intégrées ne soient discutées ni dans les forums qui traitent des produits, ni dans les forums qui traitent des services.
- Les initiatives au niveau des politiques nationales sont essentielles pour faciliter le marché unique de l'UE pour les combinaisons produits-services. Par exemple, les **points de contact unique (Points of Single Contact)** pour les entreprises (étrangères) ne devraient pas créer de procédures difficiles ou d'impossibilités pour les entreprises qui fournissent des produits et des services, ou qui fournissent des solutions intégrées qui ne correspondent à aucune des deux catégories. D'une manière plus générale, les États membres devraient intensifier leurs efforts pour mettre en œuvre la directive sur les services de manière ambitieuse afin d'éliminer ou de réduire les nombreux obstacles qui entravent encore le marché unique des services et, partant,

les combinaisons produits-services. En outre, la collaboration entre l'UE et les politiques nationales est essentielle pour les examens par les pairs et les contrôles du marché unique de l'UE ainsi que pour les processus de normalisation européens.

5. Accroître la prise de conscience du potentiel de la servitisation

En plus d'accroître la sensibilisation des investisseurs et des gestionnaires de clusters (voir ci-dessus), un défi important est d'accroître la **sensibilisation des PME** à la servitisation. Il existe de grandes différences entre les pays en ce qui concerne la part des PME manufacturières et des grandes entreprises qui fournissent des services. Cela vaut aussi bien pour les combinaisons de produits et de services de base que pour les combinaisons de produits et de services avancés.

- Afin de sensibiliser davantage les PME au potentiel de la servitisation, **les plates-formes régionales et nationales existantes** sont susceptibles d'être les réseaux les plus efficaces et les plus efficaces. Il est recommandé d'identifier les initiatives politiques nationales et régionales qui se prêtent à une extension avec une formation, une piste d'atelier, une installation d'essai consacrée à la servitisation. Les organisations de clusters, les associations industrielles et les initiatives de soutien à Industry 4.0 ou à l'économie circulaire en sont des exemples.
- Les initiatives de sensibilisation ne devraient pas seulement se concentrer sur le potentiel de la servitisation en général, mais aussi sur des **aspects spécifiques tels que les services numériques, les modèles d'entreprise spécifiques, la contribution à l'économie circulaire et les spécificités existant dans certains secteurs**. Pour ce faire, les outils peuvent inclure des partages de bonnes pratiques, des ateliers et des outils pour la co-création de services avec les clients, pour le développement de nouveaux modèles d'affaires et l'atténuation des risques. La Commission européenne, par exemple en utilisant des plates-formes à l'échelle de l'UE telles que la plate-forme EUI4.0, le Digital Cities Challenge, le Centre de connaissances sur l'efficacité des ressources européennes, la plate-forme de collaboration des clusters européens peut garantir que les bonnes pratiques et les outils sont partagés entre les pays.

1 Introduction

1.1 Objectives of the study

The topic of this study is the **provision of product-service combinations by manufacturing SMEs in Europe**. In process terms: the extent to which manufacturing SMEs consider, develop and provide services ('servitisation'). The study has been prepared by a consortium of Technopolis Group, Dialogic and the Cambridge Service Alliance on behalf of the European Commission Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs and EASME (Executive Agency for Small and Medium-sized Enterprises).

The **general objectives** of the study are defined in the call for tenders (EASME/COSME/2016/O15):

1. To provide an evidence base that allows the European Commission to support SMEs in seizing the opportunities from servitisation and moving towards other forms of product-service provision, notably, by adopting digital service-based business models;
2. To develop tools for the European Commission to monitor development in this field, by building on an in-depth analysis of the existing and potential market for servitisation and other forms of product-service provision.

Specific objectives of the study are to analyse the servitisation market (including basic as well as innovative business services); to understand the process of introducing digital and other innovative product-service combinations (including the drivers, success factors and barriers); and to propose policy recommendations to fully exploit the success factors and address any barriers identified.

The main reason for launching the study is that although manufacturing companies have been providing services for many years, existing studies about this phenomenon focus on large companies rather than SMEs, while being based more on case studies rather than on quantitative data. Macro level quantitative data about servitisation is scarce because the services component is 'hidden' in the accounts of manufacturing companies and in the statistics about manufacturing sectors. Another reason for launching this study is the rise of digital technologies: internet connectivity, mobile apps, sensors, computing power, etc. Digital technologies increase the possibilities for SMEs to introduce product-service combinations: remote maintenance, online customer support and managing warehouses and machines on behalf of clients, etc.

1.2 Conceptual framework

The conceptual framework of the study can be summarised as follows:

- A typology with **five archetypes of product-service combinations and three cross-cutting aspects** (see below) is used to acknowledge the variety of services that can be linked to products. To some extent, the variety of services reflects the variety of products and manufacturing sectors, e.g. from chemicals and metal products, to electronic equipment, motor vehicles and pharmaceuticals.
- **A value chain approach** is taken to acknowledge that manufacturing SMEs provide their products and services to business clients (and other clients), while manufacturing SMEs may collaborate with suppliers and partners in the process of developing and providing services.
- **A holistic approach** is taken with respect to the factors that can influence the process of servitisation ('manufacturers providing more or different services') and the operational activities needed to provide product-service combinations. In the literature review and the case studies, the study explored the role of skills, organisational structure and culture (micro level), markets, sectors and value chains (meso level), research and innovation (micro, meso and macro level), policy and regulation (macro and meso level), framework conditions and environmental, social and economic challenges (macro level). Most of the factors can be relevant as drivers, success factor and/or barrier, depending on the SME, sector and national context. For instance, an SME can be successful in

servitisation because of in-house skills and innovation partners. Another SMEs may be hindered by a lack of relevant skills (digital skills, engineering skills, client management skills, etc.) and difficulties in finding innovation partners.

Chapter 2 will elaborate on the five archetypes of product-service combinations. These are:

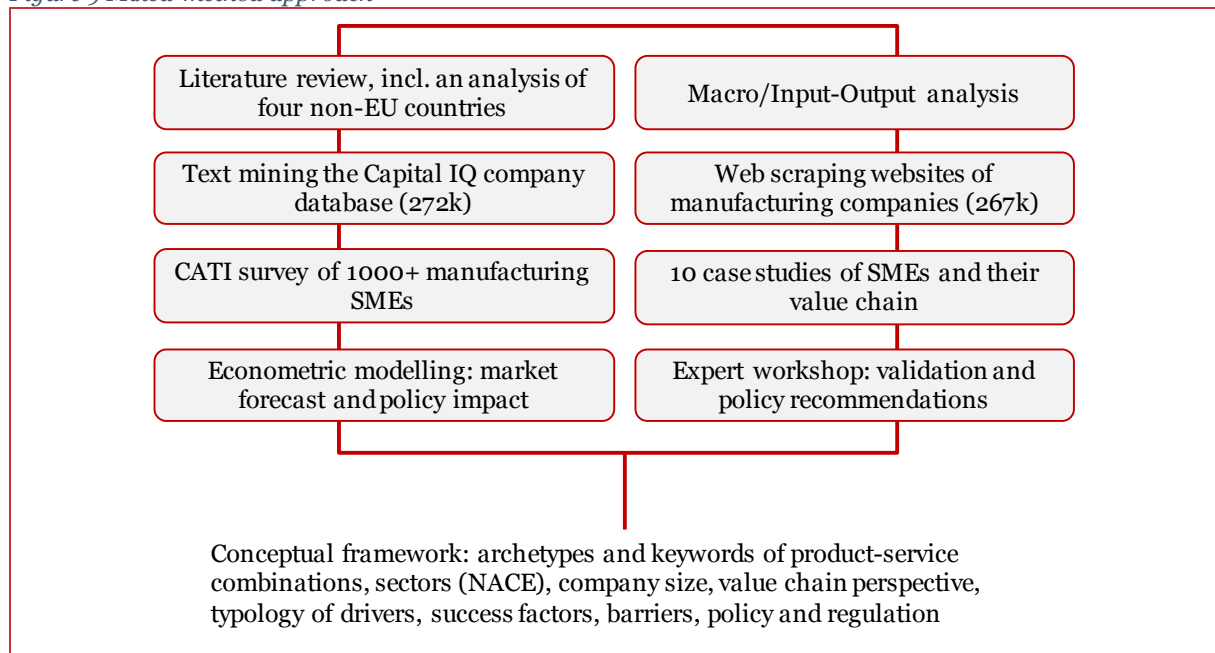
1. After sales services including helpdesk, training and spare parts;
2. Maintenance and repair services such as upgrades, monitoring and predictive maintenance;
3. Consulting, design and engineering services, before or after selling (or leasing out) a product;
4. Logistics and transportation services on behalf of clients (including warehousing); and
5. Full process outsourcing such as managing complete production lines or business activities on behalf of clients.

The three cross-cutting aspects are: I) digital services, II) financial, leasing, legal and insurance services, and III) circular economy-related services, e.g. services to increase the energy efficiency of clients, recycling and re-fitting. These cross-cutting aspects can be services themselves, but also drivers or enablers of other services. Chapter 2 will provide examples.

1.3 Mixed-method approach

The study combines **qualitative and quantitative methods** in order to understand and measure the provision of product-service combinations by European manufacturing SMEs and, to some extent, large firms. Figure 9 introduces the methods used.

Figure 9 Mixed-method approach



Source: Technopolis Group, Dialogic and Cambridge Service Alliance

Appendix A indicates the relevance of each of the methods for answering each of the research questions. Qualitative methods such as the literature review the survey and the case studies are most relevant for exploring the drivers, success factors and barriers of servitisation. Quantitative methods such as large-scale webscraping analysis were most relevant for measuring the servitisation market. Below, we present each of the methods.

The results of the **literature review** were used to refine the archetypes of product-service combinations and to identify the main factors to be addressed in the SME survey and in the case studies.

The bulk of the literature on servitisation (and related concepts) is about strategy and business models; touches on drivers, success factors and barriers; and provides indications about possible roles for policy and regulation. The literature review included a separate part about servitisation in Australia, China, India and the US. Here, the aim was to identify barriers and inspiration for developing policy and regulation. (Detailed results of the literature review are included in Appendix C of the report.)

The literature review and a quick scan of the websites of manufacturing SMEs were used to develop a set of keywords for the five archetypes of product-service combinations and the three cross-cutting aspects. These keywords were used when **text mining the Capital IQ company database** (that includes short descriptions of business activities) and when **webscraping** and text mining the websites of companies. In both cases, this concerned SMEs and large firms. (Detailed results of the Capital IQ database analysis are included in Appendix H of the report, while the results of the webscraping are to be found in Appendix I.)

The Computer-Assisted Telephone Interview (CATI) survey addressed manufacturing SMEs of which we had indications that they provide services. These indications were based on the text mining analysis using the Capital IQ database. Because of the short business descriptions and hence the need to rely on generic keywords such as ‘service’ and ‘solution’, the sampling approach led to ‘false positives’. In other words: manufacturing SMEs told the interviewer that they do not provide services or product-service combinations. This concerns 372 out of 1031 survey respondents. The non-servitised SMEs were asked questions about barriers and the role of policy and regulation. Servitised SMEs were also asked questions about the types of services, clients, partners and impact on turnover and employment. (Detailed results of the SME survey are included in Appendix K of the report.)

The **macro/Input-Output analysis** developed and tested a number of macro-level indicators about the service share (and value added) in the output of manufacturing sectors across Europe and selected other countries. These indicators could become elements of a Key Performance Indicators framework for monitoring product-service provisioning in the Europe. This framework could also include elements from the text mining exercises and from other, existing monitoring activities by the EU, Eurostat and other entities. (Detailed results of the input-output analysis are included in Appendix D of the report.)

Econometric modelling concerned the use of the survey data to estimate and forecast the volume of product-service provisioning in Europe (turnover and employment) and to explore the role of policy and regulation (according to survey respondents). (Detailed results of these estimations are included in Appendix P of the report.)

Ten case studies about SMEs and their value chain led to a rich description of drivers, success factors and barriers. The case studies were sampled to capture the different archetypes of product-service companies, sectors and countries. (Detailed results of the case studies are included in Appendix L of the report.)

Lastly, an **expert workshop** was held to validate the findings of the study and to develop recommendations for policy makers. The workshop was attended by experts and stakeholders, including the five members of the expert panel that provided methodological and topical recommendations throughout the twelve-month project.

The survey and the webscraping analysis covered **ten European countries**: Bulgaria, Czech Republic, Denmark, France, Germany, Italy, Latvia, Poland, Spain and The Netherlands. This set of ten countries allowed for a feasible yet representative study, looking into countries that lead or follow in terms of product innovation by manufacturing SMEs (Eurostat data), national competitiveness (Global Competitiveness Index by the World Economic Forum) and digital context (Digital Economy and Society Index by the European Commission). Appendix B provides the sampling framework. In order to increase coverage of COSME countries, over and above EU Member States, one of the case studies was done in Iceland. The macro/Input-Output analysis covers all COSME countries.

1.4 Structure of the report

Part A is the main report of this study and is structured as follows: Chapter 2 discusses the archetypes of servitisation; Chapter 3 presents the share of European manufacturing SMEs that provide product-service combinations; Chapter 4 elaborates on the process of servitisation; Chapter 5 discusses the barriers; Chapter 6 proposes policy recommendations.

Part B contains the Appendices with methodological details and the full results of the study, e.g. the literature review, Input-Output analysis, webscraping results, results of the Capital IQ company database mining and the survey results.

2 Five archetypes of product-service combinations

2.1 Introduction

This study refers to the provision of **product-service combinations** (specific types of combinations and solutions) and the **process of servitisation** (companies and sectors that add more or different services to their products). Both concepts are used in a neutral way. Individual companies, depending on their size, organisation, product, market and value chain, can have very different reasons to servitise to a large extent, to some extent, or to refrain from adding services to their products.

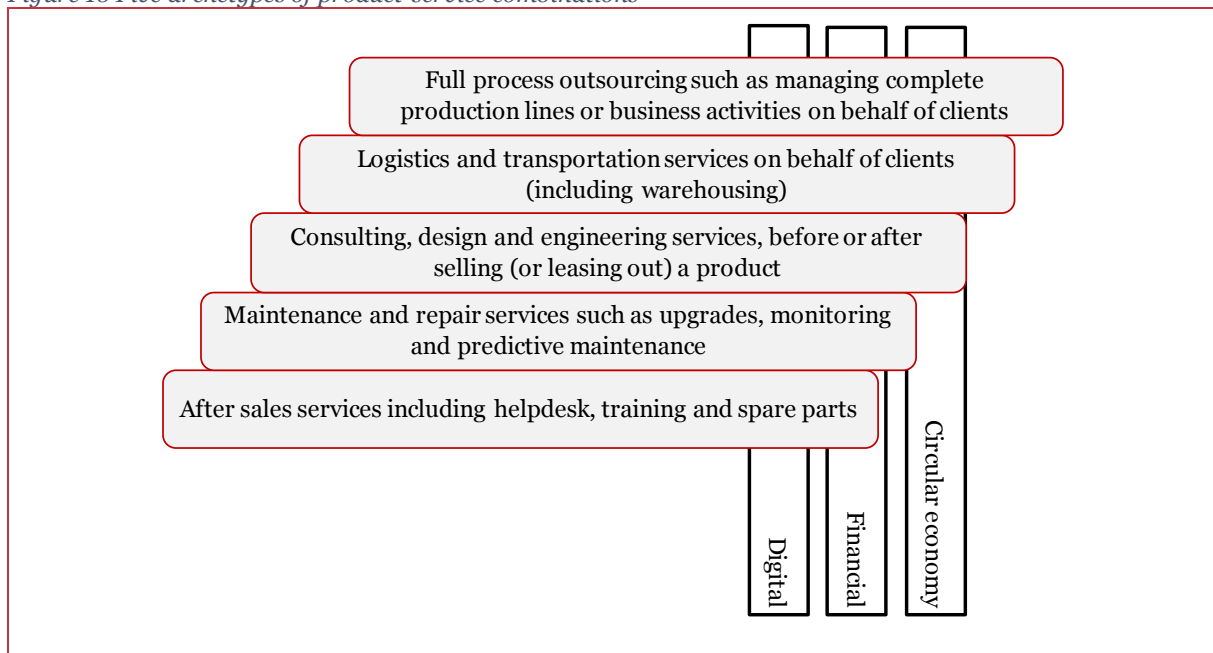
The study's terminology is based on academic literature. The emphasis in academic literature is on the process of servitisation. One example is Neely (2008): "*Servitisation involves the innovation of an organisation's capabilities and processes so that it can better create mutual value through a shift from selling product to selling Product-Service Systems.*" This definition refers to **changes in the capabilities and processes of manufacturers**. These changes are required to diversify from products into product-service systems. Note that our study prefers product-service *combinations* over product-service *systems* because the latter concept hints at advanced and technology-based systems. Servitisation concerns also basic after sales services and maintenance services.

The definition of White et al. (1999) refers to the **perspective of clients**: "*Servitising describes a business strategy which defines and serves a market's needs for speed, convenience, flexibility and other value-added attributes by changing the way in which the function embodied in products is delivered.*" This definition also points out that physical products are 'just' one way of providing clients with a function. One could argue that servitisation is less about diversification and more about a different way of providing functions. See for example the differences between selling products such as air conditioners and trucks and providing solutions and systems for managing air quality and logistics. Both products and services are essential components of these types of integrated systems.

Studies on product-service combinations and servitisation mostly concerned **large firms**. These studies differ in terms of the services that are covered by the definition of servitisation. Moreover, methods used and the moment of collecting empirical data differ. Studies published between 1989 and 2013 indicate that between one third and half of the large manufacturing firms provide services (Bowen et al., 1989; Cusumano et al., 2015; Neely, 2008; HM Government, 2012; Visnjic Kastalli et al., 2013).

This study differentiates between five types of product-service combinations (Figure 10 on the next page). This typology is adapted from Urmetzer, Neely and Martinez (2016).

Figure 10 Five archetypes of product-service combinations



Source: Technopolis Group, Dialogic and Cambridge Service Alliance

The ‘ladder’ with five types of archetypes implies that manufacturers, by means of providing services, **engage with their clients**. From the perspective of clients this concerns the use and maintenance of products (the first two archetypes), specification or co-design of the product (the third archetype), outsourcing their logistical activities (the fourth archetype) and outsourcing parts of their primary process (the fifth archetype). As such, services can be used to support the product and to support the activities of the client (Eggert et al., 2011).

The next five sections will illustrate the five archetypes and the three cross-cutting aspects. **Digital services** can be specific services that are provided and they can be a driver or enabler of product-service combinations. For example, remote monitoring, maintenance and upgrades can be specific services as well as enable remote operating of machines that are sold or leased out to clients. The second cross-cutting aspect, **circular economy**, can also refer to specific services (e.g. recycling) and can be a driver or enabler of product-service combinations. For example, when manufacturers collect real-time data about the performance of the machines and production lines of their clients, this data can be used to increase the material/energy efficiency of these machines and production lines. The third cross-cutting aspect, **financial services**, includes leasing, insurance and other financial services as well as any legal services (e.g. legal advice) that are linked to products.

The study neither addresses how manufacturing companies **stop with manufacturing activities** and start focusing purely on services (like the IBM example for large companies), nor how **service providers diversify into manufacturing** (for instance, by leveraging their knowledge about clients and markets, installing flexible production lines and providing ‘manufacturing as a service’).

2.2 After sales services including helpdesk, training and spare parts

The archetype after sales services details any interaction that would take place in a classic service structure of selling a product and then selling or creating value through additions of the product sale. This may include selling of spare parts, training or a general help desk. Our research and the analysis of literature show that manufacturing SMEs enjoy a higher revenue created by selling spare parts for a machine throughout its lifetime, rather than selling the machine itself. In the case of the Italian coffee machine manufacturer Dalla Corte, the after sales services contribute to 20% of the turnover. The type of provided after sales services depends on production activities in companies.

Having spare parts' offerings means that the manufacturing company needs to produce them and have storage, as well as, distribution channels in place. To ensure the timely delivery of after sales services to end-customers, for example the provision of spare parts by Dalla Corte, and the overall good quality of service, the production, value chain and collaboration with customers should be well-organised.

Training is often used to enable maximum use of the machines or products to be manufactured. This interaction sometimes gets bound to a sales contract or is offered to gain additional revenue. Moreover, there are cases where a firm sends to a training its representative, who will then try to deliver the training to other colleagues and increase the overall quality of business processes in a company. General examples in the case studies provided are the Italian coffee machine manufacturer Dalla Corte and the Czech firm ComAp. Both are providing trainings to their customers and use digital means of communication to facilitate collaboration. More specifically, the Italian coffee machine firm publishes webcasts with explanations on machines, competitions and general communications regularly. The Czech case firm is using webinars for trainings worldwide to support their customers.

2.3 Maintenance and repair services including upgrades, monitoring and predictive maintenance

In a wider literature, maintenance and repair services are described as the opportunity for a supplier to give further support to the customer. This can be the classic repair and warranty fulfilment approach, a monitoring approach to understand the status of a machine or provided product. For the provision of this type of service, some advanced machines have been developed; they are capable to predict a failure and to ensure that predictive maintenance will take place in time. Such machines, usually complemented with sensors, provide information about the status of a product, analyse received information on usage and inform about the need to replace parts of a product or machine.

It always represents a high value for the customer to have access to the timely and efficient repair or maintenance of products and machines. In above-mentioned case studies, a small repair service is offered locally. The monitoring of a product through technology, software and cloud storage supplied by the Czech firm ComAp has a direct impact on sustainability and life-time of a sold product. In addition, monitoring devices enable to account for a level of green energy production, thereby impacting the circular economy.

2.4 Consulting, design and engineering services, before or after selling (or leasing out) a product

Consulting, design and engineering services can be found in different ways. In general, this means to add some form of intelligent service to the manufactured product. This can occur before the production of a product or after.

The Latvian company Sakta, mentioned in our case studies, produces workwear and offers sewing, design, modelling and embroidery services. The company Arreche (Spain) is offering machining, as a service, and engineering services throughout the process. Such approach allows to reach the highest quality in the production process. In general, the provision of consulting design and engineering services indicate that the firms are providing customer support to improve the manufacturing process or a product they provide.

The case firm Houweling is offering design and engineering services to deliver circular economy / re-usable packaging. The firm engages in the design and collection of the packaging, which, if broken or damaged, will be re-used.

2.5 Logistics and transportation services on behalf of clients

Offering logistics and transportation is often outsourced to other firms, however, the delivery of product is relatively common among SMEs. In our case studies, we have found that most firms engage in the use of such services and source them on the market. The case firm in the Netherlands is offering what they call 'Total Site Service', which is represented by the bundle of services, namely, storing, delivering,

recollecting and repairing/recycling services for all plastic packaging they are offering. The firm engages in storing of products, but then as well in delivering and picking up products they have produced.

2.6 Full process outsourcing including management of production lines and other business activities on behalf of clients

Full process outsourcing including and managing of production lines is by definition an integration into the customer firm. The types of process that can be integrated into the customers' business are endless. This shows that offering services provides the manufacturer with the opportunity to move close to the customer's business and to create value for its operations by fully integrating itself into the customer's operations. This, for example, enables the machine manufacturer in Arreche (Spain) to move into producing and supplying parts for businesses. Specifically, the company specialises in provisioning supply parts for complex machines, as customers lack capability to do this in-house. The Spanish firm conducts quality check of machines, benefiting from the availability of skilled workforce. The Dutch case firm Houweling is engaged in the production of packaging, storage and as well in the collection and re-use of its products.

3 Share of European manufacturing SMEs that provide product-service combinations

3.1 Large differences between European countries

The interaction between services and manufacturing industries has been **increasing** between 2000 and 2014 for all EU28 countries as the analysis of inter-industry trade flows showed. In terms of the share of service intermediate inputs in manufacturing the top-five countries are Germany, Italy, France, Spain and the Netherlands. However, as shown on Figure 3 and Figure 4, the text-mining of company websites and business descriptions found a diverse country pattern to what extent small and medium-sized firms are servitised (please see Appendix J for the full webscraping analysis).

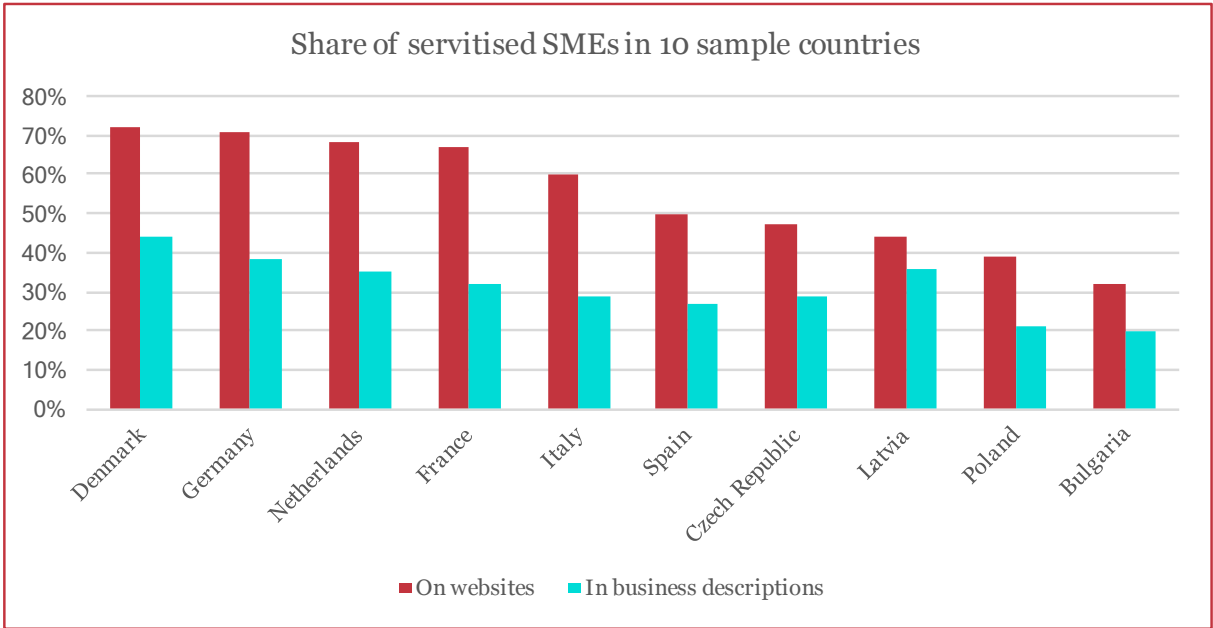
In the forefront, countries such as **Denmark, Germany, Netherlands and France** exhibit around **70% of manufacturing firms (and SMEs) with bundled product-service offers**. In contrast, in **Latvia and Poland 40%** and in **Bulgaria 30%** of SMEs have been identified as servitised. **Italy, Spain and the Czech Republic** are in the middle of the group with an approx. **50%** level of servitisation. The business description analysis found a lower share notably around 40-15% but with a very similar country pattern. The relatively high figure in Denmark or Germany can reflect that products and service provision are very much coupled in these countries and it is wide-spread that firms try to engage their customers through different types of services besides their core manufacturing business. As the case studies highlighted, some types of general services have been offered since the establishment of some of the manufacturing firms. For instance, in Poland, the metal producing firm ZWM has been offering assembly, installation and delivery services right from its start, as clients could not transport or install a metal construction themselves. In addition, it has to be stressed again that our analysis took into account both the simple services such as a helpdesk or an online payment facility and more complex ones such as a mobile application or process outsourcing, which is another reason behind the relatively high shares.

This cross-country pattern seems to **reflect the national economic development levels** and the industrial structure as well. For instance, Denmark and Germany that lead in the number of servitised firms (as captured by the webscraping analysis), are also countries with a high GDP and with the highest innovation performance as measured with the indicator 'Product innovation by manufacturing SMEs'. In some of the countries such as Denmark and the Netherlands, servitisation is enabled by a strong digital and service sector as shown by the scores of the Digital Economy and Society Index (2016). The relatively higher servitisation level of the Czech Republic can be a result of its industrial structure, being a smaller country close to domestic and German clients, and with important manufacturing sectors that offer after sales, maintenance and consultancy services.

Differences are also to be observed in the **services’ value added content across manufacturing sectors** that has been captured by input-output tables. Services’ value added content can help to clarify how intermediate inputs translate in the actual ability of adopting value-adding production processes (i.e. producing advanced, high-tech and/or customised products) as a source of competitive advantage. A general increase of services value-added in manufacturing production has been observed but there has been a dynamic of substitution from service value added participation from domestic to foreign manufacturing demand (please see Appendix D for the full input-output analysis).

Figure 3 shows the level of servitisation expressed as the share of SMEs servitised in total manufacturing in the 10 countries selected for the purposes of this study. Please note that the company website analysis covered only ten EU countries while the business description and input-output tables captured all EU Member States. The Figure depicts both **the results of the webscraping and of the analysis of business descriptions**. The webscraping found a higher level of servitisation across all the ten countries than the other methodology, however the results are in line in terms of ranking Denmark, Germany and the Netherlands as the most servitised and Poland and Bulgaria as the least servitised ones. The business descriptions might not always mention the specific services in cases where the company was presented in a very concise way, not holding it important to detail the activities (or the information was simply missing) and it must be kept in mind that the coverage of this specific data is low. The webscraping captures 20% of SMEs in average and by definition it can gather information about those firms that have an online presence. Hence, this method might overestimate servitisation somewhat given also the limitations of the semantic engine in capturing the archetypes (they might capture the concept also used in another context) even if a good number of tests and manual checks have been performed and the algorithm was fine-tuned to the highest possible extent. The final estimation of the level of servitisation should lie somewhat lower than the webscraping results.

Figure 11 Share of servitised SMEs in 10 selected countries in the EU



Source: Technopolis Group, Dialogic and Cambridge Service Alliance (based on the tool of SpazioDati)

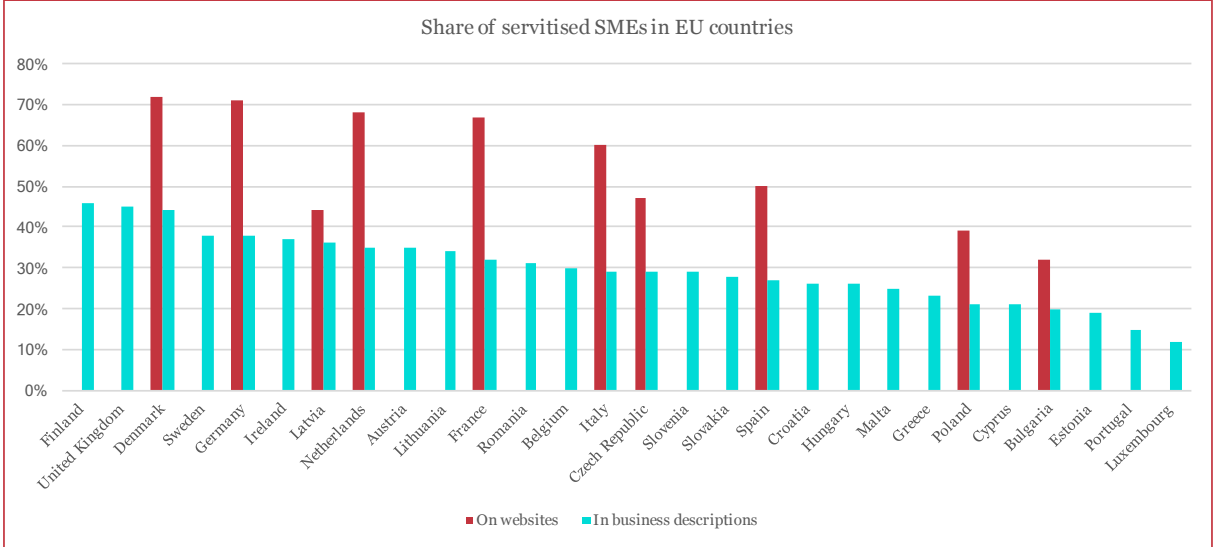
Two methods have been used to estimate the **number of servitised firms in the manufacturing sectors across EU countries**, notably the business descriptions of small and medium sized companies have been text-mined and company websites have been webscraped and analysed. Firm-level databases such as Capital IQ include the description of activities of firms and company websites naturally communicate about the services offered in addition to the manufactured products in order to attract more customers. In terms of **representativeness**, the webscraping managed to cover a large share of the manufacturing sector in the ten countries selected notably around 12-35% of the manufacturing firms, which meant the web-scraping of 267,254 websites in the ten selected countries.

The Capital IQ managed to analyse a smaller sample, around 1-4% of firms. The coverage of manufacturing industries is balanced in all samples. One important difference in the analysis is that while the webscraping captures the level of servitisation in both SMEs and large companies, the analysis of business descriptions focused only on small and medium-sized companies.

In order to provide a better idea about these methodologies, we bring an example of a business description in the database that captures the mix of offering both machinery products and consulting services “3MO Performance manufactures tools and special machines for automotive industry. It provides gear boxes with hydraulic operated gears for motorsports vehicles; and reducers for electric motors. The company is also engaged in engineering services and pipelines projects”. The website of the German company called Sigma Laboratory Centrifuges² that manufactures laboratory centrifuges also communicates about the services offered: “We perform maintenance on our centrifuges. This ensures reliable operation of the parts concerned as well as safety at work and productivity. We support you by keeping track of due dates and remind you when your maintenance service contract is up for renewal. On request, we calibrate your centrifuges using certified instruments, and we certify conformity for you. Our advanced, automated high-bay warehouse enables the prompt provision of all available spares and wearing parts, and as a matter of course we supply only OEM-grade parts. We can deliver by express or courier service on request.” Hence, both methods provide a good pointer to capture the service offers of manufacturing firms.

When we look at the comparison across all the EU-28, at the top we find further countries such as the **Finland, UK, Denmark and Sweden** and at the lower end countries such as Portugal and Greece. Figure 12 provides the full EU-28 overview based on the analysis of business descriptions. As mentioned above, the webscraping delivered results only about the 10 selected countries.

Figure 12 Share of servitised SMEs in all EU countries



Source: Technopolis Group, Dialogic and Cambridge Service Alliance (based on the tool of SpazioDati)

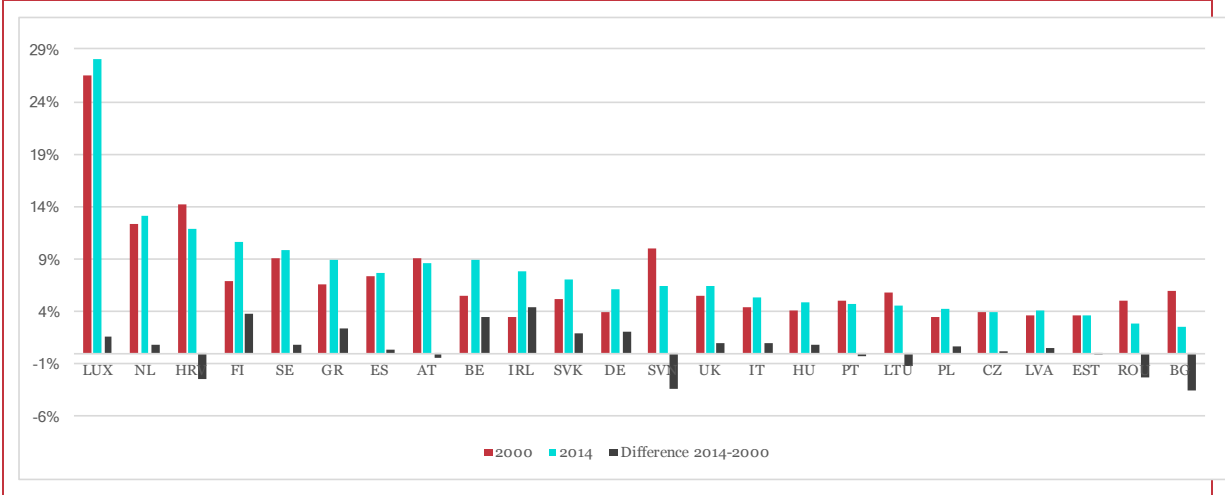
This cross-country analysis conducted at the level of firms is also in line with the broader macroeconomic perspective looking at supply and use tables. The indicator ‘Service share in total manufacturing output’ has been used at macroeconomic level to gain a further understanding about the inter-relations between manufacturing and services from an end-product perspective. The service output (such as legal, advertising, wholesale and retail, R&D or training services) appears as secondary product in the production of the manufacturing industries and this is why this indicator is one of the

² Sigma. (2018). Maintenance, calibration, and maintenance services contracts. Available at: <https://www.sigma-zentrifugen.de/en/service/maintenance-calibration-and-maintenance-service-contracts.html>

closest ways to capture servitisation by using macroeconomic data (please see the full input-output analysis in Appendix D).

The macroeconomic analysis found that looking at the situation in 2014, the top-five countries for share of secondary products of services in manufacturing production, are **Luxembourg (28%), followed by the Netherlands, Croatia, Finland and Sweden** (between 10% and 13%), again similar countries popping up at the top of the ranking. Most of the Eastern-European countries are at the opposite side of the spectrum, with shares around 4% to 5%. Overall, the service share in total manufacturing output has increased between 2000 and 2014 for the large majority of the EU countries analysed.

Figure 13 Service secondary products of manufacturing output 2000-2013



Source: Technopolis Group, Dialogic and Cambridge Service Alliance, based on the WIOD SUT tables

In terms of the size of the companies, the webscraping provides further insights into the servitisation pattern of **large vs small and medium-sized companies**, while the business descriptions captured the patterns in micro, small and medium sized firms. The analysis found that unsurprisingly, a larger share of large firms than of SMEs offer product-service combinations. This holds across all the ten countries. Nevertheless, the differences are not very big in all cases and in some countries or some sectors, SMEs demonstrate a servitisation level close the level of servitisation by large companies.

The webscraping also found that for instance in the case of Bulgaria or Latvia a relevant share of companies that are servitised are **subsidiaries of international firms** although they appear as an SME given the lower number of employed people.

Similarly, the **share of SMEs that servitise, increases with company size**, with micro companies scoring lower than small firms, and small firms scoring lower than medium-sized companies as the survey and the Capital IQ text mining analysis found. There are exceptions such as many micro companies that provide design, consulting and engineering services.

Analysing the servitisation level of firms in non-European countries such as the **United States, China, India and Australia** provided an international outlook and comparison.

Neely (2013) used data from the Capital IQ database to analyse the levels of servitisation in a number of countries, among others the United States. According to this study, 30.64% of manufacturing firms in

³ Denmark, Cyprus and Malta should not be considered for this indicator because of poor data availability. No secondary production is displayed for France, either; it was not possible to recover a clear explanation for this; however, it is very likely that that the explanation relates to data sources and construction of the supply tables.

the United States are servitised, which is at the level of Sweden of Finland but clearly higher than the EU average.

In China the current transformation of the manufacturing industry is generally conceived as a first phase in the transition towards a true service-oriented manufacturing industry, as most manufacturing services are only starting to add a limited set of services to their current product portfolio (Liu & Granadox, 2015, p. 3253). Service where not ownership of the product, but its use or the subsequent end result are the services sold, are not yet offered on a large scale (Liu & Granadox, 2015). As such, industry services are currently qualified as “immature” (State Council, 2015, p.4), “in the explorative phase” (Industrial Policy Division, 2016) and “underdeveloped” (Molnar & Wang, 2015, p.5).

In India in terms of sectoral differences in servitisation, little extensive research has been conducted. According to the available literature, the construction and infrastructure sector is one of the most servitised sectors in India. While it is acknowledged that services are profitable (CNBC, 2015), the ultimate priorities of Indian manufacturing leaders are focused on increasing the share of manufacturing in GDP and job creation (CNBC, 2016; WEF, 2016). Discussed tools to achieve this are improving India’s infrastructure, making it easy to do business, attracting foreign direct investment, increasing the brand ‘Made in India’ and changing labour laws (WEF, 2016).

In Australia various studies have (quantitatively) described the state of servitisation of manufacturing firms. In 2009 Neely conducted a study to empirically explore the phenomenon of servitisation. According to this study, 22.7% of Australian manufacturing firms were servitised in 2007. Another study from Neely and others (2011) shows that in 2011 approximately 28% of Australian manufacturing firms are servitised (please see the full analysis of third countries in Appendix F).

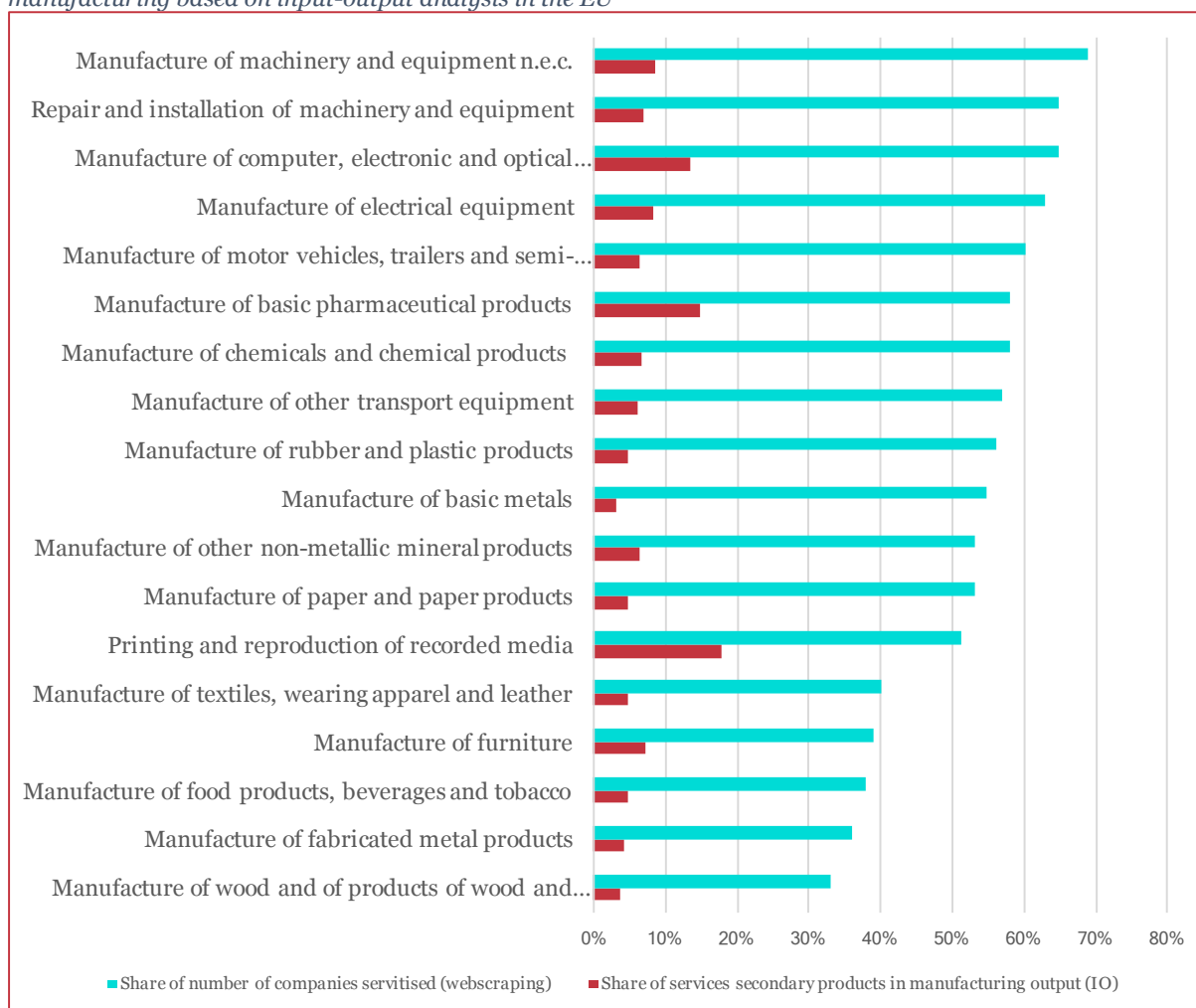
3.2 Substantial differences between manufacturing sectors

The literature on servitisation contains many case studies on sectors such as manufacturing of machinery and equipment, chemicals and chemical products, aerospace and medical instruments. Nevertheless, the understanding of the comparative position of all manufacturing industries has been weak so far. In this analysis, further insights were gained into the sectoral patterns of servitisation. The webscraping analysis found that the most servitised sectors in the aggregate of the 10 selected EU countries are: **Machinery and equipment, Repair and installation of machinery and equipment and Computer, electronic and optical products** notably with a high figure of approx. 65% of firms servitised within these sectors (see Figure 14). There are several other sectors that show a servitisation level close to 60% such as **Electrical equipment, Motor vehicles and trailers** where after sales, maintenance and consulting services are the most common. The **Basic pharmaceutical products** industry is also highly servitised given especially consultancy services that they offer (e.g. advising pharmacy stores) but also digital and logistics services that are common (e.g. services provides to cure and care providers such as hospitals).

We have to keep in mind, that the industrial classification ‘Repair and installation’ captures many firms that consider services as their core business, hence we are not talking about a pure manufacturing sector in this case but one that is serving other manufacturing industries (by definition). The servitisation level of individual sectors depends on the industrial structure of each country and the total sectoral results either amplify each other or even each other out when aggregating.

The servitisation level of manufacturing sectors was also analysed based on the business descriptions of manufacturing SMEs. Similarly, the analysis found that the most servitised sectors are Motor vehicles, trailers and semi-trailers, Other transport equipment, Rubber and plastic products and Basic metals.

Figure 14 Servitisation of manufacturing sectors based on webscraping and services secondary products of manufacturing based on input-output analysis in the EU



Source: Technopolis Group, Dialogic and Cambridge Service Alliance (based on the tool of SpazioDati and on WIOD tables)

At macroeconomic level, the same indicator detailed by manufacturing sector illustrates that the highest share of secondary products of services in manufacturing output are created in manufacturing sectors linked to ICTs as well as to the pharma sector:

- printing and reproduction of recorded media (18%), and
- computer, electronics and optical products (13.5%), and
- the pharma sector (15%).

Relatively high shares are also registered for:

- manufacture of machinery and equipment (8.6%) and manufacture of electrical equipment (8.4%).

3.3 Types of product-service combinations offered

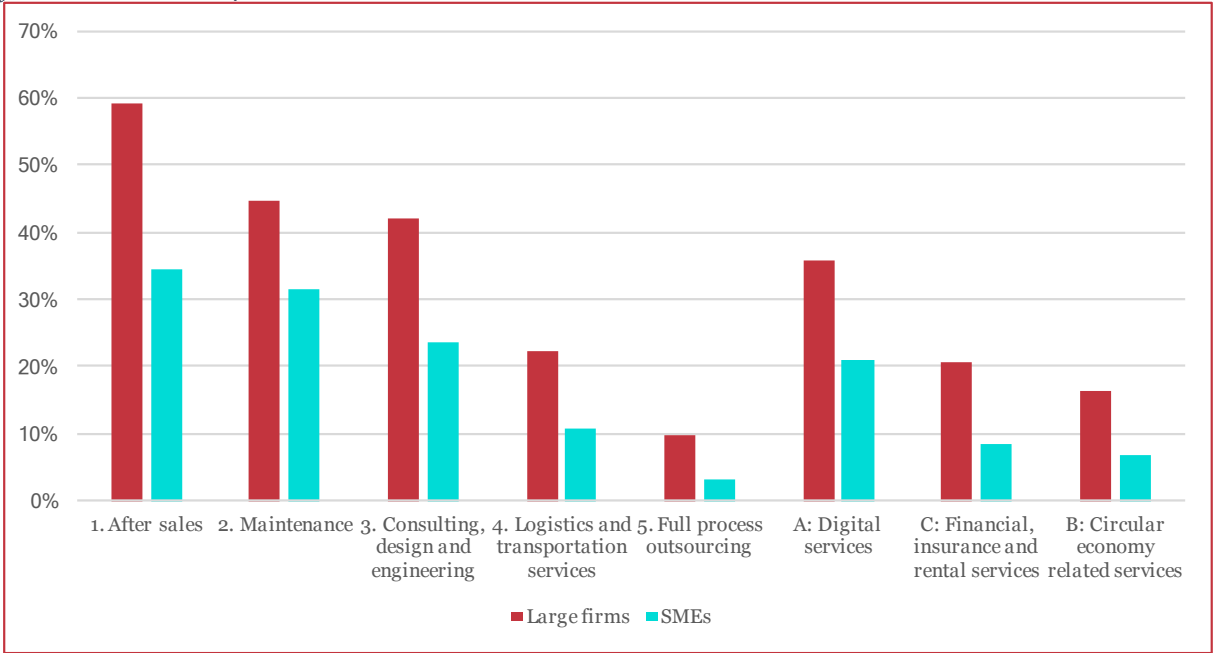
The analysis provided further insights about the servitisation level of EU countries across five selected archetypes and the three cross-cutting services. Although the average results indicate that there is a decreasing intensity of servitising from after sales to process outsourcing, **the servitisation ladder does not fully apply** in the sense that companies move from less complex service provision such as

after sales to more complex ones such as logistics. In many countries, consultancy, engineering and design services are offered to clients to a similar extent as maintenance services. The relevance of different archetypes depends very much on the nature of the specific sector. For instance, naturally the machinery industry is more engaged in maintenance and repair, while the wood or furniture industry offers more often logistics and transportation services.

With regard to the three cross-cutting archetypes, **digital services** are provided more often than services related to financial, leasing and renting services or services related to the circular economy. This picture emerges from the webscraping, the survey and the Capital IQ text mining analysis. The webscraping results are depicted in Figure 15.

When analysing the picture of individual countries, we find different patterns. For instance, in Germany, it is maintenance, after sales and consultancy, design and engineering services that are the most common product service combinations with above 40% of companies indicating such activities on their websites. The ladder model thus does not apply in the case of Germany as consulting design and engineering is equally common as the more 'basic' after sales services. Digital services are also relatively common with 27% of the companies webcrawled. The least common archetypes are financial, insurance and rental services and full process outsourcing. In the Czech Republic, after sales services are the most popular services offered by manufacturing firms, followed by maintenance, consulting, design and engineering. Logistics or financial product-service offerings are much less common.

Figure 15 Level of servitisation according archetypes and company size class as the average share of servitised firms in the total sample



Source: Technopolis Group, Dialogic and Cambridge Service Alliance (based on the tool of SpazioDati)

Looking at the archetypes as applied by **SMEs versus large companies** it is observed that SMEs are less servitised compared to large companies. In the case of both SMEs and large companies a similar pattern is observed with after sales, maintenance and consulting, design and engineering ranking as the top 3 servitisation archetypes followed by digital services. The most expressed differences between SMEs' and large companies' servitisation activities are in the 'basic' archetypes of after sales and maintenance and also in the cross cutting archetypes digital services and circular economy-related services (expressed by a 20% and higher differential). After sales and maintenance services are offered by different types of enterprises. Companies in the machinery sectors that offer maintenance services also provide after sales services. There are, however, other sectors that offer maintenance specifically and are not captured within after sales.

3.4 Innovative product-service concepts

While analysing company websites, we have specifically explored and compared the share of innovative product-service combinations that are offered by manufacturing SMEs. Process outsourcing as the most complex form of the servitisation ladder and digital and circular economy services as cross-cutting services are innovative archetypes on their own, but for instance digital services include a large variety that are worth being further analysed.

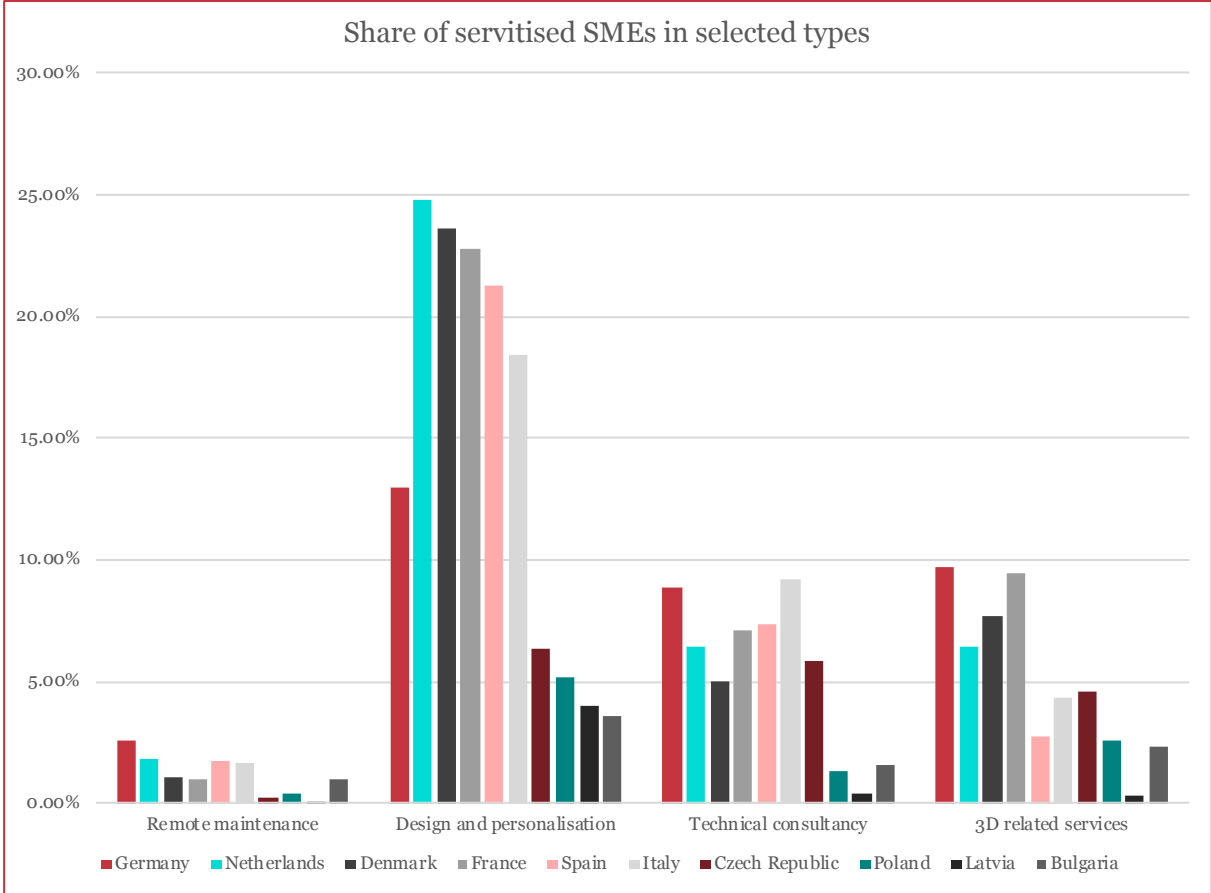
In order to further deepen our research, we have selected a number of sub-archetypes based on the results of the literature review and case studies, which are the following:

- **Remote maintenance** within 'Maintenance' (including maintenance supported by digital applications);
- **Design and personalisation** within 'Consulting, design and engineering' (including design, customisation, individualisation);
- **Technical consultancy** within 'Consulting, design and engineering' (including more complex engineering and technological support);
- **3D** within 'Digital services' (including both 3D printing and 3D related services).⁴

We have looked at both the **country and sectoral patterns** and found that Germany stands out in terms of remote maintenance, technical consultancy and 3D related services. Netherlands and Denmark perform the best in design and personalisation services, Italy is distinct especially in technical consultancy services (Figure 16). In terms of sectors, remote maintenance is the most common in 'Machinery and equipment', Design services in 'Printing and reproduction of recorded media', 'Electrical equipment' in technical consultancy and 'Machinery and equipment' in 3D related services. We highlight the sectoral distribution of design services in Figure 17.

⁴ 3D includes both digital 3D modelling services and more complex 3D printing services in this case.

Figure 16 Share of SMEs offering selected innovative product-service combinations



Source: Technopolis Group, Dialogic and Cambridge Service Alliance (based on the tool of SpazioDati)

Figure 17 Sectoral patterns in design and personalisation services



Source: Technopolis Group, Dialogic and Cambridge Service Alliance (based on the tool of SpazioDati)

3.5 Impact of servitisation on employment and turnover

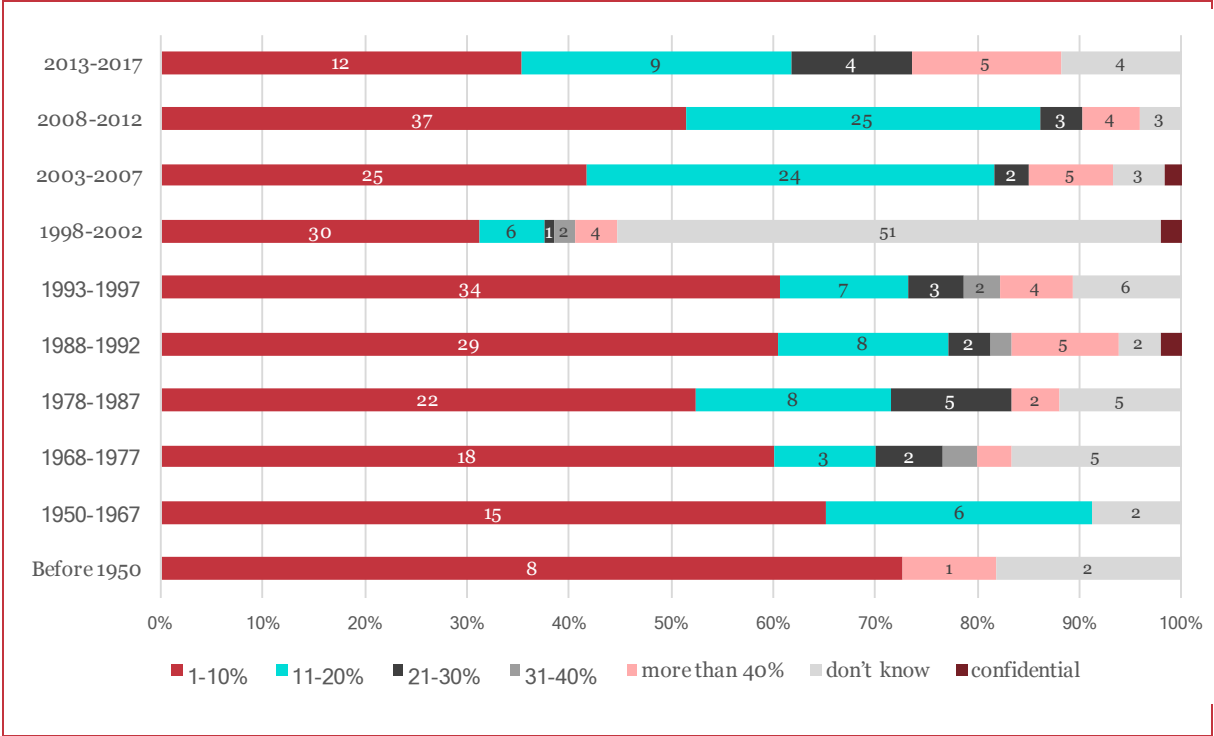
Survey respondents report several types of positive impact of servitisation. Between 61% and 87% of manufacturing SMEs that provide services, **employed additional people** as a result of starting to offer services (product-service combinations). For manufacturing SMEs that introduced services thirty years ago (or more) the figure is closer to 87%; for manufacturing SMEs that introduced services ten years ago (or less) the figure is closer to 61%. This timing effect also emerges when looking at the *number* of additional people hired as a result of servitisation. Overall, 45% of relevant SMEs report between 1 and 10 additional people. Manufacturing SMEs that introduced services decades ago report up until 50 additional people, or more, as a result of servitisation. Between 70% and 80% of respondents expect to hire between 1 and 10 new employees, per year, as a result of providing services.

These employees are not only needed to develop and provide services but also to accommodate increased production and sales of products, that benefit from the services linked to them. This includes products and services sold to **new clients located inside and outside Europe**. Survey respondents mentioned that providing their product-service combinations relies more on **in-house production** than on external partners/suppliers. This result is consistent with statements about employing additional people.

Along the same lines, the large majority of manufacturing SMEs that provide services, report an **increase of revenues** as a result of introducing services. For most SMEs concerned, this annual

increase in turnover is between 1 and 10%. Figures are higher for SMEs that introduced services 20 years ago or more, which may indicate that they succeeded in exploring and monetising the potential of combining products and services.

Figure 18 The number of manufacturing SMEs, per period of launching services, that indicate their average annual % increase in turnover (N=425)



Source: Technopolis Group, Dialogic and Cambridge Service Alliance

Respondents were equally clear and positive about the impact of servitisation on their **profit margin**. More than 50% of relevant SMEs reported an increase of their profit margin of 1-10%, over the last two years. Micro firms are most optimistic about their increased profit margin, the next two years. More than 50% of micro firms expect their profit margin to increase with more than 20%.

These types of impacts are also mentioned in literature, although there are few articles that contain empirical data about the impact of servitisation on SMEs.

3.6 Market estimation and forecast for manufacturing SMEs that provide PSC

One of the objectives of this study was first to make an EU estimate for the **share of employment linked to services** in the manufacturing industries, and second to **assess the service turnover** of manufacturing. The focus of the study was small and medium sized enterprises; hence the results refer only to manufacturing SMEs.

In order to quantify the level of services related employment and turnover in EU manufacturing we relied on the results of the webscraping analysis and of the survey that provided insights about the share of servitised firms, the share of employment and the share of turnover related to servitisation. In the survey, companies have been asked how many additional people they employed as a result of their servitisation activities and whether they have experienced a growth in turnover and if so how much. We have complemented these results with data from the Structural Business Statistics in order to estimate the overall EU performance.

It has to be noted that this exercise only provided a rough estimate given that we could not gather a sectorally representative sample from the survey and we had to make several assumptions such as

extrapolating the results of our sample to all EU countries, including those countries that have not been covered by this study directly.

The webscraping analysis and the survey focused on 10 countries from the EU-28 that had been sampled based on a range of indicators such as CIS, DESI and the Global Competitiveness Index, which helped to obtain a broad and representative coverage. We have relied on the same groupings in order to extrapolate the results of the analysis. In a second step, we created projections of average future turnover growth on the basis of the survey results with respect to the future development of SMEs' servitisation activities. We applied a simple forecasting exercise using linear extrapolation to a period of 5 years (2017-2021).

The results of the estimation indicate that **around 10% of persons employed in manufacturing SMEs in the EU are involved in providing product-service offerings** and servitisation brought between **1-10% of average annual increase of turnover**⁵ for the servitised SMEs. Moreover, **the service component of product-service combinations was around 12% of the EU manufacturing turnover** in SMEs. To put these figures in context, a study conducted in France found that firms (both small and large) that started selling services experienced a 30% increase in their employment and an increase in their total sales by 3.7% (Crozet and Milet, 2015). (The detailed results of the estimations are presented in Appendix O of this report).

When comparing these figures with estimates about the broader Industry 4.0 developments, BCG (2015) predicted that, by 2025, Industry 4.0 will lead to increased revenues in manufacturing and service sectors adding up to 1% of GDP in Germany. As such, this specific effect may seem small, while other types of effects can be more substantial (business models, productivity, quality, etc.). Existing research provides nuanced predictions regarding Industry 4.0 and employment, given the uncertainties due to automation and robotics, with substantial differences between optimistic and pessimistic scenarios at the level of sectors, and opportunities and challenges at the level of individual companies (PwC, 2016).

In terms of future growth, the calculations in this study show that the **future servitisation market will grow by approx. 5% in terms of turnover in the manufacturing industries by 2021**. These findings show that indeed for some manufacturers, services ensure additional revenues along with product sales as this has been also identified as the key driver behind servitisation in the literature. As mentioned above, the servitisation market here refers to the SME part of the market, i.e. the service revenues of manufacturing SMEs.

Nevertheless, we have to keep in mind that servitisation does not necessarily lead to more turnover or require more staff even if we look at the more advanced archetypes such as digital services. For example, design and consulting services and smart maintenance services provided by manufacturers, may lead to more intense relations with clients and more efficient equipment and machines (e.g. use of energy and materials) but this does not necessarily lead to more turnover. For many SMEs, it is exactly these other drivers that are behind investments in servitisation. Based on the survey results we learnt that 70% of interviewed firms consider as an important factor, the availability of the right suppliers and business partners. Hence, servitisation does not always result in an employment increase in house but it influences the number of employees of specialized service providers. This partnering approach, however, does increase the revenues of the manufacturing company.

Table 1 below shows the present and predicted turnover increase by servitisation by country with median, minimum and maximum values. The analysis of the possible development of the EU product service market was based on the perceived future development of servitisation activities of companies as recorded in the survey conducted in the context of this study. The estimates of the future evolution of the product-service market in the EU are provided in terms of economic indicators namely turnover and employment.

⁵ The survey asked for identifying the range of the annual average turnover increase thanks to servitisation and the median value of the results falls into the range of 1-10%. When calculating the median, we arrive to 7%.

The countries predicting an even higher turnover growth as a result of offering product-service bundles in the short term i.e. 2018-2019 are only Latvia (+0.7%) and France (+0.6%). Most of the countries, however, predict a slow-down in turnover growth such as Poland (-2.9%), the Netherlands (-2.6%), Germany (-2.2%), Czech Republic (-1.4%), Denmark (-0.8%), Spain (-0.8%) and Italy (-0.7%). The predicted median figures are generally high, which is partly a result of the design of the survey, a drop down of large bands (e.g. 1-10% for increased turnover and 1-5 for additional employees, etc.) which was necessary for the implementation of a CATI survey also considering the target group being SMEs with hence limited resources to dedicate in such studies. Moreover, it should be noted that these figures (calculated as medians by country) are based on the perceptions of companies surveyed. To explain the differences between countries multiple factors would need to be considered, including ‘catching up’ effects.

Table 1 Present and forecasted average annual increase in SME’s turnover attributed to servitisation with median, maximum and minimum value - by country

Year	Turnover increase experienced so far			Turnover increase predicted by companies in 2018-2019			Forecasted turnover growth attributed to servitisation in 2020-2021
	Median	Max	Min	Median	Max	Min	
Bulgaria	9.3%	>40%	0%	12.2%	>40%	0%	5.41%
Czech Republic	5.6%	>40%	0%	3.8%	>40%	0%	3.09%
Germany	6,3%	>40%	0%	3.7%	>40%	0%	2.59%
Denmark	7.6%	>40%	0%	6.4%	>40%	0%	6.03%
Spain	8,5%	>40%	0%	7.7%	>40%	0%	8.45%
France	6.4%	>40%	0%	6.5%	>40%	0%	6.84%
Italy	6,4%	>40%	0%	5.2%	>40%	0%	4.83%
Latvia	6.8%	>40%	0%	7.0%	>40%	0%	7.33%
Netherlands	8.7%	>40%	0%	5.7%	>40%	0%	4.45%
Poland	8.5%	30%	0%	5.1%	30%	0%	3.60%
TOTAL	7.0%	>40%	0%	5.8%	>40%	0%	

Source: own elaboration based on data from the survey. Note: country coverage for Bulgaria is based on the answers of 6 companies; the median value is calculated as follows: $Median = l + \frac{h}{f} \left(\frac{N}{2} - c \right)$, where l is the lower class boundary of the median class, h is the size of the median class interval, f is the frequency corresponding to the median class, N is the total number of observation (sum of frequencies), and c is the cumulative frequency preceding median class. Max and min are calculated as the maximum and minimum value between the answers from companies in each country.

Note: Linear interpolation is calculated as $x_{t+1} = x_t + (x_t - x_{t-1})$.

The last column presents the increase of turnover that will be reached in 2020-2021 by country and sector, based on the median value. The forecasted value has been calculated with a simple linear interpolation. Among the countries, Germany ranks as the country to experience the lowest growth (with 2.59%) which may be explained by a mature manufacturing sector in terms of its servitisation activities. The most pronounced growth (besides Bulgaria) is expected to be experienced by Spain (with 8.45%). According to the survey 43% of the companies in Spain have been servitised in the last 10 years while in Germany 33%.

4 The process of servitisation: drivers, value chains and success factors

4.1 Drivers

Based on the literature review, the three main drivers of servitisation for SMEs are (Detailed results of the literature review are included in Appendix C of the report):

1. *The potential of services as a new and separate source of revenues*

Typically, firms **diversify** either by finding new markets or new products. While the first option might help to boost existing type of sales, the second route is a way to create additional revenue streams. The survey results, discussed in more depth in section 4.3, indeed contain several indications that services are considered as a mechanism to sustain and expand the revenues of products as well as to generate a new source of revenue.

One key element of servitisation is that it allows manufacturers to commercialise their knowledge and capabilities not just by embodying these in physical products, but also by ‘selling’ them directly in the form of services. As the core of this strategy is to leverage existing assets, in particular for SMEs, this way of diversifying might be more attractive than investing in R&D and facilities required for manufacturing new products. Another reason for SMEs to choose the servitisation-route of diversification, we find, is that they feel it is easier to compete this way with (larger) traditional manufacturers that can offer cheaper and better products simply because of scale or resource costs.

Case study message 1: Servitisation can be triggered by defensive & offensive strategies

Our set of case firms shows both defensive and offensive strategies for stepping into services. Defensive approach is taken when company’s core markets are stagnating or even shrink, products get obsolete and clients opt for those firms that provide more integrated PSCs or total solutions. Offensive reasons clearly have to do with chances for more intense relationship with clients, growing market share, enter new markets and also creating more (stable) cash flow.

The German case firm Walter Rau is active in the market for oil and fats where commodities are dominating the market and it is hard to escape from the price competition. As a small player Walter Rau found itself having a hard time competing with big players with scale advantages, whilst offering customer-centered solutions could potentially add value customers are willing to pay for. As a smaller company Walter Rau is flexible (shorter time-to-market) and able to specialize in many things.

Arreche, the Spanish manufacturer of turned parts and building of carburettors, has changed to a production as a service business model in the year 2007. In the past the machines were fully used for the production of carburettors. Over time the need for these carburettors changed and market demand plummeted. The machines are now used for manufacturing of parts to provide a service for external firms. The firm produces these parts from raw material, washes the parts, checks the quality, packages and sends the parts to the customers. The firm at present is involved in delivery of single parts production. This puts the firm on the level of solution provision on the service staircase.

At ZWM (Poland), the introduction of services represented a response to economic crisis and an ambition to expand the range of business activities in order to gain a greater market share. Hence, servitisation at ZWM is both a defensive and an offensive strategy.

Services only become a **separate source of revenues** if manufacturing SMEs manage to develop a business model in which it is clear what value they add. By sticking to the traditional mode of selling products, SMEs often fall into the trap of presenting services as a marketing or acquisition activity; this particularly holds for consulting, after-sales and maintenance/repair services. Nevertheless, servitising SMEs occasionally do manage to upgrade their service provision into business lines bringing in extra revenues. Possibilities to generate new revenue streams seem to increase when firms move to higher levels of the servitisation ladder. While at lower stages the value added by services might be quite invisible, it is relatively easier to charge for services like full process outsourcing (e.g. operating machines on behalf of clients). According to our analyses, the decision to ultimately move into

competitive (and often profitable) service activities is considered a highly important driver to explore servitisation for manufacturing SMEs – even if that does not result in better firm performance in the short term.

2. The ambition to secure more intense and permanent relations with clients

Another driver for manufacturing SMEs to explore service provision is the goal of establishing **stronger relations with clients**. Such better connection might help to increase customer loyalty, but it can also be a way to get a better understanding of the customers' needs (which is, in turn, a basis for providing services; see third bullet). When only selling products from the shelf, it is hard to maintain client contact. Firms might advertise and send newsletters, but this concerns one-way communication rather than interaction. Keeping up to date about how a client is using a manufacturer's product, and how needs are evolving, requires a stream of information that comes back to the producer.

Providing services is regarded as an excellent opportunity for sustaining interactions. The most traditional approach is to offer after-sales and maintenance activities (helpdesk, spare parts, repair, upgrades) that create a need for the manufacturer and a client to meet occasionally. When providing services from higher-up the servitisation staircase, both the frequency and intensity of interactions might increase. Consultancy (e.g. on engineering or marketing possibilities) is a typical example of a service that can be provided in small portions, but on a more continuous basis. An extreme example is when manufacturers decide to lease a product instead of selling it. In that case, at least there is a permanent financial relation with the client. The continuous connection does not automatically involve intensive interactions on other accounts, but it does provide a natural basis for providing other services.

Case study message 2: Servitisation ignites a process that is self-sustaining

By adopting a servitisation approach for business development, firms start a process by which they review and improve their business on a more continuous basis. They operate closer to clients, receive more feedback and, hence, have more demand for improving and innovating PSCs offered. Clients, once they experience the service components, begin to ask for more and higher quality services. Again, this is a major impulse for innovating the PSCs offered.

DTE, the Icelandic producer of element analyzers for the aluminum industry, uses a leasing model to distribute its devices. The leasing model implies that DTE is providing solutions rather than devices, which make it easier to add upgrading and (data-based) consultancy services. All such activities can be included in the leasing contract, rather than they should be charged one by one.

The Latvian textile manufacturer Sakta reported that clients appreciate the expansion of their service range (modelling, combining textile with related products, embroidery) and their growing complexity. Therefore, clients' expectations with respect to additional services are growing and this drives the introduction of new services. Many of the other case firms in a similar vein mentioned that adding services to their products and offering more complete solutions allowed the firms to grow and expand their businesses and gain new clients.

An alternative way to mobilize service provision for setting up dialogues with clients is to offer **digital services**. A well-known example is TomTom's shift from selling personal navigation devices (PNDs) to offering monthly registrations to its 'Live Services'. For customers, the benefit was to receive real-time traffic information on their PNDs, which now needed to be equipped with digital connectivity. For TomTom itself, the strategy was to commercialize its knowledge and capabilities not any longer by selling devices (the production was outsourced anyway, and the market was quickly saturated), but through premium services. Importantly, the shift involved establishing an information exchange with users. In digital services, the exchange often concerns the customers' behaviour; in this case, their location and the routes they take help TomTom to optimize its core product (efficient route planning). Manufacturing SMEs that employ mainly engineers might find the digital way of organizing information exchange more attractive than hiring service personnel with an entirely different employee profile. Since interaction already has the form of data flows, typically it is also easier to leverage the connection not

just commercially (the customer loyalty) but also technically (by using the data to improve product quality).

Of course, there are plenty of examples of manufacturers moving to both personal and digital services. Remote maintenance, for instance, is a service that uses digitally communicated sensor-information to tell the manufacturer when to send over a maintenance provider. It is worth noting that the availability of new ICT tools in itself can also be a driver of servitisation, as it opens up possibilities for establishing sustainable client relation and for providing novel solutions.

Case study message 3: Servitisation is a powerful way to leverage access to clients

A genuine drive of manufacturing SMEs that are implicitly or more explicitly offering services to their clients (as an add-on or through offering integrated PSCs) is the motivation “to make life of clients easier”. Manufacturing SMEs are quite often still family owned business with an often long and well-established client base. These businesses sometimes have developed over the year intense relationships with their clients. In many cases they offer more than just a product, but also all sort of service elements. This is quite often triggered by the deep desire to keep clients happy and to really nurture these, quite often, personal relationships they have built over the years. By offering extra service functionality this relationship is made stronger. Clients get hooked to the extra service functionality offered, but start to appreciate the level of servicing and, as a result, they gradually want more services.

The manufacturing SME find itself in a continuous process where it adds service elements to its products to differentiate the offer from the competition, to stand out from the crowd and to keep clients happy. In this case, servitisation and adding specific service functionality is used to leverage access to the client and, in doing so, ‘growing’ the client (i.e. typically, the turnover coming from this particular client grows over the years). Houweling, the plastics and packaging firm, based in the Netherlands, has added logistics, warehousing and waste collection services over the years, and has been selling them to clients for which it produced packaging products. In a similar way, the Latvian firm SAKTA provides not only textiles, but more complete packages of workwear, including footwear and equipment not produced by itself, to provide its clients with more complete solutions and make they also keep buying the core textile products. Like Houweling, Sakta has a shop next to production facilities, which, in both cases, helps as an (additional) effective marketing and communication channel with the client. The Polish metal manufacturing SME - ZWM, has been increasingly customizing its products, but also systematically expanding the range of services to ensure that clients will keep purchasing their products.

3. Substantial and articulated demand from clients

The third major reason for SMEs to start experimenting with product-service combinations is simply because **their clients confront them with new requests**. Clients usually do not care about products or services; they just want their problems solved. It is up to manufacturers to construct a set of activities and resources that jointly deliver a suitable solution. If this concerns, for instance, the storage, delivery, financing or operating of a product, chances are high that manufacturers have to deploy service activities. Adding such activities to manufacturing and selling products leads to a relatively incremental way of servitising. Core of the strategy is not just to leverage knowledge and capabilities SMEs possess, but also to get access to clients (current and potential). Especially, manufacturing SMEs with a long history of serving the same client segment find themselves in the position where they have extensive insights in how those clients operate, and, thus, how they could be helped. Developing activities to meet the demands eventually drive SMEs towards providing ‘total solutions’, based on bundles of goods/products and associated services. This customer-oriented logic (‘pull-mode’) is markedly different from product-oriented firms that are focusing on, for example, what other machines they can sell (‘push-mode’).

Case study message 4: There are both incremental and radical routes to servitise

Most of our case firms follow an incremental strategy towards introducing services to their product portfolio, in developing PSCs and solutions. They stepwise combine the manufacturing of their core products with after-sales, trading of complementary goods, offering consulting and engineering services.

The Latvian textile firm Sakta has learned over the years in a stepwise, incremental process that the most profitable services in the textile industry are those which complement production activities. In a similar vein, the Polish producer of metal products ZWM has very gradually expanded the variety of services it offers next to production of metal artefacts, such as installation, transport and maintenance services.

The ZWM company has been testing to what extent these extra service elements generate a profit and raise demand. Houweling also shows a clear evolution of activities, based on doing more and more for existing customers by adding transport, warehousing, retailing (including a webshop), design and recollection to its core product of providing packaging. There are, however, more radical routes to servitisation. Muzeo, the French case firm that has developed into a major player in the market for design and artwork in the hospitality industry, evolved very rapidly from what was a printing firm. It integrated backward and forward in the value chain, where artwork consulting is a major service activity, which allowed the firm to enter the high end hospitality industry both in France and abroad. Not the company provides the artistic direction of projects, the actual images (including all aspects surrounding it) and frame, finish and set up and install the designs at the clients' place. These service activities have become so important that the actual printing is just an element in a wide variety of company activities. Printing is now seen as a tool to achieve the goal of the project, which is essentially about creating experiences at the client premises.

DTE, the Icelandic producer of element analyzers for the aluminium industry, has developed its business around hardware products. The company is a 'newborn' servitised firm, as it offers the functionality of its analyzers through a leasing model. Clients pay a monthly fee for using the equipment. The fee covers for both having the product, as well as, obtaining the necessary services. Apart from maintenance, upgrades and support the combination with data—analytics and the data derived from the installed base of equipment will allow DTE to provide its clients with advice on how to optimize the process and quality control of the melting process at their clients. In doing so, DTE will develop from an equipment manufacturer into a knowledge intensive business service firm.

Some of our case firms show more mixed approach. The German case firm Walter Rau often organizes interactive workshops with clients to learn more about needs, wishes and beliefs of customers. This mainly provides inputs for incremental innovations, such as optimizing processes and fixing technical issues. However, they also offer opportunities for more radical routes for instance by identifying niches and by learning more about customers point of view in discussions on technical (or societal) developments, such as genetic modification.

It is important to note that servitisation does not just entail the shift from products to product-service combinations; just as essential is the element of **co-production**. Servitisation implies that manufacturers and their clients start to develop and implement solutions together. This is relevant, because it implies that manufacturers cannot 'invent' services all by themselves, but will have to rely on the input provided by customers. To a large extent, this is a productive dynamic, as long as manufacturers listen to customers representing a larger market. A risk here is that SMEs engage in 'ad hoc' service innovation by honouring the requests of their clients, but spend an amount of resources that is not proportional to returns they can get in the market. Thus, although customer requests can provide highly valuable cues on directions for diversification, SMEs do have to be critical when it comes to deciding which requests to respond to.

Case study message 5: Demanding clients are driving servitisation in manufacturing SMEs and are instrumental in developing innovative PSCs in co-production

In case study message 3 we already flagged how servitisation is in fact a powerful way to leverage access to clients. However, clients are not passively waiting for new service functionality to be offered by the manufacturing SME, but, in quite a few cases, push for new services and solutions and help co-produce the first prototypes.

At ZWM (Poland), for example, clients appreciate customized solutions, they are actively stimulating introduction of new services and provide ideas for development of new PSCs. For example, wet paint, plasma and laser cutting services were primarily driven by requests from clients.

At DTE (Iceland), the first element analyzer was developed at the client's site and with client input, not only technical, but also commercial input. Through this intense cooperation in the development phase DTE gets a much better understanding as to what type of PSC a client would appreciate the most (and what is best for DTE). Houweling (the Netherlands) has been servitising almost exclusively by responding to client demands; there are hardly new PSCs based on e.g. adopting new technologies or own R&D-projects. With reorganization of the sales unit, Houweling works with a selection of more demanding clients to develop new services, which are also piloted using this small group clients. Such strategy was also chosen to prevent divergent co-development processes. With one of its key clients it co-developed a plastic can, which consists of 100% recycled material that fit well with the ambitions of circular entrepreneurship and closing the material loop. Muzeo (France) cooperates intensively with hotel chains to develop new generations of artistic design projects, which, typically, are the result of intense cooperation with demanding clients. The Danish firm Jørgensen Instruments views many other players in its value chain moving away from instruments to solutions. Customers therefore expect the company to offer full service solutions with high SLA's. As Jørgensen Instruments is active in niche markets, it is hard to obtain a sufficient volume to guarantee service response time.

Although the three drivers described above might go hand in hand, this is not necessarily the case. In practice, it is common for manufacturing firms to start servitising not because they believe they will enjoy new revenues, but simply because their intensified orientation towards helping existing customers lead them to explore new solutions; i.e. driver 2 and 3. In these cases, it might, in fact, take quite a while before the servitising SMEs dare to take the step towards actually charging for the services they have started to provide (see box below).

Another possibility is that firms are aware of the possibility to use servitisation for generating additional turnover and establishing client interactions (driver 1 and 2), but so far do not have any clients expressing demands that encourage servitisation. For SMEs, this occurs, for instance, when they supply **OEMs that are strictly controlling the value chain**. In those cases, the perception that servitisation might be promising is not matched with indications of particular directions the manufacturing SMEs can explore. These firm will therefore be less inclined to actually start investing in transformations that can prevent them from getting outcompeted in the longer run. A clear implication for policy is thus to raise awareness not just on that servitisation can be worthwhile, but also on what it can look like (i.e. possible directions for servitisation).

Case study message 6: Many servitising SMEs find it difficult to monetize on services

One of the most consistent messages that come from our set of case studies is that most servitising firms – even though most of our case firms are already pretty advanced in this respect – find it difficult to charge for and monetize on services. It is almost a cultural issue, as most case firms still produce and sell core manufacturing products and do not perceive themselves as firms providing services. In quite a few cases, servitising firms still do not charge for the services they increasingly offer, as they see it as a way to boost the sale of its core products rather than as a separate set of more stable revenues. Many firms are used to think in term of total product prices, sometimes for larger series or even multi-annual year contracts. Service elements are then seen as integrated in the total product price. However, quite a few of the case firms were not able to calculate in a detailed manner how much services they were actually offering and had no detailed insight into their costs as well.

Walter Rau, an advanced oil- and fat manufacturer from Germany offers many services – both product and service solutions, but it is not always charging its services separately. Houweling (the Netherlands) offers design services when it helps its client to design packaging solutions or provides warehousing for regular clients, but hardly charges for it. It is only recently, by adding more integrated ICT-systems and data analytical skill, that the company realized what is the actual cost of providing service components and how few of services are actually separately charged for. That means that in practice a lot of cross-subsidizing exists between various activities within the firm. Jørgensen Instruments is currently experimenting what pricing strategy works best in which niche. As its clients are not used to pay for services, and employees are not used to bring services in charge, serious efforts are required to start monetizing on services. As a first step in changing this situation, the company finds it important to

obtain more insight in service costs (what part of the costs is service-related, are they (separately) chargeable or do they need to be included in the product margin?).

4.2 Value chains: manufacturing SMEs combine in-house service production and external service partners

It is widely recognised that many manufacturing SMEs cannot servitise all by themselves as also described briefly above. Especially, when choosing the path towards total solutions (see driver 2, above), there is a chance that SMEs can identify the service demands of a client without being able to fulfil them. In that case, it is essential to **complement in-house capacities with activities provided by external partners**. This does not just concern the development of the services (in which assistance by strategy / IT consultants or design studios might be helpful), but also the actual delivery of these services. Rather than hiring additional staff, SMEs can engage in flexible collaboration agreements with partners that provide parts of service solutions. In some cases this might even happen entirely under the label of the core SME, without the involvement of the external service supplier that is known to the client.

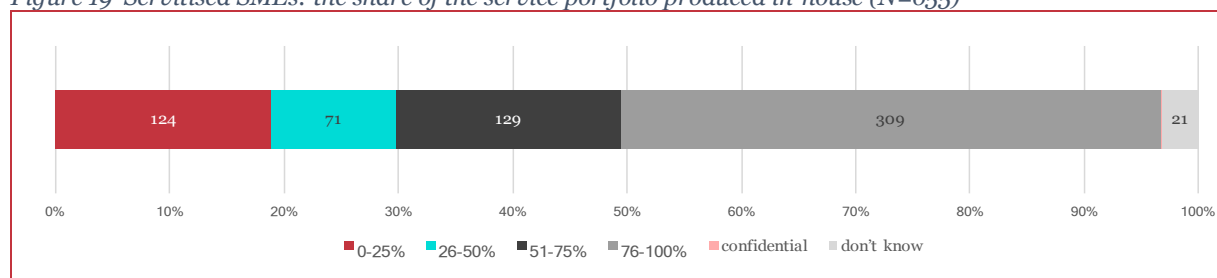
Case study message 7: The importance of capabilities for operating in increasingly complex value chains

As PSCs are bundles of products and services, it forces manufacturing SMEs to team up with partners in clusters and networks and to cooperate intensively along the value chain. Most of our case study firms manage to partner and cooperate with a varied set of partners, but this capability is especially important when further increasing the service content of the offer. This also has to do with the fact that manufactured goods can be produced centrally and then distributed, whereas services need to be created (most of the time) close to a varied set of customers.

Illustrative is the case for DTE - if the company wants to expand beyond Iceland (there are five aluminum melting factories in Iceland) then it has to invest in a service capability outside Iceland. Similarly, Houweling (the Netherlands) had to meet client demands (and set up a circular economy system), therefore the company had to collaborate with logistics providers, plastic shredders/recyclers and designers to provide packaging for their clients. Jørgensen Instruments also used collaboration as a strategy to obtain the required capacities. The company views the resources needed to hire skilled employees to be a main obstacle in moving towards services. Jørgensen Instruments has spread required investment over time by drawing upon resources of one of its suppliers (i.e. not contracting all service staff directly, but also purchasing them from supplier when needed).

According to the survey results, **about half of the servitising SMEs do not produce all their services in-house**. Almost 20% of the service providing respondents actually states that less than a quarter of their service portfolio is produced in-house (Figure 19). In these cases, it really seems to be of strategic importance to provide the services, as the starting point apparently is not the competences and capacities the SME itself possesses. Instead, it acts as a platform for linking partners to its own products and client base (which might be profitable and less risky).

Figure 19 Servitised SMEs: the share of the service portfolio produced in-house (N=655)



Source: Technopolis Group, Dialogic and Cambridge Service Alliance

The extent to which servitising SMEs rely on external partners depends only slightly on the type of services they are providing. Not surprisingly, maintenance and repair services are activities the SMEs often take care of themselves. Compared to, for instance, logistics, maintenance and repair services that are largely build on the same type of skills, used for manufacturing the products in the first place. Transporting the products is an activity requiring entirely different types of technology, organisational structure and competences, which explains why it is relatively common to involve a third party. Of course, it should be noted that these archetypical servitisation types can easily be combined, for instance, when organizing the logistics for providing spare parts and maintenance services. Even in those cases, however, it is possible that a manufacturing SME uses its own technical staff for activities involving in-depth product-knowledge, while contracting external parties for providing the trucks, drivers and logistical planning.

Figure 20 also shows that the role of external providers is related to the percentage of clients a manufacturing SMEs is serving. Across all types of product-service combinations, SMEs that provide their services to more than 50% of their clients, tend to have higher shares of in-house service production, compared to SMEs that provide services to less than 50% of their clients. A large number of clients for services may provide SMEs with the critical mass needed for in-house production of services, while this relation can also be the other way around (e.g. sophisticated or unique in-house services leading to a large number of clients).

Case study message 8: Manufacturing SMEs do underestimate the service functionality they already offer

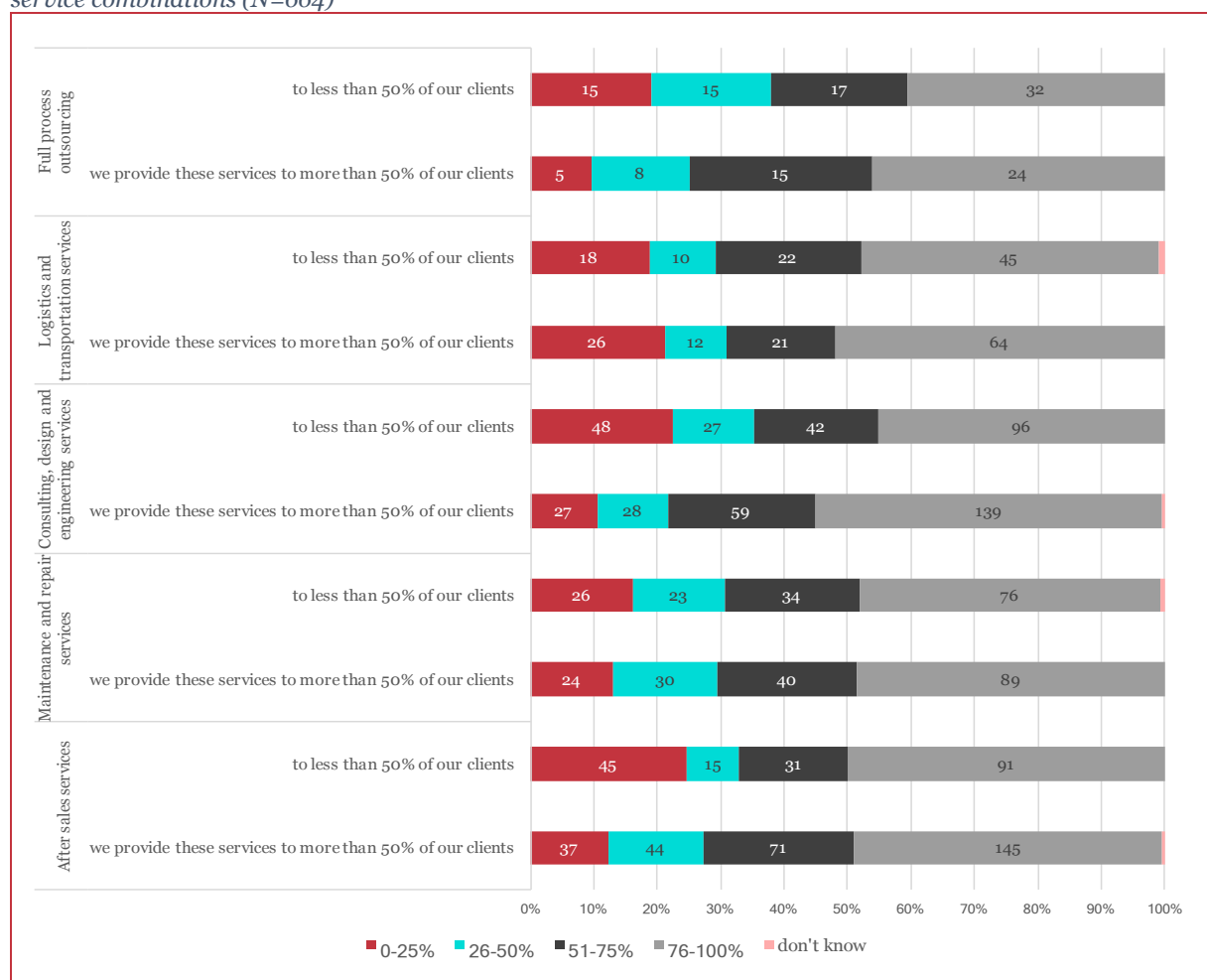
Remarkably so, many manufacturing SMEs do seem to underestimate the service functionality they are already offering, as they tend to define themselves mostly, according to the key products they are offering. It is therefore key that manufacturing SMEs do get to know their clients better. In many cases we found that manufacturing SMEs are sometimes like fish in the water i.e. they do not appreciate enough that by adding services or by offering more integrated product-service combinations they are already differentiating (and can further differentiate) their product offer. There is no tradition of thinking in terms of (untapped) client needs.

In several cases we noticed that investing in the marketing and sales function, hence getting to understand client needs much better, is a prerequisite for servitising successfully. Most employees at Houweling still defined their activities in terms of the core manufactured product, whereas most employees are already busy servicing client through transport, warehousing, advising on packaging and recycling of waste streams. A few of our case firms forgot to mention the type of services they are offering on their websites. For example, Sakta does not mention that next to manufacturing of textile they offer delivery and sewing services. Similarly, the Polish metal manufacturer did not fully realise that it actually it already offers quite a full range of services, starting from design and consulting to repair and maintenance. Interestingly, design, consulting, delivery, assembly, installation and repair/maintenance services are still not mentioned on the company website, whereas sometimes some of its manufacturing activity is subcontracted to make room for these type of activities (and keep the direct line with its customer through its service lines).

It is, however, sometimes also hard to tell what is manufacturing activity and a service activity. In the case of ZWM, it bough new equipment to also powdercoat materials. However, it can powdercoat the steel constructions it manufacturers, but also sell the powdercoating treatment as a service on products that have been manufactured elsewhere. Dalla Corte, the Italian specialist provider of high quality espresso machines and coffee grinders for mostly the professional market, creates machines which help baristas to gain the most taste out of the coffee bean. It not only has created a fully automatic Milk Control System, but its newest machines also offers “flow profiling”. Overall, this means that the firm has created an espresso machine that can change the amount of water being pushed through the coffee ground over the 25 seconds of extraction time. Through the online application this can be changed by the barista on every espresso made. This allows coffee places to gain the most out of the coffee bean and as well share their “flow profile recipes” connected with the coffee (which is handy for coffee chains for example).

These examples can be perceived as technological innovation (which they are), but they also illustrate the service functionality Della Corte offers to its professional clients. Arreche, the Spanish manufacturer of turned parts and building of carburettors (a device in an internal combustion engine) has over time moved from building carburettors to offering manufacturing various high quality parts to its customers. The core capability of the firm is ownership of the machines and personnel who have the ability to use these machines to produce high quality turned parts at the request of their customers. Hence, they use their machinery as a manufacture platform to provide a service they are offering to their customer base. They consistently produce high quality (on measure accuracy) turned parts that are delivered and then assembled with other parts and sold by other firms. They mainly focus on the parts that are either complex to produce or need accuracy in measure and hence can be done by their quality reference. However, the firm does not perceive itself as a service provider though and considers itself to be a machining firm in the first place producing products and selling them.

Figure 20 Servitised SMEs: the share of the service portfolio produced in-house across five types of product-service combinations (N=664)



Source: Technopolis Group, Dialogic and Cambridge Service Alliance

4.3 Success factors and indications about impact

4.3.1 Success factors

The literature review identified several success factors of servitisation by SMEs. This includes the setting-up and using a business network; ensuring high quality and innovativeness of products, services or product-service combinations (solutions) and geographic proximity to customers (which enables close collaboration). To some extent, success factors are the 'flipside' of barriers. For instance, having

skilled staff is mentioned as a success factors. Along the same lines, access to financial resources and changing the organisation culture and structure are mentioned as a barrier for SMEs, while these two aspects are mentioned as a success factor for large firms.

Policy and regulation are addressed most extensively in the survey, but the main insights are in line with the literature review or, at least, not disputed. Of particular relevance are training programmes, R&D&I programmes and financial support for (individual) SMEs. These findings are consistent with the observation that skills are an important barrier (that is getting or needing attention from policy makers) and that a broad range of barriers is relevant. For instance, R&D&I programmes have the potential to link SMEs to new business partners. These programmes, but also financial support for (individual) SMEs, can increase access to financial resources.

Standardisation of technical elements and operational procedures can both hinder and support servitisation depending on the specific standard and context. Survey respondents referred to inconvenient standards but also to the lack of standards and harmonisation in the EU for instance in the area of M2M (machine to machine) protocols ICT standards. Regulation related to the EU single market is mentioned frequently, e.g. a lack of harmonisation of rules about quality (e.g. eco labels), safety and data protection. To some extent, this concerns standardisation issues: differences between countries in terms of standards or versions of standards.

In addition, respondents mentioned IPR regulation. For some SMEs, IPR was not effective in protecting their IP. For other SMEs, IPR hindered or blocked access to relevant knowledge and components. Again, some of these comments were positioned in the context of the EU single market.

Most comments about regulation were not phrased as ‘show stoppers’ but as substantial burdens that require SMEs to invest in understanding regulation (across different EU Member States) and, where needed, in adapting their operational and sales activities. Compared to medium-sized and small companies, a small share of micro companies (including start-ups) indicated that regulation hindered them. This may be due to the small scale or geographic scope or their entrepreneurial attitude.

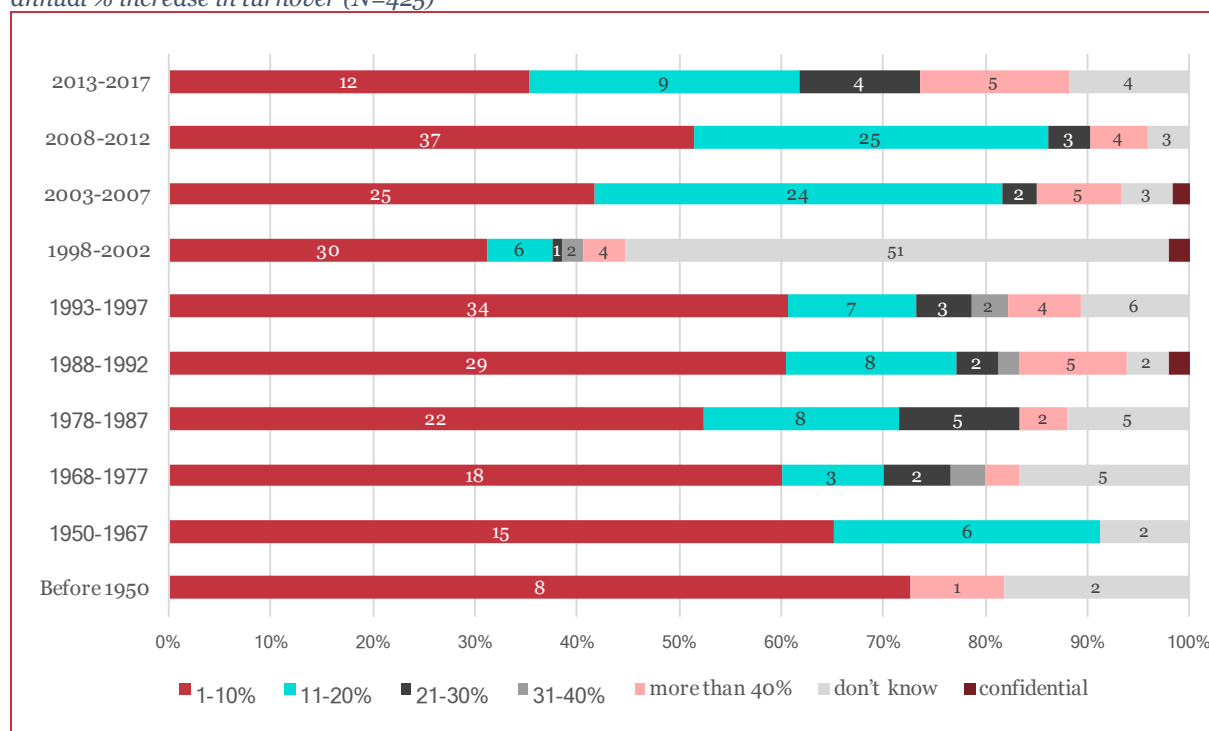
4.3.2 Indications about impact

Survey respondents report several types of positive impact of servitisation. Between 61% and 87% of manufacturing SMEs that provide services, **employed additional people** as a result of starting to offer services (product-service combinations). For manufacturing SMEs that introduced services thirty years ago (or more) the figure is closer to 87%; for manufacturing SMEs that introduced services ten years ago (or less) the figure is closer to 61%. This timing effect also emerges when looking at the *number* of additional people hired as a result of servitisation. Overall, 45% of relevant SMEs report between 1 and 10 additional people. Manufacturing SMEs that introduced services decades ago report up to 50 additional people, or more, as a result of servitisation. Between 70% and 80% of respondents expect to hire between 1 and 10 new employees, per year, as a result of providing services.

These employees are not only needed to develop and provide services but also to accommodate increased production and sales of products, that benefit from the services linked to them. This includes products and services sold to **new clients located inside and outside Europe**. Survey respondents mentioned that providing their product-service combinations relies more on **in-house production** than on external partners/suppliers. This result is consistent with statements about employing additional people.

Along the same lines, the large majority of manufacturing SMEs that provide services, report an **increase of revenues** as a result of introducing services (Figure 21). For most SMEs concerned, this annual increase in turnover is between 1 and 10%. Figures are higher for SMEs that introduced services 20 years ago or more, which may indicate that they succeeded in exploring and monetising the potential of combining products and services.

Figure 21 The number of manufacturing SMEs, per period of launching services, that indicate their average annual % increase in turnover (N=425)



Source: Technopolis Group, Dialogic and Cambridge Service Alliance

Respondents were equally clear and positive about the impact of servitisation on their profit margin. More than 50% of relevant SMEs reported an increase of their profit margin of 1-10%, over the last two years. Micro firms are most optimistic about their increased profit margin, for the next two years. More than 50% of micro firms expect their profit margin to increase with more than 20%.

These types of impacts are also mentioned in literature, although there are few articles that contain empirical data about the impact of servitisation on SMEs.

Case study message 9: It pays off to servitise in various ways

Case firms that engage in processes of servitisation remarked that by servitising they operate closer to the client, develop more intense relationship with clients and get a better feeling what is important to them. This triggers the product (or, for that matter, service) development process and ultimately leads to more and more stable revenues. In addition, products that are sold as a service create a more stable revenue stream, even in times of crisis. Servitisation may also lead to other important effects such as improvement in eco-efficiency, safer working conditions and a happier workforce. Employees, involved in servitisation, in general have more frequent and more intense relationships with clients and a better insight into how PSCs helping out clients. This is a rewarding aspect for many employees.

DTE (Iceland), the process control firm from Iceland, provides an element analyzer for the aluminum industry, which helps the latter to operate more swiftly and safer (no need any more for sample by hand), as well as, to optimize the process industry (also allowing it to operate more efficiently including eco-efficient). As a result, the impact of service integration is much wider than generating more revenue. However, by providing a service-based solution the manufacturing firm start to define itself as a service firm, as it can sell its technical skills, combined harvesting the data from its installed base, into high-end business services to help the aluminum process industry to optimize its processes. Through servitising the Latvian textile firm Sakta managed to diversify not only its business activities, but also its client base, which both help to mitigate business risks in highly cyclical textile industry. An important impact is that through its service activities the company operates much closer to its clients. This helps to understand

what clients want now and in the near future, and this helps to determine the direction in which the company should develop.

In the case of ZWM (Poland), servitisation in times of economic crisis helped the company to survive, by developing additional sources of income. The gradual introduction of services helped to regain its clients and acquire new ones. Muzeo, the French case, stemming from the printing industry showed that by adding artwork consulting, all sorts of services surrounding its image studio (from iconography to rights management) and also the framing, finishing and set-up helped enormously to boost revenues, gain a position at the top end of the market through providing artwork consultancy and making sure the solutions offered are also installed at the right quality and in time. This has transformed the printing firm into an SME with an array of profitable services and service solutions. ComAp, the Prague-based provider of electronic control and management solutions for the power generation industry, focuses primarily on its highest value-adding activities. As a result, most of the manufacturing capability is outsourced to specialised and trusted partner firms over the last years. Now the firm focuses more on the intelligence, hence software provision and process as well as the gathering and interpretation of data. They have recently started to deploy software as a service concepts, which allow the display of data and information via web interfaces as well the control. This allows customers to control machines over long distance and as well in multiple distributed places centrally from one location.

4.4 Impact of policies on servitisation

This study also reflected on the impact of policies and specifically EU policies on the performance of servitised companies and how different public policy measures can contribute to the growth of the product-service market. The approach followed was based on modelling via econometric regressions to help quantify to which extent servitised companies that received policy support performed better in terms of turnover and employment than the ones without.

The data for this analysis have been taken from the survey conducted in the context of this study. The performance of servitised companies is measured according to turnover and employment and more specifically the turnover and employment increase experienced by SMEs as a result of introducing product-service bundles.

The survey has shown that in terms of turnover **almost 80% of the surveyed companies reported that offering product-service bundles brought an increase on their average annual turnover**, while only 20% declared that the introduction of those bundles did not bring any growth in turnover.

More specifically, **companies predominantly indicated an increase between 1 and 10% increase of turnover.**

In terms of employment (in full time equivalent), **73% of the companies indicated to have hired additional employees** while 25% on the contrary did not hire additional people after the introduction of product-service bundles. The distribution of the replies in terms of the number of people hired ranges from about 20% of companies who hired between 1 and 5 additional people to 21% of companies who employed between 11 and 50 additional people. The latter higher numbers of additional people hired are partially explained by the size of the firm in particular the larger SMEs with a 100 plus employees in the sample and the fact that the question indicates as timeframe the period since the introduction of product-service bundles.

In the survey, SMEs had been asked about the received EU, national or local support and the scale of their importance. **Policy support** included the following types of (monetary or non-monetary) government support (EU, national or regional) for developing product-service combinations:

- Support for participating in a R&D or innovation programme;
- Public financial support for RDI, including grants, tax relief, guarantees and soft loans;
- Support for clusters, networking and bilateral collaboration;
- Training programmes;

- Government-sponsored advice for SMEs, for example about innovation, IPR, export or complying with regulation.

We applied **the methodology of econometric regression** in order to reflect on the impact of policies on employment and turnover linked to servitisation ((please see Appendix Q for the full analysis). Regression analysis is a statistical technique used to describe relationships among variables. The purpose of regression is to try to find the best fit line or equation that expresses the relationship between a dependent variable and one or more explanatory variables; a regression that contains more than one explanatory variable is called a multiple regression model. It is important to remember that regression cannot show causation; causation is only demonstrated analytically, through substantive theory. All that the mathematics can tell us is whether or not they are correlated, and if so, by how much.

The results of the regression analysis are summarised in Table 2 which includes the regression coefficients, p-values and pseudo R-squared. The coefficient of a regression describes the size and direction of the relationship between a predictor and the response variable.

The p-value of each coefficient, is a value that helps in deciding whether there is a relationship between two variables or not. The p-value can be expressed as the likelihood of observing the data points when the null hypothesis is true (there is no relationship between the two variables). If the p-value is smaller than a threshold (normally 0.05) this means that it is very unlikely that the dataset was generated by chance and hence the null hypothesis can be rejected, implying that there is a relationship between the two variables.

Table 2 Logistic regression results with dependent variable increase in turnover (model I) and employment (model II)

INDEPENDENT VARIABLES	MODEL I Dependent Variable: Increase in turnover (coefficients in odds ratios)						MODEL II Dependent Variable: Increase in employment (coefficients in log odds)				
	EXPLANATORY VARIABLES										
Type of support	All types						EU	Local/regional	All types	EU	Local/regional
General policy support	1.788* (0.587)						1.450 (0.514)	1.917* (0.666)	1.481 (0.405)	1.415 (0.430)	1.432 (0.414)
Policy 1: Support for participating in a R&D or innovation programme	1.949* (0.657)										
Policy 2: Public financial support for RDI	1.601 (0.539)										
Policy 3: Support for clusters, networking and bilateral collaboration	1.319 (0.733)										
Policy 4: Training programmes	1.577 (0.512)										
Policy 5: Government-sponsored advice for SMEs	1.265 (0.562)										
Recruit	0.762 (0.371)	0.862 (0.400)	0.869 (0.406)	0.791 (0.367)	0.681 (0.325)	0.757 (0.348)	0.763 (0.416)	1.082 (0.572)	1.304 (0.411)	1.344 (0.475)	1.452 (0.476)

INDEPENDENT VARIABLES	MODEL I Dependent Variable: Increase in turnover (coefficients in odds ratios)								MODEL II Dependent Variable: Increase in employment (coefficients in log odds)		
	Digital	1.217 (0.409)	1.318 (0.494)	1.235 (0.398)	1.343 (0.431)	1.152 (0.369)	1.227 (0.388)	1.256 (0.464)	1.128 (0.572)	1.974** (0.536)	2.291*** (0.698)
Access to finance	0.645 (0.237)	0.594 (0.212)	0.570 (0.204)	0.549* (0.196)	0.555* (0.198)	0.568 (0.200)	0.634 (0.261)	0.504* (0.208)			
Maturity	0.984* (0.008)	0.985* (0.008)	0.984** (0.008)	0.983** (0.008)	0.980** (0.008)	0.981** (0.007)	0.984* (0.009)	0.980** (0.009)	1.030*** (0.009)	1.015 (0.009)	1.038*** (0.011)
CONTROL VARIABLES											
Current turnover	0.999 (0.002)	0.999 (0.002)	1.000 (0.002)	0.999 (0.002)	0.999 (0.002)	0.999 (0.002)	0.999 (0.002)	0.999 (0.009)			
Size									1.329*** (0.145)	1.361*** (0.161)	1.350*** (0.153)
Country effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Sector effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	356	390	378	382	401	400	231	281	479	341	388
Pseudo R-squared	0.11	0.11	0.11	0.11	0.11	0.11	0.09	0.13	0.16	0.16	0.18

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: From column 2 to 6 the same model is presented with the different types of policy support as independent variables.

According to the results specified in the first column of the Table above **there is a positive significant link between the fact of receiving any kind of policy support and the increase of turnover at 10% significance level, but there is no relationship between policy support and employment.** In particular, Model 1 says that, holding all the other variables fixed, the odds of experiencing an increase in turnover for companies that received a policy support are 78% higher than the odds for the companies that did not receive it. Nevertheless, this link is still weak and does not mean any causation. It might be for instance also the case that companies who applied to policy support were among the ones that performed better in general. The reason why companies that received policy support registered an increase in their turnover but no increase in employment might be that they already had the necessary in-house skills to develop new services when they applied for funding their servitisation actions or they have used external service partners to collaborate with.

The models were tested separately for EU support only and national or local/regional support only. Results show there is no correlation between the EU support that companies received and an increase in turnover, **while companies that received national or local/regional support, experienced an increase in turnover.** This result is statistically significant at 10% level. The model with increase in employment as dependent variable, instead, did not show a significant correlation in either cases. It is important to note that the support provided by local or national governments is, at times, promoted or financed by the EU. Hence, it is difficult to establish the direct effect of various types or sources of policy support on company performance.

A **negative correlation** at 10% significance level has been found **between the number of years since the product-service combination has been introduced and annual turnover increase** (negative correlation in odds ratio has a coefficient between 0 and 1, since it is an exponential transformation). This means that companies that introduced product-service combinations since a long time experienced less often an increase in turnover, compared to the ones that introduced them recently.

Other explanatory variables added in the model, such as the importance of not being able to recruit people as barrier, the importance of digital services in the product-service combination proposed, the importance of the access to financial resources as barrier, and the current turnover, are not correlated with the increase in turnover.

Digital service is, however, correlated with employment increase at 5% significance level, with 97% higher odds to employ more people for companies who replied that digital services are an important part of their product-service combination offer. The link between employment increase and companies with digital services as an important part of their product-service combination offer is particularly interesting and credible considering the need for specialised skills for the development and delivery of digital services.

Maturity is also significantly correlated with the increase in the number of employees, this time at 1% significance level. This means that companies that introduced product-service combination early, had 3% higher odds to hire new employees compared to the ones who servitised later on. The correlation with maturity offers interesting possible interpretations such as for instance the requirement to build experience in the product-service market segment before employing people in a company of small to medium size.

Size is also positively correlated with the increase in the number of employees, with 1% significance level. This means that the bigger is the company in terms of size, the higher are the odds that it will hire new employees because of servitisation. The latter two findings on maturity in the offering of product-service combinations and company size show that the servitisation process for SMEs differs from that of larger companies namely in terms of the increases in the number of employees.

When looking at the specific types of policy support, the results in column 2 show that there is a **positive significant relationship** at 10% significance level between the support for **participating in a R&D or innovation programme** (policy 1) and **the increase in turnover.** Results in columns 3 to 6 show that there is no significant correlation between public financial support for RDI (policy 2) and

increase in turnover, between the support for clusters, networking and bilateral collaboration (policy 3) and the increase in turnover, between training programmes (policy 4) and increase in turnover, and not between the increase of turnover and the government-sponsored advice for SMEs (policy 5).

Both country and sector effects are present in the model, but the **sectoral effects** are the ones that explain most of the variation in the dependent variable. This means that the fact that a company belongs or not to a particular industrial sector, changes significantly the probability that the company will experience an increase in its turnover.

The predictive ability of a logistic model is denoted by the pseudo R-squared (in this case 0.11 for the first model and 0.16 for the second one).⁶ The low value of the pseudo R-squared is not surprising in empirical research, given the difficulty in finding predictors strong enough to give predicted probabilities close to 0 or 1.

5 Barriers

5.1 Main barriers

A broad range of barriers is relevant for manufacturing SMEs that consider, develop or provide services. The survey, case studies and literature review indicate that the lack of skills is the most important barrier. Firms are hindered by gaps in the **skill set of current staff** and difficulties in **hiring staff with the right skills**. According to our survey results, the lack of skills of current staff is the major problem for almost 50% of manufacturing SMEs that provide services ('that are servitised') and close to 40% of SMEs that do not (yet) provide services (Figure 22 on the next page).

The labour market mismatch between available skills and company needs, is relevant for national education policies across European countries and calls attention to associated costs of employee training for companies. When skills and recruitment issues increase costs and business risks, SMEs are more reluctant explore servitisation. In **Eastern European countries**, the lack of skills is also related to a more general problem in the labour market, namely, large emigration flows ('brain drain'). This was illustrated in both the Latvian and the Polish case study.

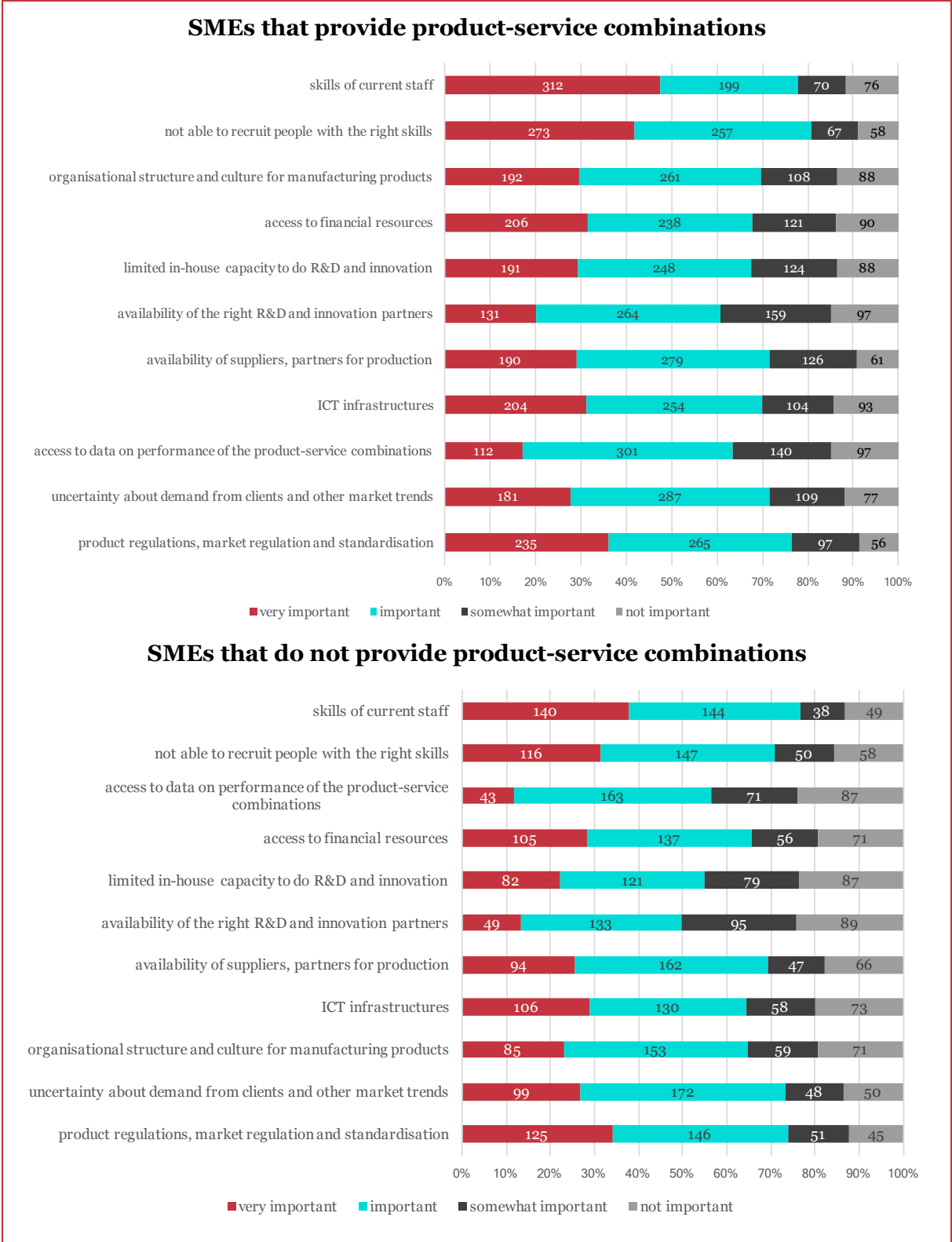
Another important barrier for SMEs is having an **organisational structure and culture** that is not fit for providing services. Servitisation, as a new business model or a process of diversification of business portfolio, requires (substantial) organisational changes, transformation of operational processes, resource reallocation and adjustment of business strategies. The company management plays a central role in addressing challenges in organisational structure/culture and ensuring a smooth transition towards servitisation in a manufacturing company. Apart from adjustments in the physical environment of the company (e.g. transformation of production facilities and operational processes), servitisation might require greater flexibility of roles and responsibilities of current staff. Hence, the first barrier – the lack of skills of employees, is closely linked to changes in organisational structure and culture.

The lack of awareness about the potential of product-service combinations (PSCs) is another important barrier for companies. Our survey and especially the case studies show that companies are not well-informed about the so-called phenomenon 'servitisation', its benefits for SMEs and their respective industries and clients. In several case studies, we found that it took a number of years before the potential of servitisation was acknowledged by senior management, product development and sales staff of SMEs. In the survey, this barrier was partly captured by responses to the questions about the availability of in-house capacity for R&D and innovation. Note that some of the

⁶ The pseudo R-squared presented in our model is the McFadden's pseudo R-squared, which is obtained comparing the likelihood contribution of the model specified with the corresponding value for the same model with only intercepts and no covariates (the null model).

SMEs surveyed or interviewed for the case study, did introduce services, without labelling this as either servitisation or innovation.

Figure 22 Barriers that hinder manufacturing SMEs to launch or provide services, according to manufacturing SMEs that provide product-service combinations and those that do not (N=657; N=371)



Source: Technopolis Group, Dialogic and Cambridge Service Alliance

The process of servitisation, as any innovation in product, service or business models, comes with uncertainty and risks about benefits. Companies, being for-profit organisations, are primarily concerned with client demand. The **lack of deep insight into demand from clients and the exact needs of current and potential clients** represents another significant barrier. Many manufacturing SMEs do not have in-house capacity and/or financial resources to invest in research about market needs. To some extent, clients do share their suggestions on how a manufacturing company could diversify its business activities and deepen their collaboration. However, the interaction between manufacturing companies and their clients is seldom as close and frequent as between companies that are involved in the provision of customised services. Moreover, an effective dialogue between manufacturers and their clients requires that one or both parties are eager to explore the potential benefits of servitisation.

The case studies illustrate the barrier regarding (insufficient) insights into user-needs:

Case study message 10: Lacking deep insight into user-needs of (potential) clients to develop competitive PSCs / well developed marketing and sales function

It is evident that servitisation is as a way of leveraging access to clients and to understand and work together with demanding clients. There are various examples in our set of case firms where this capability was signaled as in need of improvement, since the lack of it stifled the process of servitisation. In the Latvian Sakta case it was, for example, reported that a good understanding about market and client needs is lacking and that this, undoubtedly, limits the SME's willingness to take risks and integrate new services. The marketing and sales function is not strongly developed at Sakta and this clearly hampers servitisation. At DTE in Iceland, although it still is a start-up firm, the management itself has already concluded that their mostly lacking marketing and sales function would be a major bottleneck for further expansion, including making the switch to a services dominant business model. DTE has hired for the moment an external marketing advisory firm. Similarly ZWM, the Polish manufacturer of metal products has been receiving feedback from its clients and this has been stimulating integration of services. The company management recognizes that it should further improve its understanding of customer needs and therefore it has started to cooperate with the local technical university. The French Muzeo case illustrates that by heavily investing in getting to know the clients and their demands through offering case artwork consulting (involving sales representatives) is key. It allows Muzeo to act as a full service provider from the very conceptual start-up until the actual production, delivery and set-up of the final products at the clients site.

The realisation of novel business solutions relies heavily on three external factors, the first of them is **access to financial resources**. The literature review, survey and case studies have shown that the lack of capital for development of PSCs is a significant barrier for developing and launching product-service combinations. Servitisation requires financial resources for transformation of organisational structure, purchasing new equipment/tools for the provisioning of services, training of staff, finding new partners/suppliers and for several other business aspects. Due to a lack of internal resources, SMEs approach financial institutions, private investors and public investment agencies. SMEs sometimes face difficulties in persuading investors that servitisation is a sound business model. Hence, there is a need to ensure that financial stakeholders are aware of the benefits of servitisation for companies. According to the literature review and survey results, the reliance on financial institutions might be decreased through public financial support for R&D&I. The literature review indicates that public financial support can also be effective in linking SMEs to new business partners.

Case study message 11: Financial institutions and investors do not always recognise the potential of PSCs

Financers are sometimes very much product- or hardware- oriented and may have difficulties in assessing the value of providing services and solutions linked to a particular product. Banks and venture

capitalists do not always recognise the value of PSCs. This message emerged more clearly from the literature review and the survey than from the case studies. This is partly because the case studies are about SMEs that did servitise and that were open for explaining their activities. DTE in Iceland is a case where the company was successful in not only getting start-up support and financial support (in the form of two grants), but also was part of an accelerator programme in which it learned a.o. how to attract funding. The pitching opportunity provided to DTE was successful and resulted in a 1,1 mln. dollar investment by a venture capital fund. The future key to its success will also be dependent on the managers' ability to sell the functionality of instruments through leasing contracts, instead of selling pieces of equipment on which it will base its advisory services. This will also involve finding an investor that is willing to finance upfront in the equipment to be leased out. Arreche, the Spanish manufacturer of turned parts and building of carburetors has difficulty in financing the investment in newer machines. Owning newer machines, enabling quicker tool change, is key to being competitive. This is especially for the production of smaller quantities, hence, the time spent on tool change being vital. There is a problem in investing in newer machinery, especially when the firm lives of short term contracts. Larger and longer-term contracts have a bigger return, however, they need larger upfront investment in time and effort as well. Their investment is usually done using the local banking system. The firm describes the processes of receiving funding for machinery investment as complex. The bank would like to see a long term order book, however the business in the market is often based on short term business and can be based on small quantity. Contrary of course without the investment into new machines the short term and low volume.

The second external factor, that is a barrier for servitisation of SMEs, is the **lack of suitable business partners/suppliers and challenges for SMEs to function in complex value chains**. The integration of services implies an expansion of existing value chains and, consequently, a need to identify, collaborate and rely on new business partners. Companies try, with various success, to form or join existing value chains and innovation clusters. This challenge or barrier is addressed in the literature review.

Case study message 12: Servitising manufacturing SMEs cross industry boundaries by definition

Although most of our case firms still define themselves by the industries from which they originate, the companies have crossed, in most cases, several industry boundaries by servitising their product offering. It is mostly through bundling products and services that they have become active in multiple industries. Quite often the case firms have to decide whether they want to provide the service element of the service functionality or to receive it through partners. Some firms are prepared to outsource some production of the core manufacturing product to other subcontracting firms in the same industry in order to free capacity to provide the extra service elements themselves. This is evident from the ZWM-case and Muzeo. Muzeo has almost completely redefined itself and is offering artwork consulting services, image studio service, as well as, framing, finishing and installation services in order to realise the projects. Their projects and the way these are managed have by now more in common with the advertising and consulting industry than with the printing industry, as it basically sells projects and advice rather than prints.

Houweling has evolved from producer to wholesale and retail trade, to distribution and warehousing, cleaner of plastic packaging and even to design advisory services although the latter is mostly incidental so far. Similarly, if DTE implements and keeps managing its element analyzers (while processing data and using it for advice), it is actually more of a consultant using equipment than an equipment producer also doing consultancy. At Dalla Corte, the Milan-region based manufacturer of espresso machines and coffee grinders very much defines itself as a manufacturing firm, but at the mean time is very well aware of the coffee experiences it sells indirectly. The firm, for example, offers training and trips through its own training campus, organising travel tours to coffee growing regions for enthusiasts and professionals alike. The firm is also involved in sponsoring events. More specifically they have been sponsoring the World Latte Art Championship and have been involved in the World Coffee in Good Spirits Championship. The aim of the engagement is to meet people and to discuss the trends and gain ideas

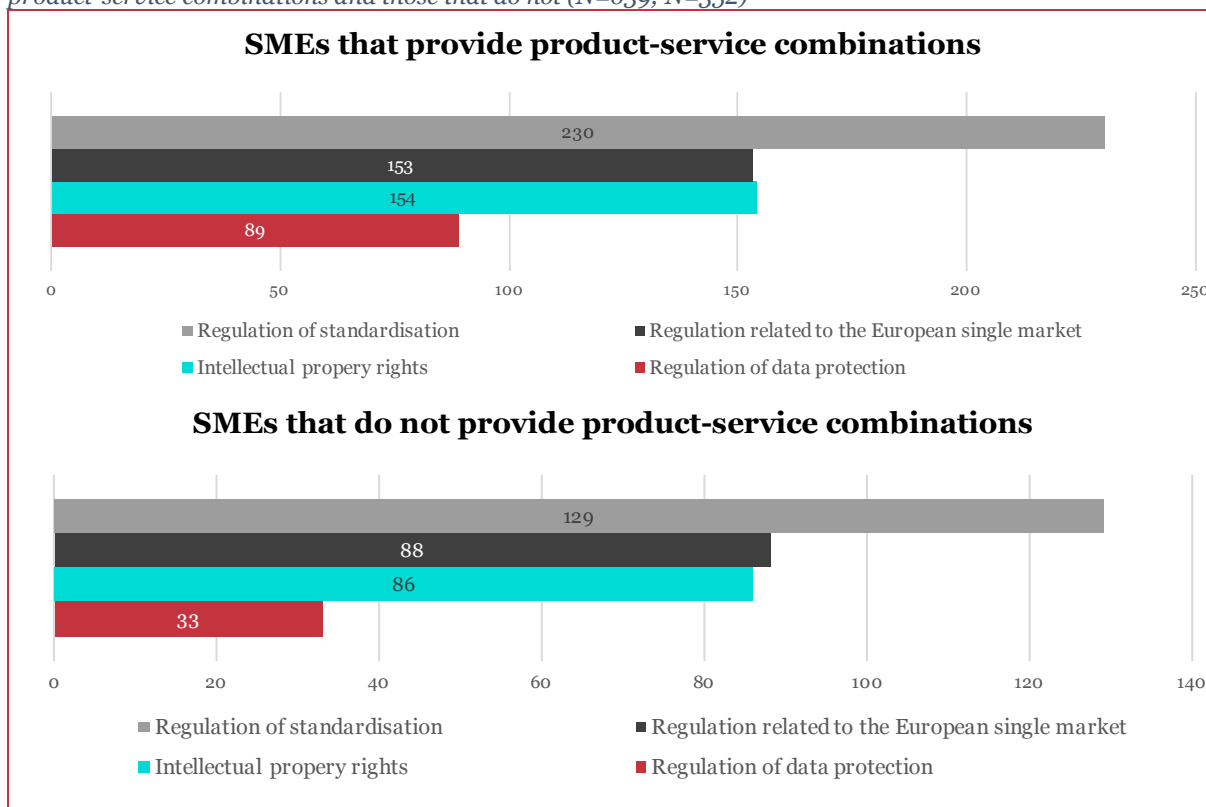
for potential innovations or problems that could be solved with innovations. By engaging in different type of activities they keep contact with their client base and learn about new user needs.

ComAp, the Czech provider of electronic control and management solutions for the power generation industry, crossed various industry boundaries as well. The latest focus of the firm is on digital and complementary software. With this change the firm is looking to be closer to the customer. They have understood that the customer needs support and sees consulting as a value-add along with installation support and commissioning. The future of the business model will be going more towards supporting the full solution. Investors into energy plants are interested in the full solution offering on large projects, including the integration of the project and supporting the customer as needed. Jørgensen Instruments started to offer installation services accompanying its environmental and industrial measurement products. Since Jørgensen Instruments started to offer installation services, the company has been competing with installation companies as well. These installation companies have a higher capacity and are able to offer a broader range of services. Jørgensen Instruments tries to differentiate itself from its new competitors by moving away from competition purely on services, and combining services (capability/skills) with the products provided.

According to survey respondents, the category of **product regulation, market regulation and standardisation** is the number three barrier, right after skills of current staff and not being able to recruit staff with the rights skills (Figure 22). This holds for manufacturing SMEs that provide product-service combinations. For SMEs that do not provide product-service combinations, regulation and standardisation are the number two barrier, after the skills of current staff. 34% of these SMEs, responding to the survey, consider regulation and standardisation a very important barrier. Regarding the importance of product regulation, market regulation and standardisation as hindering servitisation, there are very small differences between companies of different size, from different sectors or from different countries.

The answers to the closed and open survey questions about regulation and standardisation provide additional details. At first sight, the main issue appears to be regulation of standardisation (Figure 23).

Figure 23 Number of manufacturing SMEs that mention specific types of regulation as hindering their company when launching or providing product-service combinations, according to manufacturing SMEs that provide product-service combinations and those that do not (N=639; N=352)



Source: Technopolis Group, Dialogic and Cambridge Service Alliance

However, the answers to an open survey question reveal that SMEs refer to standardisation in the context of the European single market (which is also the second, separate type of regulation that hinders SMEs). More than half the respondents that addressed standardisation, elaborate on the broad range of non-harmonised regulations across the EU. Among other things, SMEs mention regulation about labelling, certificates, permissions, quality and technical standards (of components, equipment and systems). To a lesser extent, survey respondents interpret standardisation in a (much) broader way and mention that EU Member States differ in terms of regulatory procedures and various technical/IT/online systems for implementation and enforcement of regulation. SMEs also mentioned differences in terms of taxation of products, services, profits and basic administrative procedures such as business registration.

Examples of quotes are:

“The biggest problems are the norms and standards - every country has different norms, they are protecting their manufacturers and prevent other companies to enter the market”

“Certification procedures are expensive and the process to obtain them is very complex”

“Europeans are demanding high standards, like standardisation of safety conditions. They are rich countries and can afford it. In Bulgaria, this is much more difficult and this limits us from various sides.”

“We are an ecological company in the EU. The EU should be concerned that this eco-label is accepted and recognized by most countries outside the EU, because we

face many issues from countries that do not recognize this ecological seal, the EU has to make a major effort to be recognized outside the EU.”

The case studies provide additional illustrations.

Case study message 13: Many servitising manufacturing firms need to deal with too much or too few regulations that hinders them when servitising

Many servitising firms bump into regulation that is hindering them, or into a lack of regulation that is creating too much uncertainty. Case study SMEs mostly refer to a lack of harmonised regulation across the EU. These SMEs mention CE labels, barriers for cross border mobility of personnel (asking for mobility schemes), difficulties in enforcing IPR and uncertainty about data protection (e.g. the question of who owns the data of leased out equipment). There are also cases where regulation can support the introduction of PSCs, e.g. clean air regulation or regulation on noise reduction or take back regulation.

The effect of regulation depends a lot on the exact business model of a company. For example, Houweling in the Netherlands, witnessed increased demand for its recycling services. However, in the near future it might as a plastic and packaging firm suffer from stricter regulation on the use of plastics. In a similar way, the DTE case showed that stricter carbon controls would strengthen the case for the type of process optimisation DTE can provide to aluminum plants through offering its elements analyzers and the services based thereon. In a completely different market, the Spanish case firm Arreche, is struggling with a grey market for its carburettors. They have evidence of counterfeit products on the market with their brand name produced somewhere in the world. These are being sold via electronic platforms. There is, sadly, a lack of opportunity to protect the market from these counterfeit products. Here specifically the grey market of the business they were involved in is a puzzle to the employees and they do not know how to counteract the influx of grey market parts being offered on electronic sales platforms. An opportunity to investigate this influx of grey market products would be seen as positive. While there are legal options to investigate, specifically SMEs do not have the capacity to investigate.

ComAp, the Czech provider of electronic control and management solutions for the power generation industry, signalled various regulation related issues. The firm is highly specialised and therefore recruits personnel from all over the world. One area that could be of help, is if European Union could support recruitments cross borders within Europe by ensuring that it becomes easier to manage the differences in tax and social security systems between the countries. The existing agreements are still in many cases not updated for many years. By contrast, movement of goods and services is not seen as problematic and well established. Data management and data protection is another regulatory issue mentioned by ComAp as a continuing focus of attention for ComAp (especially as a global company working from a European base). Greater consistency of international data regulation would help this situation for SMEs. This applies also to personal data regulation, which is recognised as increasingly stringent. For small companies this can impose considerable administrative burdens and constrains internal processes. Finally, warranty regulations as well as sales contracting and related regulations are mentioned as complex across Europe and internationally. Less regulation or very clear regulation is seen as positive, as it reduces overheads for firms and companies.

Survey respondents also considered IPR and, to a lesser extent, data protection regulation as hindering the provisioning of product-service combinations. For some SMEs, IPR was considered not effective in protecting their IPR on products or the service component. For other SMEs, IPR hindered or blocked access to relevant knowledge and components. As such, there are indication about 'both sides' of typical IPR debates. Regarding data protection, SMEs referred to non-personal data. As one survey respondent puts it:

“My client is 'A' and I needed the data of 'B', it cannot be given to me because of national regulations, so I can give it only to a company in the country of 'A'. This prevents the work with 'B' or there should be several intermediaries – external organisations”

Some of the comments about IPR and data protection were positioned in the context of the EU single market, e.g. concerns about IPR enforcement in other European and non-European countries and (see above) constraints in sharing data across national borders.

Manufacturing companies outside the EU also face several barriers, when developing or providing product-service combinations. In **China**, manufacturing of components and equipment as part of global value chains, means that the structure of companies is fit for products instead of services and integrated solutions. The attention for servitisation, including collaboration with clients, is increasing. Substantial public financial support for the manufacturing industry and less support for service sectors, does not provide an incentive for Chinese companies to invest in their service portfolio. Similarly to the EU, in **India** manufacturing firms lack understanding about the processes and benefits that servitisation might bring, and they experience a shortage of relevant skills. In the **United States**, manufacturing companies that provide services reported that they struggle to understand the real value of their services for their clients. The lack of awareness of the benefits of servitisation and of the organisational changes that are required, result in unpreparedness and unwillingness of company management to introduce PSCs. In **Australia**, manufacturing firms experience a lack of highly skilled workers and a deficit in management quality to organise the transition of a company towards service provision.

When summing up the barriers discussed above, one can stress the broad range of barriers. From the perspective of manufacturing SMEs, individual barriers ‘can add up’ and they can be intertwined. One of the cross-cutting aspects is knowledge about servitisation. There still are stereotypes about what manufacturing entails and how it differs from service provisioning. Examples of these stereotypes, and the product-service dichotomy, were found in governments, companies and investors. The lack of knowledge about servitisation should be acknowledged when discussing how policy makers and other stakeholder can better facilitate servitisation. Based on the discussion above, this concerns awareness raising, skills development, collaboration between manufacturing SMEs and business/innovation partners, increasing access to capital and fine-tuning of regulation.

5.2 Barriers for different types of SMEs and sectors

The most important barriers to servitisation, discussed above, are relevant for the majority of surveyed SMEs, regardless of company size, manufacturing sector or country. Moreover, there are minor differences only regarding the barriers perceived by SMEs that provide PSCs and those that do not. However, some contrasts are noticeable. For **micro companies** that already provide PSCs the access to financial resources is more problematic than for larger SMEs. **Micro companies** that do not yet provide services experience difficulties in finding the right suppliers/partners and in complying with product/market regulations. The main challenge for **small and medium sized companies** is the inability to recruit people with the right set of skills and the lack of skills of current staff (Figure 24 on the next page). This applies to SMEs that do provide services and those that don't.

There are **small differences between manufacturing sectors** with respect to the relative importance of barriers.

- The lack of skills of current staff is the major barrier for SMEs that manufacture machinery and equipment (C28, in NACE terminology), metal products (C25) and electrical equipment (C27).
- The inability to recruit people with the right skills represents a big challenge for SMEs that produce computer, electronic and optical products (C26), metal products (C25) and non-metallic mineral products (C23).
- The unavailability of suppliers and partners for production is considered an important barrier for SMEs in these sectors: manufacture of motor vehicles (C29), printing and reproduction of recorded media (C18) and manufacture of chemicals and chemical products (C20).
- Product regulations, market regulations and standardisation are seen as major challenges for many companies that manufacture motor vehicles (C29), machinery and equipment (C28), electrical equipment (C27), chemicals and chemical products (C20) and food products (C10).
- Uncertainty about client demand and market trends is experienced most clearly by companies that produce basic pharmaceutical products (C21) and printing and reproduction of recorded media (C18).

Figure 24 Barriers that are (very) important for launching or providing services, according to manufacturing SMEs that provide product-service combinations and those that do not, by company size class (N=657; N=371)



Source: Technopolis Group, Dialogic and Cambridge Service Alliance

Case study message 14: Skills, organizational culture and management support are key for making the switch to PSCs

Many manufacturing firms are struggling to change the skill sets, management attitude and firm culture towards making the switch from goods to services and, eventually, to integrated solutions. The skill sets of the current population of the real hardware producing manufacturers is not in line with what is needed for developing and providing services, not matter whether it is in the form of add ons, PSCs or service solutions. Missings skills have to do with the ability to really understand and liaise at various levels with (potential) clients, to think in terms of functionality for clients, instead of the manufacturing logic for the firm itself. In service operations, the skills that are related to dealing with clients, such as marketing, sales, consulting, are very important. These types of capabilities cannot simply be bought from the shelf by hiring new staff, as staff turnover does not always allow to hire new staff on a large scale. Of course, management needs to lead this change and the organizational culture needs to be adapted as well.

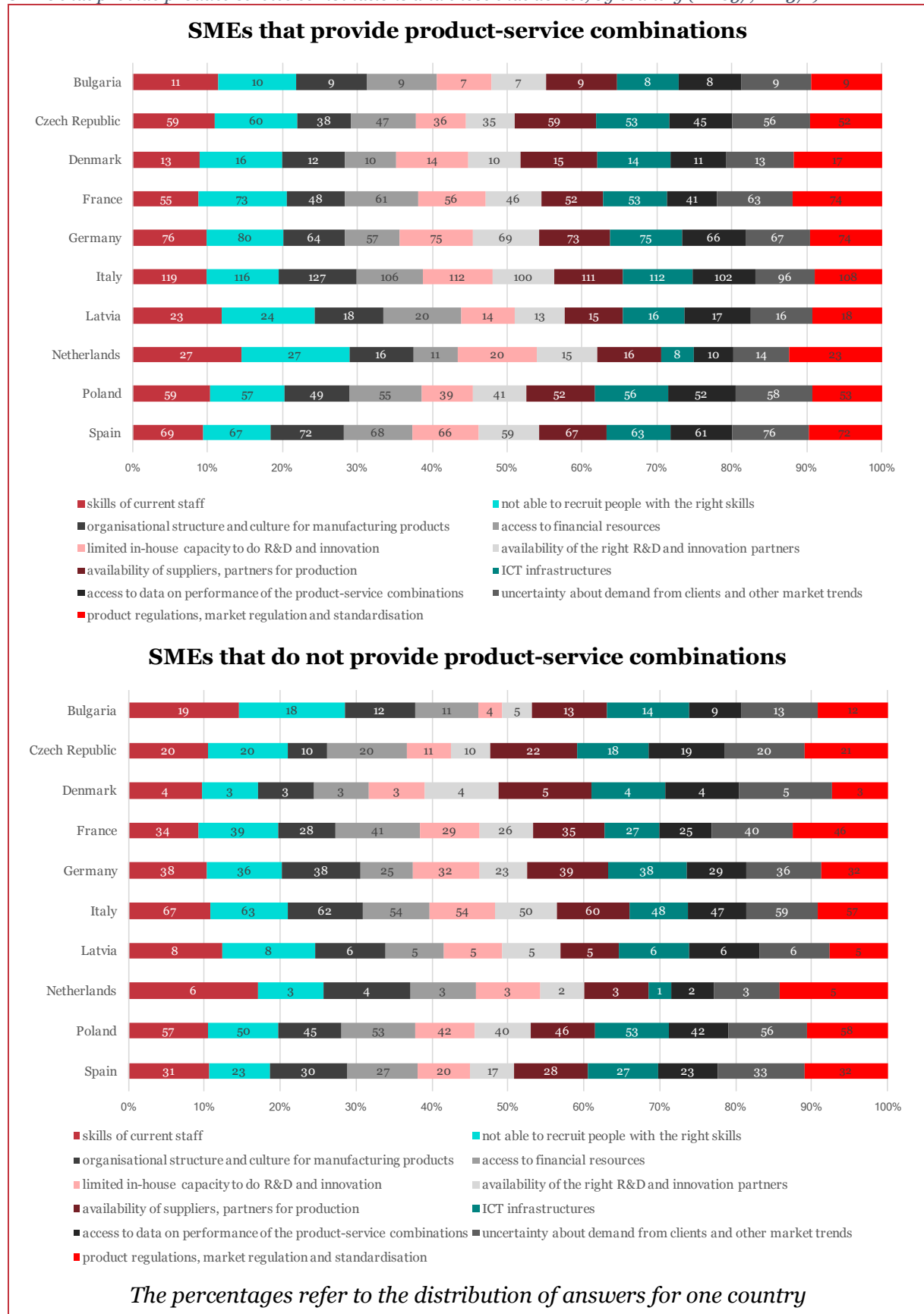
The skills that were signaled in some of the cases are related to digitalization/data-analytical skills. Not all SMEs are benefitting from available big data. Training at all levels, both formal and on the job can be beneficial, as well as, a senior management that actively steers on understanding clients and developing solutions that better satisfy client needs. At Sakta, the management support has been key in enabling and driving servitisation. The lacking skills of employees to develop and provide services and liaise with varying sets of clients (next to a simple lack of available workforce due to emigration – and brain drain - from Latvia) pose major challenges for introduction and diversification of PSCs. At Walter Rau, the management created ample support for the transition to services e.g. by creating a new physical Customer Solution Center (1000 square meters, €3 mln. Investment), which also helps to flag to its own employees how important a client orientation and more customized services are.

At ZWM, the company's management commitment to expand the range of PSC's has been central in its servitisation process and in enabling organisational change. The lack of available workforce with the right qualifications and skills has been hindering the firms' shift towards PSC's. At Houweling, the role of management steering the firm into new directions by helping staff to recognize and meet client needs is seen as imporant. At the same time, investing in ICT and data analytic skills has helped to understand much better where there are opportunities to charge for services provided for the wrong (that is mostly too low) price and to understand much better the margins of the various product and service categories. It does so by hiring at middle management positions key personnel with the right skill sets to develop a richer set of services, to understand the data and to work together intensively with clients.

5.3 Barriers in different countries

According to the survey responses, the **relative importance of barriers hardly differs between the ten European countries studied**. However, in most surveyed Eastern European countries, such as Czech Republic, Latvia and Bulgaria, as well as, in the Netherlands, skills is the most prominent barrier to servitisation. In the Czech Republic, Latvia and Bulgaria, the survey responses and the case studies contain some indications that 'brain drain' plays a role. In the Netherlands, this may be due to tight labour markets. It may also be due to other possible barriers (such as ICT infrastructure) being removed. For SMEs that are located in Southern Europe, represented by Italy and Spain, the organisational structure and culture for manufacturing products constitutes a more important barrier than in other countries. In several Western European countries, namely, in the Netherlands, France, Denmark and Germany, the product or market regulation and standardisation are seen as more important barrier than in other countries (Figure 25).

Figure 25 Barriers that are (very) important for launching or providing services, according to manufacturing SMEs that provide product-service combinations and those that do not, by country (N=657; N=371)



6 Policy recommendations

6.1 Introduction

Chapter 6 proposes **policy recommendations in five key areas** that emerged as the most important factors of servitisation from the analysis, plus a sixth recommendation regarding **monitoring** of servitisation in Europe.

The five policy recommendations concern skills development, facilitating SMEs to meet business and innovation partners, access to finance, the EU single market and awareness raising.

The recommendation for monitoring servitisation in Europe includes a proposal for a framework with Key Performance Indicators, creating synergies with existing data collection efforts and pursuing innovative data collection tools like the webscraping exercise conducted in this study.

6.2 Assess skills gaps and adapt skills development initiatives

6.2.1 Key findings

The importance of skills for servitisation is acknowledged in definitions of servitisation (e.g. Neely et al. 2008) and in studies on servitisation by large companies (e.g. Gebauer and Friedli, 2005; Martinez et al., 2010; Wise and Baumgartner, 1999). In short: manufacturing companies that launch services, need to master the skills to develop, produce and sell services. The case studies in our studies revealed how skills needs and skills development are one element in the process of servitisation, linked to decisions about the exact product-service combinations to be provided, changes in the structure and culture of manufacturing organisations and decisions about the extent to which services are produced in-house or in collaboration with suppliers and partners (Chapter 4).

A lack of skills, needed for providing product-service combinations, is the main barrier to emerge in the SME survey and one of the main barriers revealed in the literature review (Chapter 5). The lack of skills of current staff is a barrier for servitisation for close to 50% of the SMEs that responded to the survey and that provide services. For SMEs that do not (yet) provide services, the figure is close to 40% of SMEs. The number two barrier to emerge from the SME survey is the inability to recruit people with the right skills. This barrier relates less to current staff and more to the availability of job seekers with the right skills set, as developed in education and training.

The survey results indicate that skills is an important barrier for micro, small and medium-sized companies; for a broad range of sectors; and in all countries. The skills barrier appears to be slightly more substantial for medium-sized companies (possibly because they need to recruit and train more staff) and for sectors that are highly servitised (e.g. electrical equipment (C27) and manufacture of computer, electronic and optical products (C26)).

Only to some extent, skills are mentioned as a success factor, e.g. senior management, technical or sales staff having the relevant skills or being quick enough to grow their skills. In other words: few companies mention successes in developing skills. An example from the literature review is Cenamor et al. (2016, p.6) although this article refers to training rather than skills already being mastered: “...*new types of skills were required among the back-end functions such as data scientists. Moreover, extensive training programs among the front-end units were required to build operational competences.*”

To some extent, the literature review and the case studies shed light on the **type of skills** that SMEs consider to be important for servitisation, yet being too scarce in their organisation and on the labour market. This concerns: understanding and experimenting with emerging technologies (such as the Internet of Things), IT and digital skills, data science, different types of engineering skills, process operations, machine operating (technicians), business process (re)design, client-relations (marketing and sales) and management and collaboration across departments. As such, SMEs refer to a broad range of intellectual and social skills, rather than physical skills. Moreover, SMEs refer to the skills of persons in different parts of their organization, e.g. management, sales, IT and operations.

6.2.2 *Examples of existing policy initiatives*

EU, national and regional policy makers all play a role in the identification and monitoring of skills needs (and any labour market shortages) and supporting education and training initiatives.

There are **several EU policy initiatives** related to digital skills, engineering skills, social skills and other skills that are required for servitisation. These initiatives do not refer to servitisation as such but have overlapping and aggregated labels such as digital skills, Industry 4.0 (that requires engineering, digital, data science and other skills), STEM skills (Science, Technology, Engineering and Mathematics) and 21st century skills (a broad range of transversal skills including entrepreneurship, creativity, communication and collaboration).

At EU level, the main skills initiatives are brought together in the **New Skills Agenda for Europe**, launched in 2016. One of the initiatives is the **Digital skills and jobs coalition**. Taking into account subsidiarity, effectiveness and other criteria, the European Commission created this coalition together with Member States, companies, social partners, NGOs and public and private providers of education and training. Among other things, the coalition makes transparent and shares the lessons of training initiatives for digital/IT experts, other staff, job seekers, students (digital skills in education) and the population as a whole. Moreover, the European Commission asked Member States to develop national digital skills strategies and to create national coalitions to define and implement these national strategies. This approach acknowledges that skills needs and the required skills development initiatives differ between countries.

Another initiative under the New Skills Agenda for Europe is the **Blueprint for Sectoral Cooperation on Skills**. This approach acknowledges that skills challenges differ between sectors, while there can be similarities, spillovers and collaboration between countries. The expectation is that the sectoral cooperations will address a range of skills relevant for their sector, while combining actions targeted at staff (e.g. vocational training), education (e.g. updating curricula) and labour markets (e.g. mobility). The first set of cooperations is launched early 2018 and concerns the following six sectors: automotive, maritime technology, space - geo information, textile, clothing, leather and footwear, and tourism. It is expected that the implementation of sectoral cooperations will be funded by private and public actors. At EU level, this includes programmes that address vocational training, such as Erasmus+ and Upskilling Pathways: New Opportunities for Adults.

An example of a national initiative, relevant for servitisation, is the **skills pillar in the Dutch Smart Industry Agenda**. Very similar to the concept of Industry 4.0, Smart Industry concerns the use of digital, robotics and other technologies in the manufacturing industry. Among other things, the group of Smart Industry stakeholders will ensure that smart industry pilot facilities ('field labs') are not only used for research and innovation but also as a learning environment for staff and students. For instance, SMEs, universities and other education institutions are invited to participate in field labs. Aimed at a larger group of SMEs and large firms, Smart Industry stakeholders discuss how lifelong learning can be better funded and how more companies can create a learning culture. Other actions address modernisation of ICT and engineering curricula and research into human-centric technology, to achieve that more workers can use new technologies and tools. Both these actions should reduce the shortage of staff with ICT and/or engineering skills.

6.2.3 *Recommendations at EU level*

The first recommendation with respect to skills for servitisation is to **embed this topic in existing, broader initiatives about skills for Industry 4.0**. In a broader, Industry 4.0 perspective, servitisation is regarded as one development, in addition to technologies and developments such as the Internet of Things, 3D printing and robotics. The intellectual and social skills that are relevant for servitisation, according to our study, to a large extent overlap with the skills that are addressed in the broader context of Industry 4.0. This holds especially for digital skills, engineering skills and social/collaboration skills. Another overlap could be data analytics skills. Data analytics, including big data, is at the heart of Industry 4.0 (and Smart Industry and Factories of the Future) and is also relevant for advanced types of product-service combinations (such as full process outsourcing) and other digital-

enabled services (such as predictive maintenance). Skills are being addressed in Industry 4.0 initiatives such as Smart Industry in the Netherlands (see above), Germany's Work 4.0 and Sweden's Industrial Skills actions. The same could apply to the European platform, EUI4.0, that will bring together national Industry 4.0 initiatives.

The second recommendation is to continue the efforts of EU institutions to **analyse which types of skills**, at which skills levels, and for which employees and entrepreneurs are most relevant for servitisation and Industry 4.0. For instance, skills needs may differ not only between sectors but also between micro, small, medium-sized and large enterprises. Two challenges are to apply shared skills and competences frameworks and to share the results of the various skills monitors and studies. The New Skills Agenda for Europe but also the EUI4.0 platform could be platforms to share these frameworks and study results. Among the organisations launching studies about skills for Industry 4.0 are **European Commissions** DGs (e.g. GROW, EMPL and CONNECT), **Cedefop**, **Eurofound** and the **Joint Research Centre** (JRC). For instance, DG GROW together with EASME launched a study on SME skills development for big data, Internet of Things and cybersecurity (EASME/COSME/2017/007). Other examples are Cedefop's Skills Panorama, Eurofound's studies on the Future of Manufacturing in Europe and Cedefop's/Eurofound's European Company Survey.

The third recommendation is to further **increase the level of priority of SME skills development**, not just with EU and other policy makers, but also with public-private partnership. See for example how skills often are 'the last topic on the agenda' in national initiatives about Industry 4.0, Smart Industry and Factories of the Future (another example is the Big Data Value Association where skills is Task Force 9). Two of the means to increase the attention for skills are the recently created **EU Industry 4.0 platform** (EUI4.0) and the **Sectoral Cooperations on Skills**. One of the challenges will be to not only share lessons among the Industry 4.0 initiatives in leading countries such as Germany and Italy but also to incentivise other countries.

6.2.4 *Synergies between EU, national and regional initiatives*

The discussion above touched on the importance of creating synergies between EU, national and regional initiatives for skills development (cf. subsidiarity). The **New Skills Agenda for Europe** illustrates that EU-level initiatives focus on skills and competence frameworks, international mobility of workers, monitoring of skills needs and training initiatives, awareness raising, exchange of good practices and co-funding of national and regional initiatives. Although SMEs are an important target group, EU level initiatives also address large firms, students, job seekers, education and training institutes and other stakeholders.

National Industry 4.0 initiatives could be effective platforms to refine the analyses conducted at EU level and, especially, to support SME's skills development initiatives. Note that these skills initiatives can be public, private or public private. Along the same lines, national Industry 4.0 initiatives should become partners in the Sectoral Cooperation on skills. Again, this concerns a variety of stakeholders.

Regional policy makers are relevant too, because sectors tend to cluster around specific cities and in parts of the country. Regional policy makers, together with partners such as cluster organisations, should stimulate collaboration between SMEs and providers of education and training.

6.3 **Clusters and crossovers: facilitate SMEs in meeting innovation and business partners**

6.3.1 *Key findings*

External collaboration when developing product-service bundles has been identified as one of the important enablers and success factors behind profitable servitisation. In our literature review, 'setting up and using a network' was one of the key success factors behind servitisation. The articles highlighted that the success relies on the ability to handle business relationships, both with customers and within the business network. The availability of the right business partners and suppliers are also mentioned as a key barrier in 10 different articles reviewed. What companies highlighted is that **it is almost impossible for SMEs to have a complete set of expertise in-house in all necessary areas**

and their ability to develop new business models is much more limited than for larger firms. Similarly, external cooperation is also among the drivers behind servitisation since the initiatives taken by suppliers or business partners can influence very much firm behaviour. Setting up a network and handling business relationships are crucial as several case studies in the academic literature revealed.

It is not only the availability of innovative business services closely such as consulting, engineering or digital that is important but also the type of test facilities, pilot production lines or inspiring suppliers. In terms of the archetypes, there are some which need even more external collaboration such as the development of digital services, logistics or financial services.

Interestingly, the survey also revealed that a large number of SMEs selected their **main partner or supplier from their own industry**. SMEs can increase their scale of operations by means of cooperation with a partner that is more active in specific client industries, countries or that is more experienced in providing specific services that complement products.

The survey also revealed that 34% of manufacturing SMEs that provide services, mentions that their main supplier or partner is located in another country than their own, which is a non-negligible share and calls the attention to the importance of international relationships in developing product-service bundles. Clusters and networks can also support the development of **international relationships** and better positioning in **global value chains** where external cooperation in international context can also foster the successful servitisation of companies.

Clusters as innovation business ecosystems play a crucial role for firms to be able to find easily such external cooperative opportunities. Manufacturing and service firms that co-locate in innovation clusters are more prone to knowledge spill-overs and have a better access to multidisciplinary competences and new types of business relationships. Clusters ease the access to specialised suppliers (Porter, 1990; Cooke, 2001; Ketels, 2008) which is also important in enabling the development of innovative services such as for instance a new digital application linked to the manufactured product. In terms of finding partners, large firms face fewer problems than SMEs, hence being part of a cluster can be even more beneficial for them where they can create synergies more easily.

6.3.2 *Examples of existing policy initiatives*

We present three national and regional policy initiatives and one European level policy initiative that support firms finding collaboration partners in their servitisation efforts.

The Service Cluster Denmark was launched in 2011 with the aim to fostering the development of innovative service concepts in both manufacturing and services industries. Its vision is to contribute to growth, innovation and competitiveness amongst service intensive enterprises in Denmark. The cluster strengthens research-based service innovation by creating new possibilities for cooperation and co-creation between enterprises, researchers and knowledge transfer institutions. Apart from stimulating service innovation activities in businesses, Service Cluster Denmark is a partner, facilitator and knowledge broker in service innovation both within Denmark and Europe. The cluster also offers support to internationalisation for their cluster members (ESIC discussion paper, 2015).

The **Digital Catapult**⁷ is one of the UK Catapult Centres established in 2013 in London. It works with companies of all sizes to transform their businesses by accelerating the practical application of digital innovation. The Digital Catapult bridges the gap between research and industry, finding the right technologies to solve problems, increase productivity and open up new markets faster. The Digital Centre is underpinning digital service innovation by providing facilities and expertise and by bringing partners together. The Digital Catapult is a physical centre, where facilities are made available and research and events take place. (ESIC discussion paper, 2015).

⁷ Catapult Digital. (2018). Available at: <https://digital.catapult.org.uk>

The **Service Science Factory**⁸ is an initiative of the Maastricht University in the Netherlands to stimulate service innovation. It helps identifying business challenges and potential innovations by fostering the development of innovative service concepts also for manufacturing companies. The firms wishing to develop a new service can hire a team of professionals and students to perform a project that is valuable and informative to all parties involved. The projects provide access to external partners and collaborations.

The **EIT Climate-KIC's**⁹ mission is to bring together, inspire and empower a dynamic community to build a zero carbon economy and climate resilient society. Climate-KIC integrates education, entrepreneurship and innovation resulting in connected, creative transformation of knowledge and ideas into economically viable products or services that help to mitigate climate change. In this respect, it also funds projects of manufacturing entrepreneurs that develop a new environmental service.

6.3.3 Recommendations at EU level

Policy-makers can foster the servitisation process within manufacturing industries by **providing explicit incentives** to manufacturing and service companies and other organisations to support increased collaboration, which can educate entrepreneurs and business executives on the practicalities and potentialities associated with servitisation and create matchmaking opportunities between firms. Creating innovation platforms for business networking can result in the development of strategic alliances between SMEs or foster spin-offs, buy-ins between large and small firms.

At EU level, the European Observatory for Clusters and Industrial Change (and especially its policy support tools to regions and clusters) and the **European Cluster Collaboration Platform** should explicitly embrace the concept of servitisation and support exchange of experience and collaboration among European cluster management organisation in this specific field. A training programme or awareness raising workshop could be organised for cluster managers on servitisation in the framework of the European Cluster Collaboration Platform. A **dedicated European Strategic Cluster Partnership** could be launched with the aim of developing product-service combinations.

Similarly to the '**INNOSUP-Cluster facilitated projects for new industrial value chains**', a call could be launched that would stimulate cluster facilitated projects for the development of new product-service offerings. The call could be divided into the development of innovative product-service bundles such as powered by digital technologies and to the development of non-technological business concepts linked to creativity for instance.

Besides cluster development, the **Enterprise Europe Network** and the **Horizon 2020 programme** and especially its strand on 'Innovation in SMEs' could include specific calls that target collaboration in the area of servitisation. The Enterprise Europe Network could take up servitisation as a specific element and organise match-making events around this topic or even targeted to digital/circular economy services.

Servitisation could be more explicitly embedded into the **EIT Knowledge and Innovation Communities**, which provide an open platform and international meeting point for the development of innovations. For instance the EIT Digital's Digital Industry action line could target servitisation projects in the area of digital services offered in the manufacturing sector or the Climate KIC could have an even more targeted focus on sustainable product-service offers. The upcoming EIT Manufacturing will aim at strengthening high-value (or added-value) manufacturing industries to guarantee Europe's competitive position. Since it is expected to develop both product and service innovation, and contribute to a sustainable society, it will be a good basis to support servitisation and finding external collaboration partners for manufacturing companies.

⁸ Service Science Factory. (2018). Available at: www.servicesciencefactory.com

⁹ Climate-KIC. (2018). Available at: <http://www.climate-kic.org/>

6.3.4 Synergies between EU, national and regional initiatives

Support to external collaboration can be best provided at **national and regional level** where policy-makers can influence the local innovation ecosystem and have direct links to companies.

One of the obvious tools in supporting business cooperation is **cluster initiatives and networks** that have been a popular policy instrument since the 2000s across the EU. Policy-makers can not only launch cluster initiatives and create cluster organisations but they can also strengthen the framework conditions that are necessary for the emergence, or support, of service-based clusters or that fosters cross-sectoral business cooperation. Such framework conditions include the development of a service infrastructure, the expansion of cultural and social capital, knowledge enhancement and improved access to new types of funding. This has been emphasised both by the European Service Innovation Centre (2015) and the European Cluster Observatory (2015).

Cluster organisations can specifically facilitate **links among firms** and offer **specialised business services** to cluster firms also in the area of servitisation. New tools are for instance consultancy in design, access to knowledge-intensive services, provision of testing facilities or information offers. This can greatly increase the chances of developing new hybrid product-service solutions for customers.

Nevertheless, cluster managers themselves are not always aware of the potential in servitisation or sufficiently skilled to consult their cluster members in this area. This means that **training programmes about servitisation offered to cluster managers** could have a wide impact and could result in improved and innovative cluster support services. Cluster organisations can also play an important role in facilitating **international cooperation**.

Servitisation can be also fostered by novel innovation platforms such as launched widely in Finland. Many Finnish regions moved from traditional cluster-based policy towards platform-based innovation where **open innovation and cross-sectoral collaboration** are emphasised. In this open innovation platform approach, more focus is placed on fostering new combinations of knowledge and on the co-creation with users than in the previous cluster-based policy that focused on building linkages between research and industry (Romanainen and Izsak, 2016).

Important **synergies** can be created between the European, national and regional level actions. At regional level, SME collaboration schemes and cluster initiatives can help manufacturing companies to find partners for their servitisation efforts; at national level the overall framework can be addressed and servitisation included as a thematic element of national research and innovation collaboration actions and the EU level can raise awareness and support international cluster cooperation in this area. For product-service combinations to become one of the point of attention, policy makers at all levels should be open to explore the links between clusters and the particular importance of ICT, logistics and other enablers of servitisation.

6.4 Increase access to finance for innovation in product-service combinations

6.4.1 Key findings

Servitisation does not only represent a potential new source of revenue but **it has a cost** since the development of innovative product-service bundles needs an initial investment, the acquisition of necessary technologies or even research. This means that the ability of firms to finance this development stage plays an important role in being able to move into a servitised business model. Access to financial resources is even more pertinent to SMEs (and as our survey found to micro companies) who might not have enough financial means to manage the risks linked to the servitisation process.

Indeed, access to financial resources was found the **second most important barrier of servitisation in our literature review** where at least 13 articles dealt with this topic. The survey confirmed that access to financial resources is a barrier for a large share of SMEs. The case studies reviewed pointed out that SMEs have fewer internal resources in terms of financing and the cost associated with servitisation is a significant obstacle. For instance, the Polish case study highlighted that the lack of financial resources hinders the further development of service offerings of the company and

slows down processes such as testing or scaling up. Since the new service ideas should bring an immediate return on investment for the SME in order to survive, the company cannot consider service innovations which may be profitable only in the long-term.

Where access to finance is especially relevant is the **start-up stage** of firms that venture into new product-service bundles or for companies that start up as a new hybrid company for instance offering both a digital product and a service right from the start. For them getting an initial loan or venture capital can help kicking off their business and make their idea a reality. The costs that emerge linked to servitisation can represent technical facilities such as 3D printing or other technical equipment that needs financing. Another stage in the business life-cycle where a specific source of financing is again needed is **when servitising companies want to scale up or want to offer a new type of service**. Often, services are offered as a part of the business portfolio and return on investment is growing slowly. The roll-out of a new service concept to more customer segments or to more product ranges need further investment and financial resources.

In terms of the archetypes, some need more investment than others. While developing a simpler after sales service or adding a logistics service needs not much financial effort, offering a new digital service or venturing in process outsourcing requires adequate capital to finance all the emerging costs. It is especially the innovative, new service offerings that will need support.

6.4.2 *Examples of existing policy initiatives*

We present three national and regional policy initiatives that help servitising firms accessing finance.

LimburgMakers¹⁰ is a programme of LIOF and the Province of Limburg in the Netherlands launched in 2013 that aims at structurally strengthening the competitiveness of the manufacturing industry. One of the strands of this programme is a financial scheme and support to innovation projects with a maximum of € 70,000 (funding 35% of the project costs). The programme supports both the development of innovative products and the development of innovative services linked to a physical product. The developed service is expected to provide an important added value for the customers. In this respect, the programme recognises how services can contribute to the success of economic activity in manufacturing sectors and provides both advisory and financial support to SMEs in their servitisation endeavors.

The **Danish Industry Foundation** develops and supports innovative, inspirational and economically sustainable projects and initiatives that strengthen the competitiveness of the Danish industry. The Foundation supports projects that generate application-oriented knowledge, new competences and innovation for the industry. Each year projects are financed up to 30m euros.

InnoServPro¹¹ is a programme of the German Federal Ministry of Education and Research (BMBF) launched in 2015. The scheme funds projects in the area of innovative service products for new business models. Its overall goal is to realise new business models in the manufacturing of capital goods. Innovative service products can be based for instance on intelligent sensor technology and integrated information management.

6.4.3 *Recommendations at EU level*

Although improving access to finance is primarily the role of the national and regional level authorities, there are also important actions at European level that could improve the situation of manufacturing SMEs thinking to develop a service-based new concept.

First of all it is important that both **public support organisations** and **private financial institutions** are aware of the potential in bundled product-service solutions and consider it worth of investing in such businesses. An often-occurring problem is that they do not have a good understanding

¹⁰ LIOF LimburgMarket. (2018). Available at: <https://www.liof-limburgmakers.nl/>

¹¹ InnoServPro. (2018). Available at: <http://www.innoservpro.de/>

about the potential in service development and they underrate such opportunities compared to technological innovation for instance. The EU could play a role in publishing a **specific guide** in the topic tailored to public and private financial organisations.

Public support such as enterprise development schemes financed through the **European Structural and Investment Funds** currently lack an attention on servitisation. The thematic objectives linked to smart growth include strengthening research, technological development and innovation; enhancing access to, and use and quality of, ICT; and enhancing the competitiveness of SMEs. Servitisation could be imbedded in these priorities by drawing the attention of Managing Authorities for the potential in the development of product-service concepts.

Servitisation could be a recognised model supported by the **European Fund for Strategic Investment** which is one of the three pillars of the Investment Plan for Europe and helps to finance strategic investments in key areas such as risk finance for small and medium-sized enterprises among others.

Another financial scheme, which could embrace servitisation is the **‘SME Instrument’**¹² operated by EASME as part of the Horizon 2020 programme and which is part of the European Innovation Council pilot. The SME Instrument supports top-class innovators, entrepreneurs, small companies and scientists with funding opportunities and acceleration services. The main focus of the pilot is on radical, market-creating innovations to improve productivity and international competitiveness and generate new jobs and higher standards of living. This instrument could publish a **specific call for servitisation based innovations** and support SMEs to develop product-service offerings.

6.4.4 *Synergies between EU, national and regional initiatives*

The public sector can foster a **financial environment that is favourable to servitisation** and service innovation as the Smart Guide on service innovation (2012) also highlighted. Access to finance for the development of new product-service combinations can be supported through public SME financial schemes, through improving access to loans and venture capital or through tax credits. It is not only a loan that is helpful but also offering investment readiness support such as the development of a sound business plan or facilitating networking with public and private investors.

Existing enterprise and innovation support schemes could be improved by **opening up the scope to services in manufacturing support schemes** and not only focusing on novel products as innovations. Similarly, private financial institutions are often reluctant to fund service development concepts because they do not see a sufficient return on investment as a result. Awareness-raising about the potential in servitisation both in public and private funding bodies would help companies to get sufficient financial resources to back up their innovative service ideas.

Access to finance for servitising companies could be improved by **reviewing the eligibility and award criteria** and the focus of financial measures. It is often the type of projects that are expected and approved that hinders SMEs to submit applications in the area of new service offerings. Another practical issue is that the eligible costs of the support schemes does not allow accounting for the costs linked to servitisation, which could be easily changed and adapted.

Improving tax policy is another avenue for supporting servitisation. Several Member States offer R&D and **innovation related tax credits** which could be extended to account for the costs of companies developing new and innovative service in addition to their manufactured products. The tax credit could finance the costs of hiring new skilled employees or the access to testing facilities.

Besides the traditional financial schemes, the potential in using alternative financial sources such as crowd-sourcing or business angel networks could be also explored and addressed at national and regional level.

¹² EASME Executive Agency for SMEs. (2018). SME Instrument. Available at: <https://ec.europa.eu/easme/en/sme-instrument>

6.5 Facilitate the European single market for product-service combinations

6.5.1 Key findings

As discussed in Chapter 5, the majority of survey respondents consider **shortcomings in the EU single market** an important or very important barrier for providing product-service combinations. Among other things, SMEs mention non-harmonised regulation of labelling (e.g. eco-labels), certificates, permissions, safety and quality standards, and technical standards of components, equipment and systems. Survey respondents also interpret standardisation in a (much) broader way. Here, they mention that EU Member States differ in terms of registrations, licenses and permits, regulatory procedures and technical/IT/online systems for the implementation of regulation.

The survey data and the case studies do not allow for specifying whether the EU single market statements concern the product or the service component of a product-service combination, or the very nature of providing integrated solutions. Some examples mentioned, such as non-harmonised national registration and licensing procedures, hint at the service component. The same holds for mentions of posting of workers in other countries. Other examples mentioned such as technical standards and eco-labels, hint at the product component.

Many if not all single market issues that emerged in this study about servitisation, also emerged in earlier studies about the EU single market. For example, a 2015 stakeholder consultation by the European Commission, looking at services, discussed single market issues about registration and authorisation, recognition of professional qualifications, posting of workers (and social security implications), standards and certification, points of Single Contact and access to information about national regulations and procedures.

6.5.2 Examples of existing policy initiatives

Functioning of the EU single market is at the heart of the EU. In addition to removing barriers in the EU single market for products, EU institutions have intensified efforts to remove barriers in the single market for services. An important moment was the Services Directive of December 2006. Among other things, this Directive called on Member States to introduce **Points of Single Contact**. These Points of Single Contact should give service providers clear and updated information regarding applicable requirements in the area of the Services Directive. In addition, they should allow service providers to complete online all procedures and formalities needed for access to and exercise of their service activities. In practice however, the quality of these Points of Single Contact varies significantly across Member States. In many Member States, relevant information is often missing or incomplete and e-procedures are often not available. Where such e-procedures are available, they are often designed for domestic companies and not adapted to cross-border situations.¹³

The 2006 Services Directive also introduces **national peer reviews, implementation reports and evaluations** about the EU single market for services. These showed that many obstacles to the single market in services still remain in place, ranging from regulatory barriers to administrative burdens which service providers face when expanding to another Member State. This makes it difficult for service providers to become active in the internal market, which impacts also negatively on companies offering a combination of products and services.

Other examples of policy initiatives, relevant for product-service combinations, address products, data and standardization. The 2008 Legislative Package to support the single market for goods addressed certification, e.g. **CE marking**. The December 2017 Communication "The Goods Package: Reinforcing trust in the single market" discusses development in European industries and markets (e.g. digitalization) and persistent or emerging shortcomings of the single market. Servitisation is mentioned in footnote 1 but not discussed in the Communication.

¹³ Capgemini Consulting and Eurochambres. (2015). The Performance of the Points of Single Contact. An Assessment against the PSC Charter.

The January 2017 Communication "Building a European Data Economy" discusses the **(free) flow of data**. To complement the European General Data Protection Regulation (GDPR), the emphasis is on non-personal data. This includes data about transactions, production processes and logistical processes, shared in value chains that adopt data platforms, Internet of Things, servitisation and other elements of Industry 4.0. One of the main topics in the January 2017 Communication is whether ownership rights exist on non-personal data that are generated as part of a business process or that are de facto in the possession of a business. What are the conditions of usability and access to such data? The discussion zooms in on cloud computing and data localisation restrictions, but the proposed Regulation (COM(2017)495) is relevant for data and data-driven services in general.

The EU single market is one of the main considerations in EU standardisation policy. A recent step is the **June 2016 EC vision on the new European Standardisation System (ESS)**, including the creation of the Joint Initiative on European standardization. In January 2018, the European Commission published the report on the implementation of EU standardisation policy and the contribution of European standards to EU policies. The report, accompanied by a Staff Working Document, reflects on the **Annual Union Work Programme for European standardisation (AUWP)** and the Rolling Plan for **ICT Standardisation**. The emphasis is on international, European and national procedures (and their linkages). The discussion is about the effectiveness and efficiency of standardisation procedures and institutions, including their flexibility. Specific industry trends are touched upon. Servitisation is not mentioned.

6.5.3 Recommendations at EU level

The first recommendation is to **explicitly address product-service combinations** (as one element of Industry 4.0) in peer reviews, monitors and evaluations of the EU single market. This should ensure that specific challenges of creating a European market for product-service combinations are explored and fully understood. For instance, providers of providers of product-service combinations can be consulted and/or case studies of servitised SMEs can be done: how are manufacturing SMEs and large firms that are servitised hindered by constraints in 'the product and service segment' of the EU single market?

The second recommendation is to add servitisation to the agenda of policy debates about **EU standardisation processes**. For instance, one could explore whether standards for integrated solutions (e.g. advanced types of servitisation) are discussed, or should be discussed in fora that focus on products and/or in fora that focus on services. The risk is that integrated solutions are discussed neither in fora that address products, nor in fora that address services.

6.5.4 Synergies between EU and national initiatives

Initiatives at the national policy level are essential for facilitating the EU single market for product-service combinations. For example, the **Points of Single Contact** for (foreign) companies should not create any difficult procedures or impossibilities for companies that provide products as well as services, or that provide integrated solutions that fit in neither of the two categories. More broadly, Member States should step up their efforts to implement the Services Directive in an ambitious way in order to remove or reduce the many remaining obstacles to the single market for services and, hence, product-service combinations. Moreover, collaboration between the EU and national policy level is essential for peer reviews and monitors of the EU single market as well as European standardisation processes.

6.6 Awareness raising

6.6.1 Key findings

Existing literature on servitisation indicates that many firms do not come along in the shift towards providing product-service combinations, simply because **they are not aware of what servitisation could look like** in their industry and what the potential is. Even if firms are familiar with the ongoing transformation of industries, a poor understanding of this development and the associated investments might prevent them from exploring which opportunities exist in their particular case. A traditional

approach to manufacturing could remain dominant for small firms with product- and technology-centred routines, as they typically have less resources for engaging in experimentation with entirely novel propositions. On top of that, the literature's bias towards strategies and challenges in large firms also implies that **little documentation is available for SMEs** to learn about servitisation.

This study provides indications that many SMEs lack awareness about the potential of servitisation. Not only do individual manufacturers differ highly between the insights they have on this matter; it is likely that **structural differences exist also between countries and industries**. Countries like Denmark, France, Germany and the Netherlands have a relatively high proportion of firms that provide product-service combinations; this is a stark contrast with for instance Bulgaria. Moreover, countries have different profiles when it comes to the **types of product-service combinations**. For instance, in the Czech Republic, manufacturing industries are particularly inclined to engage in after sales and maintenance services, whereas the Netherlands has a higher share of firms providing consultancy, design and engineering services. In both cases, companies engaged in manufacturing electrical equipment and machinery are more likely to be servitised than firms producing beverages and food. Servitisation thus has a different meaning in different countries and industries, which implies that SMEs are likely to vary in their understanding of the strategic and organizational implications of making the shift to services. Inspirational examples and learning opportunities are not equal across space and economic activities.

Of course, the encountered patterns might be partially explained by **firm-internal and external reasons** preventing SMEs from deploying intended services (including a deliberate choice not to opt for servitisation). However, the case studies show that **awareness in small manufacturers is sometimes of recent date**, especially when considering non-high tech industries. The case of Houweling shows that amongst Dutch plastic providers it is still quite unique to combine the production and trade of packaging with warehousing, transport and recycling services. Houweling's focus on 'Total Site Services' is in fact a recent shift for the almost 100 years old company. The start-up DTE in Iceland, furthermore, builds heavily on engineering skills to develop an element analyser for the metal casting industry: insights in how to commercialize this were partially obtained by **hiring a business model consultant** (an example of a provider of Knowledge Intensive Business Services). Overall, the tendency to explore servitisation possibilities appears to be still far from common for SME manufacturers.

6.6.2 *Examples of existing policy initiatives*

Given that still plenty of manufacturing SMEs are unaware of the potential of servitisation, or have little directions when it comes to where to start, some industries face under-investments in service innovation. The starting point for policy intervention in this situation of low servitisation awareness is thus to **make SMEs at least consider whether experimenting with services can be worthwhile**. We distinguish two suitable policy responses:

The most straightforward approach is to target policy at **supporting manufacturing SMEs to familiarise themselves with servitisation**. One could think of varieties of subsidised 'servitisation masterclasses' or trainings provided by experts from knowledge institutes or public research facilities. According to the survey analysis, training programmes are the type of government support SMEs with product-service combinations have received relatively often. It is also the one most commonly found amongst small firms and especially micro-firms, which is line with the observation that especially firms of these sizes lack capacity to acquire training (or trained staff) privately. Illustrative is the type of workshops and co-creation activities provided by for instance the Service Platform Denmark. Apart from ad-hoc programmes, there are examples of public support for research centres that on a permanent basis investigate (and help others with) servitisation and service innovation; these include the Centre for Service Innovation in Norway) and the Aston Business School in the UK.

Masterclasses and trainings are most effective when they are **tuned to the particular context of the audience**. Although there are some fundamental lessons about servitisation, we have also seen that industries differ in the type of product-service systems they embrace (e.g. the PSC-archetype that is dominant). The proposed type of intervention is relevant only when SMEs and the manufacturing industry they belong to are still hardly aware of the phenomenon and have not taken action yet

themselves to explore it in more depth. The difficulty is to involve parties who are not yet realising why the topic might be relevant to them; even participating in a subsidised training is a (time) investment that manufacturing SMEs don't easily make. This is why the masterclasses/trainings can best be **embedded in existing structures and be promoted through influential (industry) networks**, rather than offering it as stand-alone treatments. The Smart Service World Initiative in Germany had such an objective, as it aimed to spur servitisation in the context of digitisation. Recommendations for doing so include making servitisation part (but not focal points) of joint development efforts and common research agendas.

The above-mentioned approach focuses on servitisation training provided through public channels (or by private providers of training). This might lead to more demand for knowledge and capabilities suitable for actually developing and implementing services. Another way to boost latent demand is by **mobilising commercial companies that can assist in the process of servitisation**. These parties include strategy consultants, design firms, engineering firms (e.g. with expertise on circular economy practices), and IT firms (for software-based services). In a perfectly functioning market, such parties themselves manage to convince manufacturing SMEs of their relevance. However, if the manufacturing firms adhere strongly to their existing routines they might not be able to value and absorb the 'servitisation' knowledge on offer. Besides from this information asymmetry, product-centred SMEs might face difficulties when **identifying suitable suppliers of servitisation-relevant solutions** (a form of coordination failure). A possible response to this situation is to support these suppliers in putting themselves more in the spotlight, e.g. by establishing a 'service cluster' (see section 6.4). One specific example of an attempt to enhance visibility of parties with servitisation expertise is found in the Service Design Vouchers (Netherlands, 2016) for getting manufacturing SMEs in contact with firms from creative industries.

Finally, it is important to note that there is also an entirely different type of player that holds abilities to inspire and inform SMEs: **large firms** (including MNEs) to whom the SMEs are supplying. As these clients have a major influence on the strategic decisions and innovation behavior of SMEs, there is a clear potential in encouraging them to articulate their expectations on entering more service-based interactions with SMEs.

Other examples, taking a demand side perspective are Service Innovation Sweden (a platform for exchange of experience in relation to service innovation, digitalisation and value creation) and **Industry 4.0 initiatives** such as Fieldlabs in the Dutch Smart Industry initiative (e.g. Smart Dairy Farming) and innovation projects to implement the Digital strategy for an Intelligent Spain.

6.6.3 Recommendations at the EU level

When formulating policy for awareness raising, it is important to consider the geographical scale at which this can be best implemented. Experts have consistently recommended to bring servitisation under the attention by **connecting to the topics and regional and national networks manufacturing SMEs are naturally engaged with**. This implies that an EU-wide policy initiative focused exclusively on the broad concept of servitisation, like a virtual European Servitisation Centre or campaign, is perhaps not the most effective approach for spreading insights. Instead, such initiatives might primarily have a role in accumulating knowledge on what SME servitisation entails and what it takes. Before any information can be disseminated or incorporated in trainings, it is essential to **collect evidence and good practices**. In order to inspire firms from various manufacturing industries and countries, it is recommended to organise the investigation of SME servitisation dynamics at the EU level.

Another promising avenue for policy formulation at the EU level is to integrate insights on servitisation processes (e.g. on business models, client interaction / co-production, marketing strategies) in **existing initiatives around topics already widely recognised as important**, e.g. digitisation, Industry 4.0, increasing productivity, material efficiency, competitiveness and export. Under these broader labels, it is still possible to stress the relevance of servitisation and specific dimensions such as the circular economy.

6.6.4 Synergies between EU, national and regional initiatives

EU-level initiatives are most effective for identifying and sharing good practices across borders. However, awareness raising in the end is typically a topic that might best be implemented by incorporating relevant insights in programs '**closer to home**'. When trying to inform and involve SMEs, policy makers deal with a target audience that is hard to reach. Relying on programs not linked to anything or anyone already having the attention of the SMEs, is a challenging way to go. In fact, it is quite surprising how many of the firms approached for the case studies, admitted to be highly interested in servitisation without realising there were relevant policy initiatives in their country. A fairly uncontested suggestion is therefore to **identify which national and regional policy initiatives lend themselves for being extended with a training / subsidy / workshop track / test facility devoted to servitisation**. National and regional policy makers could encourage existing clusters and innovation programmes to address the challenges and opportunities of servitisation within the context of topics they are currently promoting (like digitisation and Industry 4.0). Such an approach would complement the suggestion to make servitisation an explicit part of policy initiatives at the EU-level. This should not only concern exchanging best practices but also sharing data about the level and types of servitisation that are picking up in specific countries and regions.

6.7 Framework for monitoring the provision of product-service combinations in Europe

The development of **Key Performance Indicators (KPIs)** sets the conceptual and empirical basis for monitoring the developments of the product-service market in the EU.

The KPIs presented are a meaningful selection of the most significant and robust indicators analysed in this study through different methodologies. Next to proposing a general KPI framework, this section presents the **strengths and weaknesses of each indicator**, and proposes an assessment of their **replicability**.

Furthermore, the links with existing European level monitoring tools are reviewed and ideas on how to link servitisation KPIs with the latter is assessed.

The objective of this section is to build a **monitoring framework** that can be used as a reference for policy makers to advice the future monitoring of the product-service market. Some of the criteria and aspects taken into account for the selection and analysis of the KPIs are:

- The general notion that these indicators must fulfil the SMART criteria (specific, measurable, attainable, relevant, time-bound);
- The requirement that the indicators should allow for a comparison in time and across countries, and industrial sectors when relevant;
- An assessment of the replicability of the indicators, intended as:
 - Resource-efficiency balance between methodological complexity for the indicator production, and accurateness of the results that the indicator can provide.
 - Replicability by the European Commission services.
 - Replicability through time.
- The possibility to establish links with other monitoring platforms/databases, to answer policy questions that tend to go beyond the exclusive use of indicators within a single field (with a focus on science, technology and innovation, or demographics, or pure economics, or sectoral/industrial etc.).

The KPIs collected have been assigned to three conceptual blocks, corresponding to three levels of the analysis of servitisation (Figure 26):

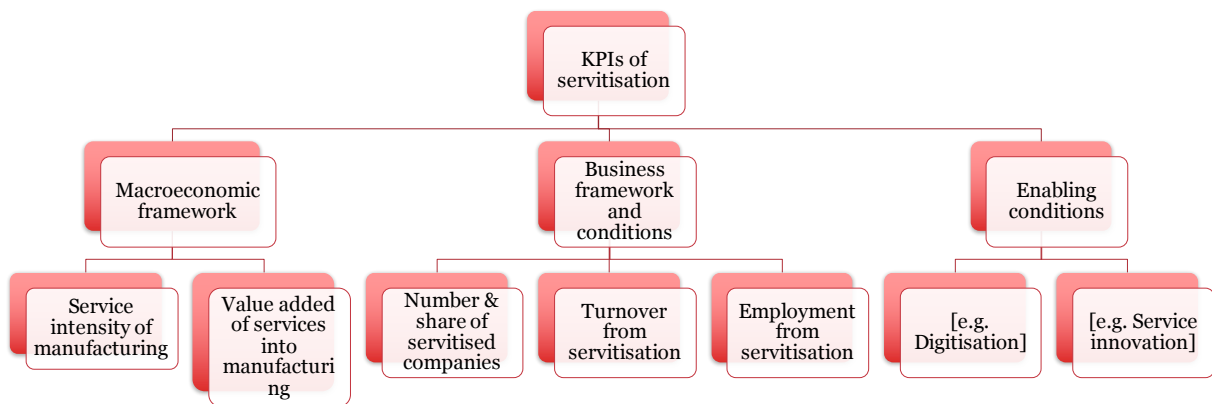
- The **macroeconomic framework**. These indicators reflect the macroeconomic environment that is precondition for servitisation to take place. In a holistic approach, also indicators that do not

directly deal with the interlinkage between manufacturing and services, could be included. Among these indicators, one could mention the importance of ICT infrastructure and service offering, transport infrastructure, access to finance, or the attitude towards collaboration and entrepreneurship. In the KPIs framework here proposed, a more focused approach is taken, thus, only those indicators that are directly concerned with measuring the interaction between services and manufacturing are taken into account. Importantly, due to the high-level of data aggregation of the available macroeconomic data, these indicators should not be considered as a direct measure of servitisation as such, but rather, to contextualise the intensity of inter-sectoral interactions happening within the macroeconomic environment of reference.

- The **business framework and conditions**. These indicators provide a firm-level perspective and include the quantification of servitised firms by country, and sector, together with the estimation of business fundamentals such as the turnover and the employment stemming from servitisation. The methodologies selected for their calculation vary from primary data collection through survey, web-scraping, or company database analysis.
- The **enabling conditions**. This set of indicators do not follow typical industrial sector categories, but rather try to capture cross-sectoral firm dynamics, at meso level. Digitisation, service innovation, but also skill structure, are examples pertaining to this category. As this set of indicators hardly fits into statistical categories, the preferred method for data collection is primary data collection through surveys or webscraping.

The monitoring framework presented below is to be thought as a living instrument, in light of the exploratory nature of some of the methodologies used in this study, and different possible specifications of the indicators proposed.

Figure 26 Servitisation KPIs monitoring framework



Source: Technopolis Group, Dialogic and Cambridge Service Alliance

Table 3 Servitisation KPIs assessment

	Indicator name	Source and Reference	Specification/Unit	Description	Strengths	Limitations	Notes for future use
Macroeconomic framework	Service intensity as indicated by secondary service products of manufacturing	WIOD Supply Tables	By country and NACE sectors 2-digit, as share of the total supply of the service sector at basic prices, 2000-2014	The columns of the supply tables indicate, besides the principal product of each sector, also the production of its secondary products, to get the total output of the sector in column (i.e. CPA categories of manufacturing and services); this shows the diversity of production output of each industry, and it is one of the closest ways to look at the product-service relation from the perspective of the end-product. It is the closest indicator to the concept of servitisation that one can extract by using macroeconomic data.	Conceptually, it is the closest indicator to express servitisation based on macroeconomic data.	The indicator should not be used as a direct proxy for servitisation, because of high data aggregation. By using publicly available Supply tables, it is not possible to distinguish the destination use share of service products in manufacturing, thus, the shares that are used internally to the company and the shares that are destined to the market.	Intermediate supply tables can be checked by country under request, to assess feasibility of more detailed specification of this indicator (i.e. providing service secondary products shares for internal manufacturing company use, for market use, for other use).
	Service intensity as indicated by the value-added content of manufacturing final domestic demand.	WIOD IO inter-county tables	By country and NACE sectors 2-digit, as percentage of total final demand (domestic and exports), 2000-2014	It presents the service value added contribution to domestic manufacturing demand. Value added can be considered as a measure of economic performance as it is the value of the production net of all intermediate costs. A high service value added content of manufacturing reflects a relatively high value creation brought by services to manufacturing. The indicator can be split in the (domestic) service value-added contribution to manufacturing exports (external demand) and to manufacturing domestic demand.	It is one of the few method and indicators able to express the link between services and manufacturing in value added terms; Different specifications of the indicators are possible, which grants a degree of adaptability to different research questions.	The indicator is not intended to measure servitisation as such, but rather to describe its macroeconomic framework conditions; this is due to high data aggregation and to the impossibility to distinguish which part of the value added embedded in manufacturing demand is actually sold on the market as product-service combination.	

Business framework and conditions	Number and share of servitised companies	Analysis of company database	By country, by company size, by NACE sector 4-digits, and by archetype	The indicator derives shares of servitised companies by text mining of company business descriptions, in an extension of the approach developed by A. Neely (2008). The reference company database used is the Capital IQ database.	<i>See general methodological remarks</i>	Expected limitations to reach statistical representativeness mainly due to data coverage of company databases.	
	Number and share of servitised companies	Webscraping	By country and NACE sectors 2-digit, by archetype, in number and share over total crawled companies	Number and share of servitised companies as outcome of the text mining web-scraped data.	If statistical representativeness is reached, it allows to be used as comparator in the triangulation of data and statistics from different sources.	<i>See general methodological remarks</i>	
	Number and share of servitised companies	Survey	By country and NACE sectors 2-digit, in number and share over total survey sample	Companies that have confirmed to be servitised during the survey, according to the question Q2 (and sub-questions) "Do you provide product-service combinations".	If statistical representativeness is reached, it allows to be used as comparator in the triangulation of data and statistics from different sources.	<i>See general methodological remarks</i>	In the current study, the sample was pre-selected according to company description (only companies pre-identified as servitised were enquired)

	Turnover increase due to servitisation	Survey	By country, in percentage shares and ranges (i.e. 1-10%; 11-20%; 21-31%; 31-40%; more than 40%)	Percentage increase in turnover attributed to servitisation, following the survey question 45 of the current study survey: "Did you experience an increase in turnover because of offering product-service combinations?".	<i>See general methodological remarks</i>	Need to carefully design the question to avoid misunderstandings, as of what share of turnover the company is referring to.	
	Share of servitisation turnover as percentage of total turnover of servitised company	Survey	In shares, by type of product-service combination offer (archetypes).	Share calculated on the basis of question 27 of the current survey: "Do you estimate that the service component of product-service combination as a percentage of your total turnover is between 1-10%, 11-20%, 21-30%, 31-50%, more than 50%?"	<i>See general methodological remarks</i>	<i>See general methodological remarks</i>	It is important to account for country and sectoral dimension when designing the survey. If this is done (and statistical representativeness is reached), a gross-up at total country and sector level is possible. For future exercises, the survey sample can be tailored to take into account large companies (the current study only considers SMEs). It is important to account for this dimension when designing the survey.
	Additional people employed because of servitisation	Survey	By country, by NACE sectors 2-digit, in number of people	Calculated as additional people employed because of servitisation (in FTE). Calculated following the survey questions 40 - 41 - 42 of the current study: "- As a consequence of starting offering product-service combinations - Did you employ additional people? How many FTEs?"	<i>See general methodological remarks</i>	<i>See general methodological remarks</i>	

Enabling conditions	Importance of digital services within the servitisation strategy	Survey	Per country and by company size. Presented only for degrees of importance: "important" to "very important", at NACE sectors 2-digit.	Calculated based on question 18 of the current study survey: "In the product-service combinations that you provide, how important are digital services?" (very important, important, somewhat important, not important)	It captures cross-cutting and cross-sectoral dynamics	<i>See general methodological remarks</i>	
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Source: Technopolis Group, Dialogic and Cambridge Service Alliance

6.7.1 Link with existing monitoring systems, European data platforms and other tools

One of the objectives of the development of a monitoring framework for servitisation through servitisation KPIs, is to create indicators that are of possible use in a combined analysis, in view of adding value to other existing monitoring systems, and at the same time, to use these monitoring systems as instrument to collect new data on servitisation indicators.

After review of the most important past and present European level initiatives including data tools such as monitoring platforms, scoreboards, composite indicators, and databases, we identified those that, in our view, have the potential to be linked and have synergies with servitisation. The table below provides a summary.

Table 4 Servitisation KPIs links with existing monitoring systems

Monitoring tool/database	Time period	Link with servitisation KPIs	Main reference servitisation KPI
European Observatory for Clusters and Industrial Change	Works started in Fall 2017	<p>The new Observatory for Clusters and Industrial Change will update the findings of the previous European Cluster Observatory and Scoreboard (running until 2017), and will incorporate the service innovation dimension under Task 2.2: Provision of an update of the European Service Innovation Scoreboard and a summary report of key findings and developments. In fact, Service innovation was previously monitored through the European Service Innovation Scoreboard (ESIS, 2014, 2015), which intended to demonstrate the “transformative power of services” by using structured scorecards.</p> <p>The new Observatory provides a good opportunity to include indicators of servitisation for future monitoring, based on the methodologies proposed in this study and/or on a revised version of the Eurostat CIS questionnaire (see below).</p> <p>The old version of the European Service Innovation Scoreboard mostly focused on three kinds of services (Networking, connecting and brokerage services; Utilities and infrastructure services; and Knowledge intensive business services (KIBS)). The results of this study based on the identified servitisation archetypes can also feed the discussion on the “new transformative power” of service categories, thus possibly coming to support the updated structure of the ESIS framework.</p>	The choice of the reference indicators depends on the reference framework that the new ESIS will develop; following the framework suggested in this section, indicators on all the three pillars (Macroeconomic framework; Business framework and conditions; Enabling conditions) are relevant.
CIS (Community Innovation Survey), Eurostat	Released every two years	<p>In view of new releases of the CIS survey, a servitisation analysis can be performed conditional to slight modifications of the current CIS survey questionnaire. This would be possible by tailoring selected sub-questions at sectoral level (e.g. introduction of new products of services into the market or the company [Q.2.3, 3.2 and 7.2, CIS questionnaire 2014] and analysing the data at micro-level.</p> <p>Of note, the previous versions of ESIS used the CIS to develop a number of indicators on service innovation. In view of the new version of the ESIS, the proposed tailoring of the CIS survey questionnaire could be extremely useful to make a better targeted analysis of servitisation that would also add value to the ESIS.</p>	<p>Indicators that can be extracted by linking these sources are:</p> <ul style="list-style-type: none"> - Number and share of servitised firms; - Servitisation turnover; - Innovative servitisation activities (e.g. number and share of servitisation activities that are new to the market/to the company).

		<p><i>Online:</i> http://ec.europa.eu/eurostat/web/microdata/community-innovation-survey</p>	
European Innovation Scoreboard	Released yearly	<p>The inclusion of indicators of servitisation in the European Innovation Scoreboard would require a more solid analysis of the links between servitisation and innovation performance, and/or, it would require selecting a sample of only innovating companies for these indicators. This said, indicators of servitisation could be added to the sections:</p> <ul style="list-style-type: none"> - “Linkages”. Current indicators are: “Innovative SMEs collaborating with others”, “Public-private co-publications”, and “Private co-funding of public R&D expenditure”. The addition of indicators of servitisation in this section would add information on the linkages between sectors and cooperation. - “Sales impacts”, with indicators “medium and high-tech product exports”, “knowledge-intensive service exports”, “sales of new-to-market and new to firm innovations”. <p><i>Online:</i> http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en</p>	<p>Reference servitisation indicators are:</p> <ul style="list-style-type: none"> - Linkages: “Number of innovative servitised companies, by country and sector” - Sales impacts: “Turnover increase due to servitisation”
European Regional Competitiveness Index	Released yearly	<p>Indicators of servitisation can be added to the section “Business sophistication” of the Index framework. Current indicators are: “Employment” and “Gross Value Added” (sectors K-N), and “Innovative SMEs collaborating with others”.</p> <p><i>Online:</i> http://ec.europa.eu/regional_policy/en/information/publications/working-papers/2017/the-eu-regional-competitiveness-index-2016</p>	<p>“Number of servitised companies, by country and sector”</p>

Source: Technopolis Group, Dialogic and Cambridge Service Alliance

Servitisation is, by its own nature, a **cross-sectoral phenomenon**; this implies that available statistics at European level are most likely to miss this dimension, and that further work needs to be done to build appropriate indicators and statistics, by including servitisation as a dimension in databases, scoreboards, indexes or other relevant monitoring tools.

The development of servitisation KPIs in this study was done, with different degrees of methodological experimentation, through four main methodologies: macroeconomic analysis based on Input-Output tables, the analysis of a company database, webscraping and the company survey. Each methodology has proven to add value to the study, with webscraping being overall the one with the highest potential for further exploration, and the survey the one with the highest adaptability to different research questions.

Regarding the **link with existing monitoring tools**, a good potential for linking data and collecting new data on servitisation, can be found in the new European Observatory for Clusters and Industrial Change, and more specifically, in the update of the European Service Innovation Scoreboard. The latter has a good fit for further studying aspects related to the servitisation of the EU industry. This can be, in turn, linked to the Eurostat CIS questionnaire; we have in fact observed that, provided some adjustments/additions to the CIS questionnaire, new analysis on the product-service market could be proposed.

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