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Deliverable 7.1

INTANGIBLE ASSETS IN THE PUBLIC SECTOR: AN EXTENDED DEFINITION AND METHODOLOGICAL GUIDE

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1 Introduction

The recent economic crisis, which following the events of 2007 and 2008 significantly changed the nature of the economy and started a deep crisis (Keeley & Love, 2010), which was in many European economies overturned only in 2013 and 2014 (Eurostat, 2020). Today, again, we are facing a severe downturn due to Covid-19, which could cause a deeper decline than the recent financial and economic crisis did (OECD, 2020; Oxford Economics, 2020).

The intense study of intangible capital in the economic literature started spreading in 1990s with the seminal papers by for example Lev and Nakamura (Lev, 2001; Nakamura, 1999), who already provided the first definitions of intangible investment/capital. But it was the definition by Corrado et al (Carol Corrado et al., 2005, 2006a) that is now a widely accepted definition of intangible capital. Their definition of intangible capital divides intangibles into three broad groups with sub-groups: 1) computerised information (computer software, computerised databases); 2) innovative capital (which mainly incorporates R&D, but also other innovative expenditure); and 3) economic competencies (brand equity, firm-specific human capital, and organisational structure). The empirical analyses of the size of investment in intangible capital and its contribution to productivity in the private sector showed that the literature so far confirms that intangible capital represents a sizeable share of GDP, between 5 and 13%, and is in some countries quite comparable to investment in tangible capital (e.g. US, UK) (CoInvest Project, 2012; Carol Corrado et al., 2009b; Fukao et al., 2009; Innodrive, 2008; van Ark et al., 2009). In the EU, Corrado et al. (2018) find that intangible investment in EU-14 was around 7%. In 4 new EU member states that were also studied, intangible investment was around 6.4% of GDP. Another study finds that on average between 2000 and 2013 the level of intangible investment was 9.2 percent in the EU-14 (Jona-Lasinio & Meliciani, 2018). Recent Globalinto results show that intangible investments in the business sector were in the period between 2000 and 2015 very different across European economies, from around 4.5% in Greece to roughly 17% in Sweden. The results also show that the intangible investments across Europe declined by much more than the tangible (Roth, 2020).

Early estimates of intangible capital's impact on aggregate productivity growth suggest that intangible capital contributed up to one-third of productivity growth. For example, in the USA, total labour productivity growth between 1995 and 2006 was 2.96 percent, intangibles in total contributed 0.83 of a percentage point to total labour productivity growth. The contributions in other countries were also significant, ranging from around one-quarter to around one-third of total labour productivity growth (Carol Corrado et al., 2009a; Fukao et al., 2009; van Ark et al., 2009). Recent estimates by Jona-Lasinio and Meliciani (2018) show that between 2000 and 2013 the contribution of intangibles to total factor productivity growth was from 14 percent (Denmark) to 30 percent (Netherlands) and even slightly higher in Spain, Finland and the UK (e.g. 33%). According to the authors, the overall decline in labour productivity growth is mostly the result of the TFP slowdown, and not tangible and intangible capital. Corrado et al. (2018) investigate the period between 2000 and 2013, finding that during the crisis intangible investments were relatively resilient, while tangible investment fell. Also the most recent Globalinto results stress the importance of intangible investment, because their growth had a strong and systematically positive impact on productivity growth (Roth, 2020).

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However, the evaluation of intangible capital and intangible investment in the public sector has been much scarcer. The key input was made by SPINTAN project (C. Corrado et al., 2017; SPINTAN | Smart Public INTANgibles, 2013). The SPINTAN project also defined methodological guidelines for the capture and the measurement of intangibles in the public sector by (Carol Corrado et al., 2014):

Providing an extended definition of public intangibles, relying on existing definition of intangibles (Carol Corrado et al., 2006b), however taking into account the characteristics of the private sector

Providing a measurement approach, which is the first comprehensive approach to measurement of public intangibles, based on the approach defined by the research done within the group (Carol Corrado et al., 2006b), however adjusted for the public sector.

This report revises the existing approach to capturing intangibles in the public sector and proposes an alternative approach to measuring intangibles relying on the existing Innodrive methodology, however upgrading it and extending it to make it suitable for the analysis of the intangible capital in the public sector.

In continuing, the report first summarizes the prevailing definition of intangibles in the public sector, followed by a discussion of the SPINTAN methodology as well as other attempts and finally, proposes a methodology for the Globalinto project, based on the Innodrive methodology.

We would like to stress that at this point in the project, the research on the characteristics of intangibles in the public sector is still an on-going process within this project and consequently this report is an interim report that captures current developments. While data across countries differs, additional approaches may be suggested to either exploit additional possibilities offered by the data or to overcome challenges in countries, where data is harder to obtain or is less complete.

2 Overview of existing approaches to measuring public sector intangibles

Intangible capital and intangible investments are equally important in the private and public sector. Public sector intangibles are important because

- of their direct impact on the performance or the productivity of the public sector;
- indirect impact of public sector performance on the private sector performance by providing more or less efficient services to the private sector in those industries, where public sector provides such services (for example NACE O/ Public administration, defence, compulsory social security)
- indirect effect on the private sector, because the public sector intangibles impact the quality of intangible capital in the private sector (e.g. NACE P/Education).

2.1 The SPINTAN approach

The first comprehensive approach to measurement was provided by SPINTAN project. The methodological approach provided by the SPINTAN project relies on the intertemporal approach, which was developed for the measurement of the intangible in the non-market sector. The manual defines, that the non-market sector comprises according to NACE 2 activities the following sectors (Carol Corrado et al., 2014, 2016), following the Statistical classification of economic activities in the European Community (2008):

- public administration and defence;
- education;
- human health and social work activities;

The above sectors are typically non-market sectors, however Corrado et al. (2014, 2016) also add two more, due to the extensive amount of non-market production:

- scientific research and development;
- arts, entertainment and recreation

In detail, the sectors that the SPINTAN methodology included, comprises (Carol Corrado et al., 2014, 2016):

- M
  - B Scientific research and development, NACE 72
- **O** Public administration and defence; compulsory social security, NACE 84
- **P** Education, NACE 85
- Q
  - A Human health activities, NACE 86
  - B Residential care and social work activities, NACE 87-88

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- R
  - Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities, NACE 90-91
  - Gambling and betting activities; sports activities and amusement and recreation activities, NACE 92-93

- The SPINTAN methodology (Carol Corrado et al., 2014, 2016) continues to **define the list of intangibles in the public sector and relates them to the original CHS definition of intangibles** (Carol Corrado et al., 2005). The methodology is summarized in

Table 1. CHS methodology makes in fact two attempts: (1) to keep consistent with the existing definition of CHS in the private sector and (2) extend, adapt the intangibles definition used in the private sector in order to incorporate categories which are relevant for the public sector. The CHS methodology introduces the following categories, which in essence differ from its corporate counterpart:

1) Information, scientific and cultural assets and societal competencies, which incorporate databases, including open data, available to everybody (from statistical to geospatial data to other public databases);
2) Cultural and heritage assets, which are public intangibles, which can derive broader benefits;
3) Professional/managerial capital
4) Human capital, which is a consequence of schooling

The categories of public intangible assets that are listed above differ from those of private. In continuing, the differences, as defined by the SPINTAN methodology will be only briefly presented. Namely, the purpose of this paper is not to discuss in detail their methodology, but rather present it briefly as well as other used approaches.

With regards to the **Information, scientific and cultural assets** the SPINTAN methodology defines further two categories (Carol Corrado et al., 2014, 2016):

- Information assets, which refer to information and content, which is either prepared/produced or as collected by a public institution as part of the tasks that it undertakes within its regular activities. Examples that SPINTAN provides are geo-spatial, meteorological data, business statistics, etc. The data are stored in databases, that the public sector institutions own, and can be used as an asset. Some of the data are open data, some can be sued under specific conditions and some are, despite being collected, not available to the public. SPINTAN carefully revises the existing 2008 SNA methodology and discusses the demand and supply-side measurement possibilities. The conclusion is that the supply-side approach of adding costs of acquiring and preparing the databases, which includes the labour costs of those directly involved as well as part of overheads.
- Software is already included in the ESA 2010 and are available for EU countries.

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- In the case of R&D in the public sector, the fact that the producer or executor of R&D, who pays for R&D, which is not necessarily the case in publicly funded R&D and represents a challenge in the measurement of public R&D.

Table 1: Market vs. non-market intangible capital

Market sector	Non-market sector
Computerised information	Information, scientific and cultural assets
1 Software	1 Software
2 Databases	2 Databases, including open data
Innovative property	
3 R&D broadly defined to include new product development costs	3 Basic and applied science research, industrial and defence R&D
4 Entertainment and artistic originals	4 Cultural and heritage, including design
5 Design	
6 Mineral exploration	5 Mineral exploration
Economic competencies	Societal competencies/Social infrastructure
7 Brands	6 Brands
8 Organizational capital	7 Organizational capital
8a Managerial capital	7a Professional/managerial capital
8b Purchased organizational services	7b Purchased organizational services
9 Firm-specific human capital (employer provided training)	8 Function-specific human capital (employer provided training)
	9 Schooling-produced human capital

Source: (C. Corrado et al., 2017)

Innovative property. Cultural assets were added to the definition of public sector intangibles. These according to SPINTAN methodology include value derived from cultural goods, which generate value because they have artistic, aesthetic, symbolic and spiritual values. Public investments in cultural assets should be according to SPINTAN added. Further on, the culture category distinguishes between cultural and creative industries. Cultural industries include market or non-market oriented activities that provide cultural goods and services, which are film, radio, books, arts, etc. Creative industries have culture as input, and also have a cultural dimension, but produce functional outputs (e.g. graphic design, advertising, architecture, etc.). After an extensive discussion of the definitions of culture, SPINTAN methodology follows a methodology that includes cultural heritage (museums, historical places, archaeological sites), archives and libraries, visual arts, performing arts, books and press, audiovisual and multimedia and cultural education. The methodological guide points to the problems of providing appropriate data. Besides the lack of suitable data (lack of detail in NACE, consistency of data through countries and possibility of use of satellite accounts on culture and other sources), the problems is also how to define the public expenditure on culture, where the project relied on Classification of the Functions of Government (COFOG) (Carol Corrado et al., 2014, 2016).

Economic competencies. SPINTAN also studies the problem of **brands**. While in the market sector, brands are assets referring to a name, symbol, design, etc., that helps define and distinguish a product or a service provider from another. The manual also stresses that for public organizations as well as non-profit organizations (e.g. charities, sports clubs, etc.) typically consistency, focus, trust and partnership are key for brand value and also adds that brands are important but the concept and drivers of brand loyalty differ. The

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SPINTAN approach to measuring brand value in the public sector relies on input-output data and internal wage costs, however data is available for Sweden, and even for Sweden for a limited period of time (Carol Corrado et al., 2014, 2016).

Organizational capital is defined for the SPINTAN purposes in accordance with the CHS (2005) framework, which defines organizational capital as accumulated knowledge that is built into the organizations through the processes of organizing and changing the production process. It is either purchased through consultancies or generated within the firms and organizations, where primarily certain occupations matter, primarily managers and much less professionals, but there is a lot of diversified results in the data. The manual also points to several problems that the methodology should answer: (1) that very different workers can carry out tasks that affects the organization and organizational change. It is also important that organizational capital is an asset, which is part of an organization and does not depend on a single worker/manager. While it would be relatively easy to evaluate investment in organizational capital by assessing cost of mangers, the problem is that not entire work-time (consequently wage cost) can be taken as organizational investment, there is also a problem of depreciation, which is very fast and possible leakages due to employment changes (Carol Corrado et al., 2014, 2016).

With regards to training, SPINTAN defines the following types of training: Function-specific human capital (employer provided training) and Schooling-produced human capital. To capture training, several approaches are being suggested, from Continuous Vocational Training data, to Labour Force Survey and linking PIACC to national data. The manual also stresses problems of direct and opportunity costs of training, subjective and objective value, capturing informal learning and on-the-job training as well as depreciation.

Overall, the CHS SPINTAN approach, which is in detail described in the manual (Carol Corrado et al., 2014, 2016), provides the first such comprehensive approach to measuring public sector intangibles and highlights a number of issues that also are relevant for the Globalinto approach: from sector definition to data availability, very different types of data and data sources the analysis must rely on as well as country differences in data availability.

2.2 Survey-based measurement of intangible capital and its impact on the public sector (but excluding wider effects)

Following the practices of the measurement of intangible capital in the private sector (J. Prašnikar, 2010; Janez Prašnikar, 2012; Janez Prašnikar et al., 2012; Janez Prašnikar & Knežević Cvelbar, 2012), Prašnikar and Redek in 2015 extended their methodology also to the public sector. Their first survey-based study of intangible capital was conducted in 2010 among largest manufacturing companies in Slovenia, followed by an extended study to services sector in 2011. The survey was extended also to Bosnia and Hercegovina and Albania. Later, the methodology was extended and modified to be also used in the public sector in 2015.

The focus of their 2015 survey was primarily to investigate **the characteristics of intangible capital in the public sector and NOT public sector intangibles**. The second notion, which is used by Corrado et al. (2014) is broader and incorporates also elements with spill-over effects to the private sector. However, the survey is a unique experiment, trying to capture intangibles in the public sector institutions.

The first obstacle the methodology encountered was the **definition of the public sector**. While relying on the public sector definition, used for accounting purposes (The Institute of Internal Auditors, 2011), which defines the public sector as one that includes (1) Core government (governing bodies with defined territorial authority, such as governing bodies, government, ministries, legislature, branches of government, etc.), (2) Public agencies (agencies that operate for public good, deliver public goods, services or execute public programmes, but are normally own legal entities and have a governing body) and (3) Public enterprises (independent legal entities, that deliver public goods, services or execute public programmes, but have their own financial revenue besides the state funding, they might compete in private markets and make profits, but state major shareholder), the survey also used a more functional approach as defined by Brejc (Brejc, 2014). The definition of the public sector relied on 5 criteria: (1) organizational (when public sector incorporates all public law legal entities), (2) public finances (direct and indirect users of public financing), (3) functional (performing activities of public interest), (4) economic (all entities established and/or predominantly owned by the state or municipality) and (5) combined functional and economic. By combining criteria two to four, the public sector was limited to institutions that are financed by the budget, performing activities in public interest and are established or predominantly owned by the state. By doing so, the target sectors were limited to general public administration at national and municipal level, primary, secondary and tertiary education, and health care (primary and secondary level), social service activities and police.

The questionnaire comprised 41 questions on intangibles, many questions also had sub-questions. The questionnaire included the components from the Corrado et al. (2005) definition of intangible capital. Questions were grouped so that each part studied one part of intangible capital (informational and relationship capital with information technology, branding and brand capital, innovation and R&D, social capital,, economic competencies with HRM and organization, and also access to finance due to the relevance of the topic at the time). Also general information about the institution and its performance were collected.

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<u>The approach also included 4 additional aspects of intangible capital:</u>

1) Informational capital, which refers to information and knowledge that the organization has about its products/services, also its processes (including production), cooperants, clients, customers and suppliers and resources that the organization uses, including the knowledge about possible other organizations in the same line of business/services.

2) Relational capital focusing on examination of customer-organization relationship and the impact of this relationship on product/services development, on the intensity and consequences on the organizations and its processes primarily also in relation to innovation activity, etc.

3) Social capital focuses on the relationships between workers, management and owners (establishers, state, municipality), that is interest groups, and the impact of their relative power on organization behaviour and strategy. This topic was examined via three parts, one dealing with ownership structure (establishers), second with employment characteristics in firms, the nature of wages, and presence of worker unionization and at the end decision making is studied.

4) In addition, eco-capital was added, which focused on strategic issues regarding sustainable development, its role in organization strategies and perceived impact on organization's position, as well as surveying very specific behaviour (specific data) on eco standards, waste management, etc.

The questionnaire comprises three types of questions: (1) cascading type of questions, (2) Likert scale questions and (3) questions requiring specific piece of information (employment, expenditure on different investment, etc.).

The data for the police and tax administration sector was gathered in late 2014. In total, 177 answers were received. 150 answers (85.7 %) came from the police units (regional, local outlets) and 17 tax offices responded. Both represent the total population of tax administration and police outlets.

The results primarily show that there is a lack of intangible capital in the public sector in comparison to the private sector. For example, Figure 1 presents selected results of the "computerised information" component in the private and public sector. The results primarily reflect the comparatively lower "quality of computerised information" in the public sector, where only 11% of respondents were satisfied with their IT.

The examination of items, related to "economic competencies" (Figure 2) again reveals weaknesses of the public sector in comparison to the private. While brands/ image is important in both private and public sector, there is evidently less loyalty and a wide presence of "doing minimum" required tasks and there is also much less willingness to carry out any tasks that are not necessary (only 40% in comparison to 83% in the private sector).

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Figure 1: Computerised information (selected dimensions) in tax and police and corporate sector
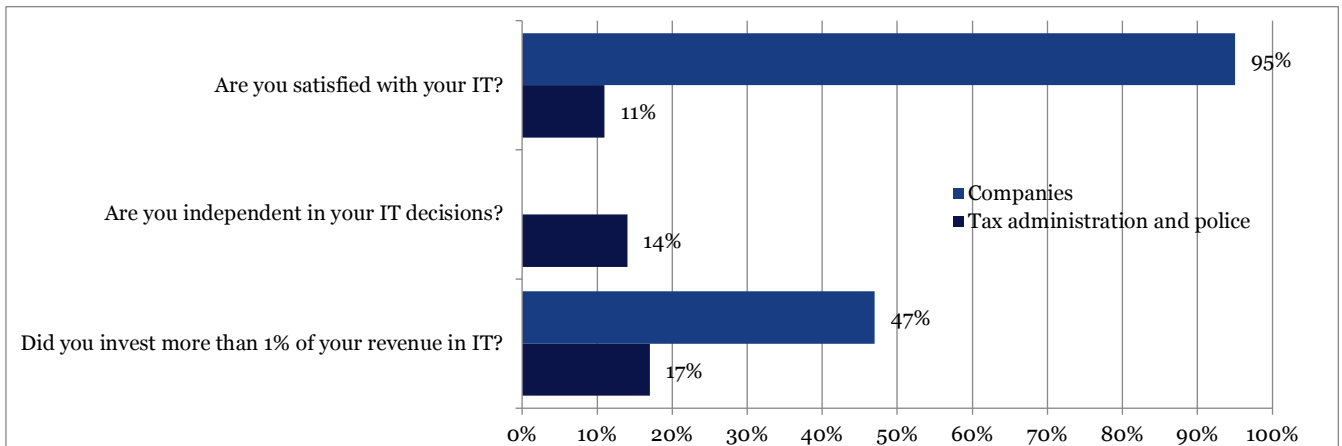
Source: (Redek & Prašnikar, 2019)

Figure 2: Economic competencies in private and public sector

Source: (Redek & Prašnikar, 2019)

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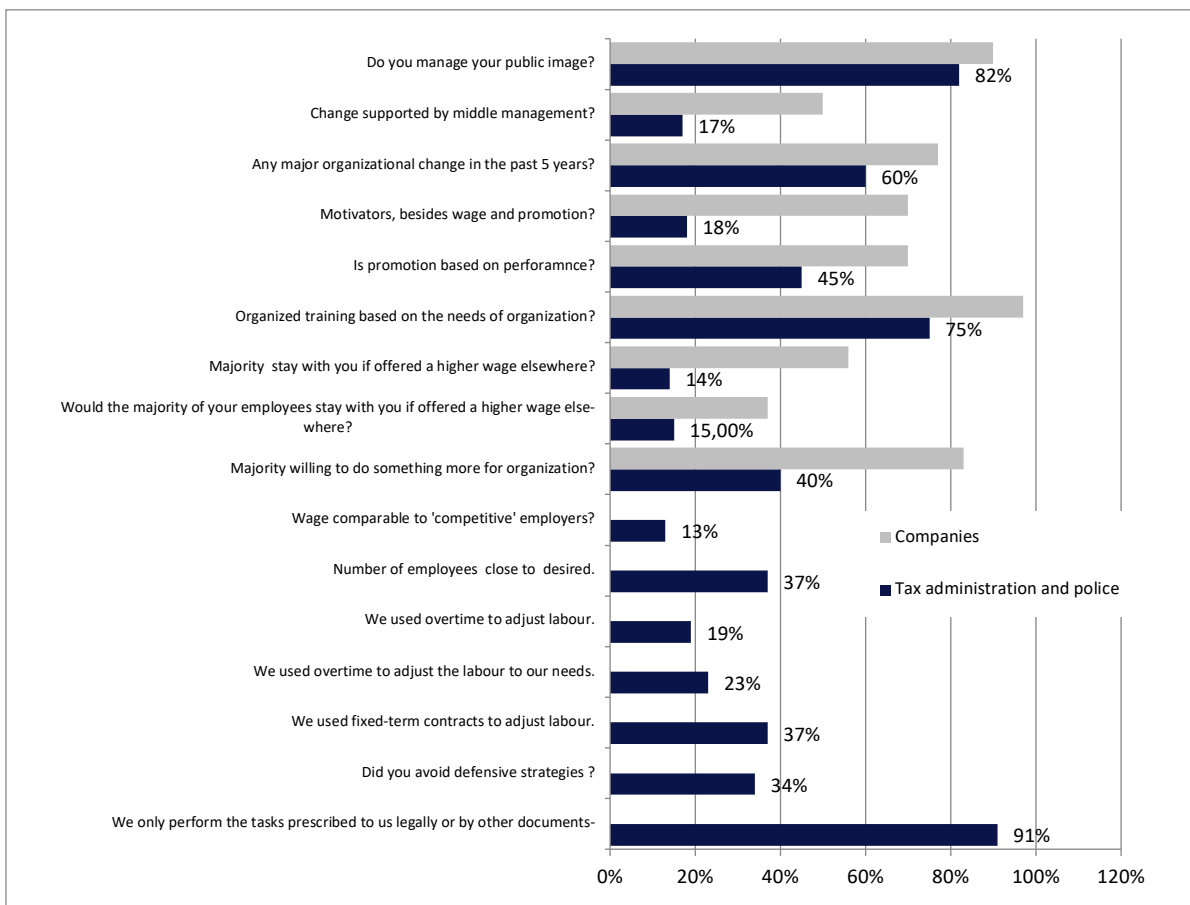
The overall results that are summarized by authors (Redek & Prašnikar, 2019) are presented in Table 2. The results, if these were compared to private sector (J. Prašnikar, 2010; Prasnikar et al., 2017; Janez Prašnikar, 2012; Janez Prašnikar et al., 2012) in detail, would reveal a number of deficiencies in the public sector, which comparatively most likely has an effect on its performance and consequently on private sector performance as well. Therefore, the problem of intangible capital in the public sector even in the narrow form (following just the basic Corrado definition from 2005) is an important research aspect.

Table 2: A summary of main differences in the intangible capital

Type		Survey results insight
Computerized information	Computerized information	Low IT investment Centralized decision-making about IT decisions Low satisfaction with IT
Innovative property	Innovative property	Low focus on services development More focus on process development Cost cutting important in process innovation Not user focused
Economic competencies	HRM	Training obligatory in many cases, large share of employees takes part Training effects not measured Wages low Motivation mechanisms very limited, can not Promotion not performance based
	Branding, advertising.	Public image important, monitored, communication specialists employed
	Organizational capital.	Organizational changes made, but organizational structure rigid, increasing in hierarchical levels, low flexibility, lack of satisfaction of middle management with the changes

Source: (Redek & Prašnikar, 2019)

2.3 Capturing the "heritage capital" using user-generated content: the case of tourism

This section presents an idea to capture the value of the heritage capital using web-based data. The idea was not developed within this project; however it presents another option of how to use existing data sources to evaluate the "comparative" size of world heritage that can be viewed as intangible capital.

Cultural heritage is namely a constituent part of the definition of intangible capital in the non-market sector, and similarly as for companies entertainment and artistic originals represent value added or help distill additional value added, similarly also specific assets, either cultural or heritage, provide additional value to a location or an economy in comparison to others that do not have such an asset. In addition, public sector intangibles has been shown to be important for growth, for example for the correct accounting of growth of the new economy in the US (Jorgenson & Landefeld, 2011). The existence of such »public intangible capital« and continuous improvement in the public intangible capital will have spill-over effects on the private sector as

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well. In the case of world heritage, the possible spillover effects of the »public intangible capital«, which is world heritage listing of a specific site on the UNESCO list, will directly impact the tourism sector and indirectly the linked sectors and the overall economy as well.

The authors develop a model to capture the comparative **value of public intangibles, only its heritage capital, on relying on user-generated content**, specifically user-generated reviews of locations that have one of the world-heritage assets. The rationale for this approach is that if the intangible capital that is supposed to be embedded in the world heritage that is present in a specific location, then in order for this to in fact »be« an asset or capital should be acknowledged by tourists. If this is so, then in tourism, the locations that do have a world heritage site, should be valued higher or should be valued higher by at least those that appreciate world heritage. The users impact and guide the behaviour of future tourists (Filieri et al., 2015; Gretzel et al., 2007). Consumers in this case co-determine the »brand value« of the location, which has heritage. If this is so, then such world heritage would result in higher value added per unit of labour as it would also impact the prices and would help strengthen local (private) brands. The approach does not rely entirely on the Corrado et al. (2014) definition of public intangibles, but is relying on UNESCO framework and heritage definitions.

Empirical evaluation. The approach relied on user-generated content and text-mining in combination with other standard statistical analysis. In total 51,443 reviews which comprised overall 6,024,630 words were investigated. The reviews evaluated locations and hotels in Australia, Croatia, Dubai, France, Malaysia, Singapore, Slovenia, US and UK. Among the locations, which were investigated in the sample are also several locations, which are included in the UNESCO Heritage list. In total, 62.4 percent of the reviews were referring to one of the heritage broader locations (for example Dubrovnik and Dubrovnik hotels in general) and 4.7% were referring to specific locations from the world heritage list, for example Tower of London or Sydney Opera House). Given that the intangible capital, in this case world heritage, is expected to derive value, in case of tourism, such value should be acknowledged by tourists. Thus, the analysis studied, whether:

1) the world heritage contributes to overall positive evaluation of the location;
2) how the reviewers acknowledge the presence of world heritage in the location:
   a. higher average numerical evaluation or/and
   b. more positive textual evaluations
3) and whether market segmentation (to attract more those, who value heritage more) allow a different and more value generating destination management.

Methodologically, the analysis relied on sentiment analysis and key-words analysis, both examples of text mining.

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Table 3: Systematization of the methodology used

| Method	Key references	Output

Sentiment analysis
  (a) sentiment value of each comment using several methods
  (b) polarity analysis
	(Hu & Liu, 2004; Mohammad, 2015; Nielsen, 2011)	Numerical evaluation of each reviews, where the sentiment of each word is analysed.
		Determination of the prevailing emotion in the text.
		Option to link sentiment analysis with the star ranking, price and usefulness of review.

Key-words analysis	(Feldman et al., 1998; Zhang et al., 2008)	Identification of most discussed aspects

The results show that

- overall, the location, which are »heritage locations« or even the specific »heritage site« (e.g. Sydney Opera House), on average received a higher average evaluation in terms of star evaluation (Figure 3) and the difference is also highly statistically significant. Generally, reviews praise the heritage locations and it is hard to find a negative review of the location itself, usually they are very positive, even if the review refers to the general location and not the heritage site itself. Usually, when more negative reviews do appear, they primarily criticise the experience itself which might have been less perfect than expected due to over crowdedness, prices, lack of ability of take photos, etc.
- Also specific world heritage sites (e.g. Tower of London, Sydney Opera, etc.) receive higher star ranking on average
- However, interestingly, the sentiment is systematically and significantly lower in case of heritage locations/sites, which could be attributed to a number of factors. Primarily, when one was describing a certain heritage site, it was descriptive, factual, which has less sentimental value. The reviews did include also the personal experiences, which are more emotional, but these textual parts were not prevailing in text.

While this is still a work in progress, the analysis does offer a novel approach to capturing the heritage part of intangible capital, especially since the data is widely available. The method could be more widely used primarily in decision-making and thereby help value creation based on heritage component of intangible capital.

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Figure 3: Evaluations by world heritage general locations (*** indicates significance of differences) – star rating evaluations and sentiment evaluations using different sentiment methods
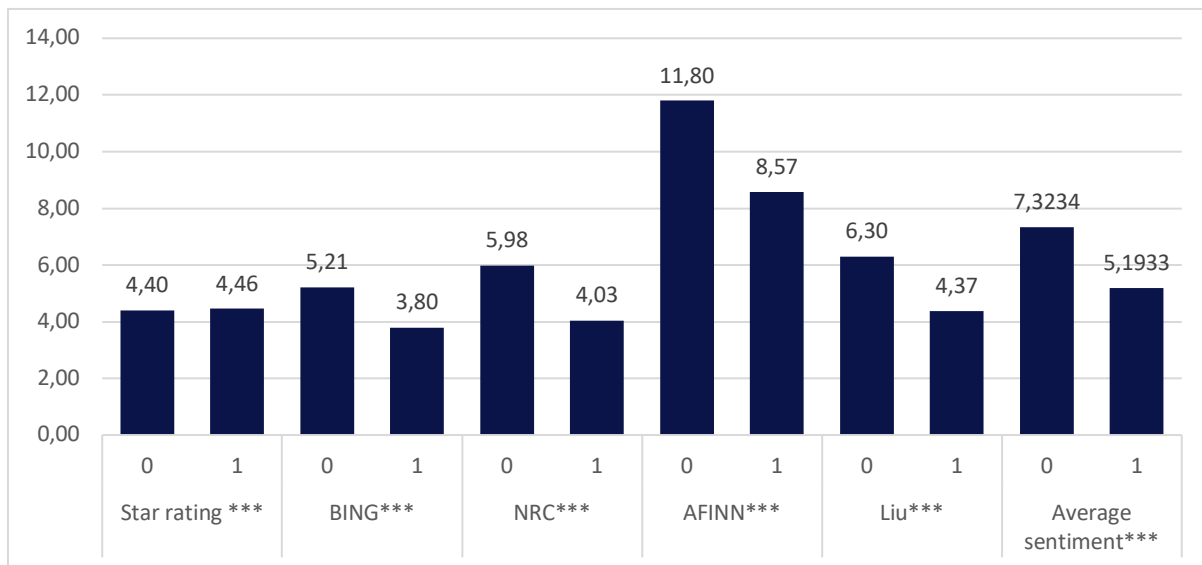
Implications. In terms of possible impact on future tourism development in a world heritage location, several points can be made:

1) the reviewers discuss many elements of the world heritage even in general locations where the heritage is located. For example, mentioning of »old town in Hvar«, »old Dubrovnik centre«, »statue of liberty« etc. appears many times even in hotel reviews, implying that if visitors visit the general location, they are attracted either because of the world heritage site or the world heritage site is an additional attraction, allowing the destinations to distill additional revenue by targeted pricing models.

2) Not all reviewers are equally attracted to location, which offers an additional option to optimize the revenues as well as ensure sustainability. In particular, the history buffs and art and architecture lovers represent the most important target group, which would due to their revealed preference also be willing to pay a premium.

3) Understanding the preferences of these two groups and in particular studying in detail their reviews can be used a source of intelligence to further develop the location and services and attractions provided. Namely, especially the locations with many reviews can obtain important information about the strengths and weaknesses of their locations. This can serve as information used to further improve the location and consequently achieve two important goals: (1) improve the location and be able to improve also the pricing schemes to ensure higher value added, (2) in the future design a targeted marketing policy to attract by location characteristics and developments a desired group of consumers. This would limit the pressures of mass tourism and ensure a more sustainable tourism development, while at the same time ensuring also higher guest satisfaction.

4) Important policy implications could be drawn based on studying such reviews, especially in terms of developing national heritage site management strategies, which are also stressed by UNESCO.

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3 INNODRIVE methodology

The methodology used in Globalinto to evaluate the intangibles in the public sector will follow the innovative approach developed for the purposes of INNODRIVE. The methodology will be upgraded and adapted for the public sector, however, nonetheless, first we briefly present the INNODRIVE approach. The presentation is based on Piekkola (ed.) (2011), in particular the paper "*Firm-level intangible capital in six countries: Finland, Norway, the UK, Germany, the Czech Republic and Slovenia*" (Piekkola et al., 2011) and the methodological guide prepared by Innodrive team (available at project web-pages).

3.1 Innodrive methodology overview: Measurement of intangible capital (IC) and tables

Innodrive methodology relies on occupation data, combined with wages data (Linked employer-employee dataset). The idea, from which the Innodrive methodology stems from is that firms produce three types of goods:

- Information and communications technology (ICT),
- Research and development (R&D), and
- Organisational capital (OC).

The methodology further assumes that firms produce these "types of goods" for own use. If not used in current period, but later, these can be classified in accordance with (Carol Corrado et al., 2005) approach and general definition of investment (goods not consumed today, but in future) as investments. To produce them, companies use three types of labour:

- ICT personnel (information and communication experts);
- R&D personnel (technicians, engineers and related occupations);
- OC personnel (management, including owners) and marketing employees.

Further, the methodology assumes that a share of the employees of specific occupations are used in the production of new intangibles and thus only "investing in this proportion" of workers is actual investment in intangible capital, while the rest of the workers are performing tasks related to current production and do not produce goods, which have a life span of longer than 1 year. The Innodrive approach relies on proportions, which differ across countries. For example, the proportions used were: 40% for Germany, 30% for UK, 15% for Finland and 7.5% for Slovenia and Czech Republic (Piekkola et al., 2011, p. 66). The assessment of these factors was estimated on EU Klems.

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The key challenges in the analysis were also related to the identification of appropriate:

- Industries (NACE codes)
- Occupations related to each category of intangible investment and
- Depreciation rates are also determined (see e.g. (Piekkola et al., 2011, p. 66)).

Occupation selection. Occupation data are used to evaluate the innovative labor input in IA activities. The following table shows the innovation occupations chosen using ISCO08 3-digit coding (the earlier ISCO2001 version is in parentheses). An important additional identifier of different types of IA work is the use of educational information to reallocate the type of IA work. Workers in the educational field isced2011 computing are reallocated to ICT work, and workers with the educational field code social sciences and business (at the 1-digit and 2-digit levels) are reallocated to OC work if the occupation suggests that they are IA workers (Innodrive methodology).

Organizational work

- Managing directors and chief executives 112 (112)
- Administrative and commercial managers 12 (123 all)
- Services and administration managers 121, Sales, marketing and development managers 122
- Managing, mining, construction and distribution managers 13, 131 (122)
- Manufacturing, mining, construction and distribution managers 132 (122)
- Professional services managers 134 (122)
- Teaching professionals 23 (23)
- Business and administration professionals 24 (241 all)
- Finance professionals 241, Administration professionals 242, Sales, marketing and public relations professionals 243
- Legal, social, cultural and related associate professionals 34 (all) (242)
- Legal, social and religious associate professionals 341 (343), Sport and fitness workers 342 (347), Artistic, cultural and culinary artist professionals, 343 (347)
- Business and administration associate professionals 33 (excluding 335):
- Financial and mathematical associate professionals 331 (343), Sales and purchasing agents and brokers 332 (342), Services agents 333 (342)
- Administrative and specialized secretaries 334 (332)

> *Notes:*
>
> *OC work is reclassified as R&D work if the educational field code is not social sciences and business and isco3 in 1, 12, 13, 23, 24, and 34.*
>
> *OC work is reclassified as ICT work if the educational code is Isced2011 computing in 1, 12, 13, 23, 24, and 34.*

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R&D work

- Technical and mathematical work professional R&D managers 1223 (1237)

- Science and engineering professionals 21 (excluding telecommunication engineering 2153)

- Physical and earth science professionals 211 (211), Engineering professionals 212 (212) Mathematicians, statisticians, life science professionals 213 (212), 214 (212), Electrical, electronics engineering 2151, 2152 (212), Architects, planners 216 (212)

- Health professionals 22

- Medical doctors 221 (222), Nursing and midwifery professionals 222 (223), Other health professionals 226 (223), 22 (isco3 not available)

- Science and engineering associate professionals 31

- Physical and engineering science technicians 311 (311), Life science technicians and related associate professionals 314 (321)

- Nursing and midwifery associate professionals 226 (322)

Notes:

R&D work is reclassified as OC work if the educational field code is social sciences and business and isco3 in 2, 21, 22, 3, 31, and 32.

R&D work is reclassified as ICT work if the educational field code is International Standard

Classification of Education (Isced2011) computing and Isco3 in 2, 21, 22, 3, 31, and 32.

ICT work

- ICT managers 133 (1236)

- Telecommunication engineering 2153 (213)

- Information and communications technology professionals 25

- Information and communications technicians 35 (312)

Business services NACE M are the main providers of IA to other industries and R&D plants of large firms are also classified into these industries. Marketing and management utilize services provided by head offices, and management consultancy services (NACE M69-M70); advertising, and market research services (NACE M73); and other professional, scientific and technical services and veterinary services (NACE M74-M75). Scientific research and development industry M72 is the source to derive the deflator for all kind of R&D activities, but naturally do not create a good picture of R&D activity in the economy as a whole.

The benchmark factor multipliers follow Innodrive to represent the entire EU27 area, and are a weighted average of the factor multipliers for Germany (40% weight), the UK (30% weight), Finland (15% weight), and the Czech Republic, and Slovenia (both countries have weights of 7.5%) from upstream industry N=OC, R&D, ICT. IA work shares l_Y are lower than from Innodrive, since IA type occupations are defined more broadly.

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The shares l_Y are considered the same in all countries and the combined multiplier $a^N l_Y^{IC}$ is 1.8 for OC wage expenses, 1.6 for R&D wage expenses, and 1.45 for ICT wage expenses. Table 4 summarizes the combined multiplier A^{IC} (the product of the share of effort devoted to IA production and the factor multiplier).

Table 4: Combined multipliers for OC, R&D and ICT and their depreciation

	OC	R&D	ICT
Employment shares l^Y	25%	50%	35%
Factor multiplier a^N	1.8	1.6	1.45
Combined multiplier $a^N l^Y$ (rounded)	45%	80%	50%

Innodrive methodology represents an innovative approach towards measurement of intangible investments in firms based on rich employer-employee linked data. However, the approach was developed for the corporate sector. Globalinto builds on this experience and broadens and adjusts the methodology for the public sector.

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4 GLOBALINTO methodology of measuring intangible capital (IC)

Canel and Luoma-aho (2018; 2015) stress that there are several differences between intangibles in the private and public sector. These are among others the following:
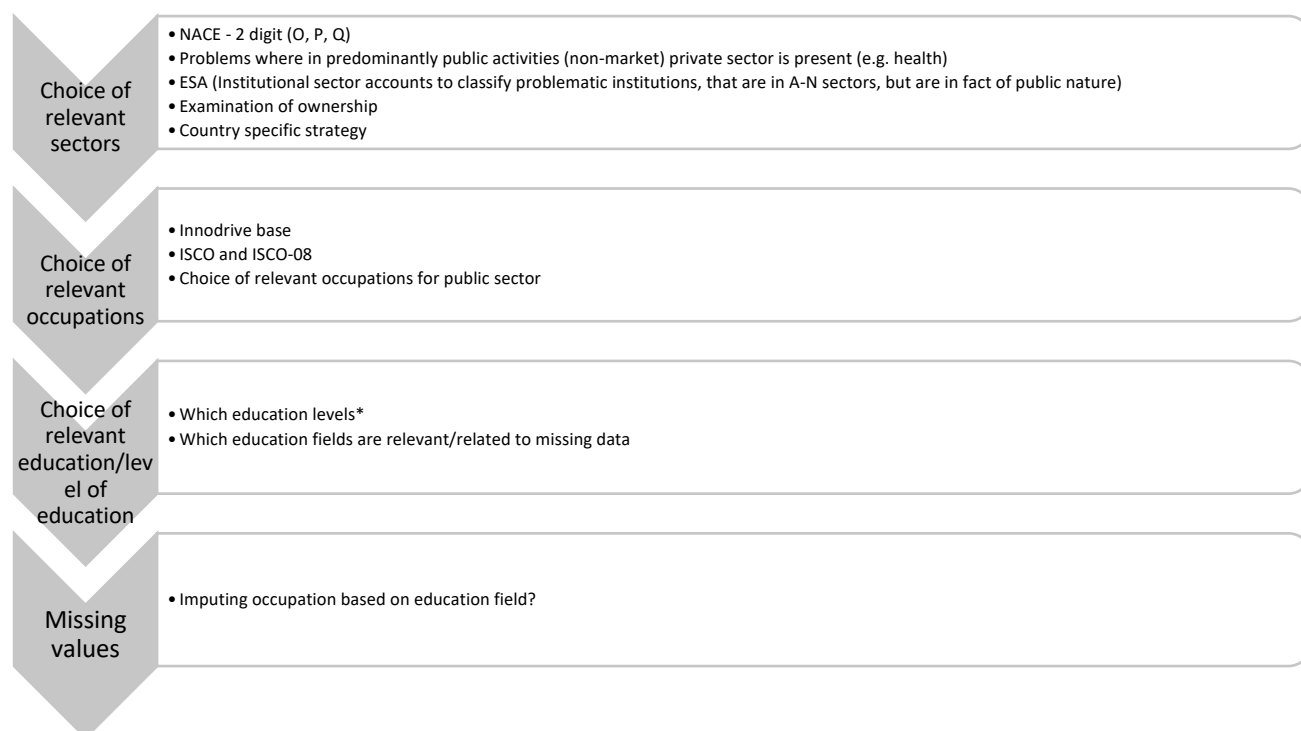
1) The process of evaluating/measuring intangible investments and capital in the private and public sector are different;
2) Public administration has multiple tasks and roles that shape the intangible assets;
3) Valuing public intangibles mirrors the range of public services from social benefits to public benefits;
4) Intangible investments and intangible capital structure in the public sector are influenced by the political environment in each country.

The Innodrive and Spintan projects suggested that in health and science sectors large part of experts should be considered as contributing to R&D in professions such as ISCO 22 (221 Medical doctors and 222 Nursing and midwifery) and ISCO 31 Science and engineering science technicions or ISCO 32 (321 Medical and pharmaceutical technicions 322 Nursing). Innodrive did not analyse the role of these occupations in intangible capital as the analysis concentrated on manufacturing and business services. Globalinto will continue with addition of experts 3 such as 31 Science and engineering, 32 Health associate professionals, 33 Business and administration (331, 332) and legal 34. ISCO 31 Science and engineering associate and ISCO 32 Health associate professionals (321) belong to R&D, while ISCO 33, 34 to OC. Including also 3 technicians and associate professions as professionals in the public sector would imply that the share of as innovation-type work is almost twice higher than without these additions.

4.1 Application and development of GLOBALINTO methodology to capturing intangibles in the public sector

In continuing, the text highlights the changes made to the Innodrive methodology to make it suitable for the evaluation of intangible capital in the public sector. The data is being worked on and several approaches are being examined in order to distil the best and most universal approach. The methodological note below is consequently still work in progress. Figure 4 summarizes the main steps in the preparation for data analysis.

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Figure 4: Identification strategy

Choice of relevant sectors
- NACE - 2 digit (O, P, Q)
- Problems where in predominantly public activities (non-market) private sector is present (e.g. health)
- ESA (Institutional sector accounts to classify problematic institutions, that are in A-N sectors, but are in fact of public nature)
- Examination of ownership
- Country specific strategy

Choice of relevant occupations
- Innodrive base
- ISCO and ISCO-08
- Choice of relevant occupations for public sector

Choice of relevant education/level of education
- Which education levels*
- Which education fields are relevant/related to missing data

Missing values
- Imputing occupation based on education field?

* Given that public sector requires multiple task we also emphasise the high education requirement. Therefore we will also consider the alternative of having upper tertiary education requirement in innovation-type work in the public sector. It is also clear that the different sectors may further require the adjustment of intangible workers. Hence, further work will be done to adjust the measurement.

Given that public sector requires multiple task we also emphasize the high education requirement. Therefore we will also consider the alternative of having upper tertiary education requirement in innovation-type work in the public sector. It is also clear that the different sectors may further require the adjustment of intangible workers. Hence, further work will be done to adjust the measurement.

These were some of the further challenges that are being encountered in the preparation of the methodology and in practice primarily are linked to:

- Identification of variation in relevant sectors at 2- 3-digit levels;
- Identification of further sector-specific occupations at 4-digit levels and
- Identification of relevant sector-specific educations including doctoral degree

Analysis may require differentiation with respect to occupations at central government level versus municipal levels. To have full picture of intangible related work also the foundations and related institutions should be consider that e.g. in Finland are responsible of about 10% of total employment.

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4.1.1 Definition of public sector / non-market sector

In general, NACE does not differentiate between market and non-market activities, as defined in the SNA/ESA, even if this distinction is an important feature of the SNA/ESA. The Corrado (2014, 2016) approach, the following were considered:

- M
  - • B Scientific research and development, NACE 72
- O Public administration and defence; compulsory social security, NACE 84
- P Education, NACE 85
- Q
  - • A Human health activities, NACE 86
  - • B Residential care and social work activities, NACE 87-88
- R
  - • Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities, NACE 90-91
  - • Gambling and betting activities; sports activities and amusement and recreation activities, NACE 92-93

The sectors in question in the Corrado et al. (2014, 2016) approach are not equally relevant also for the European context, in particular not NACE 92-93, only 93 (part of it, as will be discussed).

For each country the following NACE codes should be included, but additional criteria in P and Q are important:

- **O** (Public administration and defence, compulsory social security)
- **P** (Education)
- Q
  - o A (Human health services)
  - o B (Residential care and social work activities)
- Other, depending on the characteristics of the sectors at national level. These comprise:
  - o M and
  - o R

The discussion, whether a sector should be included or not, depends on the status of the sector and organizations within the sector. Only those that are part of "general government" and are publicly financed should be included. For example, such detailed analysis is possible in some countries (e.g. Slovenia).

For example, **in Slovenia**, the following definitions are being used to distinguish between two categories. The first (general government) should be included, the second, public corporations, however, not.

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- **General government** consists of all institutional units which are under public control and which cover less than 50% of production costs by market sales. Those are units that are included in public finances – central government budget, local government budgets and social security funds; also public institutes, public agencies and public funds if they cover less than 50% of production costs by market sales, and also some other units.
- **Public corporations** are corporations under control by units of the general government sector. The basic criterion for determining control is owning more than half of the voting shares, meaning that a unit is under public control if general government or corporations under public control are the majority equity holder in that unit. Other criteria are: control of the board or other management body, control of appointment and discharging of key staff, control of sub-boards in the corporation, the option of buying the majority equity, the control of prevailing buyer, control concerning borrowing, etc. (STAT, 2020)

Section O, and problems with P, Q and mixture of private sector and non-market sector in P and Q. Public administration and defence; compulsory social security NACE does not make any distinction regarding the institutional sector (as defined in the SNA and ESA) in which the institutional unit is classified. Moreover, there is no NACE category that describes all activities carried out by the government as such. Consequently, not all government bodies are automatically classified in Section O "Public administration and defence; compulsory social security". Units carrying out activities at national, regional or local levels that are specifically attributable to other areas of NACE are classified in the appropriate section. For example, a secondary school administered by the central or local government is allocated to group 85.3 (Section P) or a public hospital is allocated to class 86.10 (Section Q). On the other hand, not only government bodies are classified in section O: private units performing typical "public administration activities" are also classified here. This **mixture of public and private in the two most relevant sectors** (P and Q) but also in some other (M – research activities and public research institutes for example) is a problem that will have to be addressed.

In this context, a consideration of other classifications is also relevant. **Standard Classification of Institutional Sectors** (SCIS, in accordance with ESA) identifies as the public sector the following:
- general government (S.13)
- public corporations: public non-financial corporations (S.11001),
- central bank (S.121),
- public deposit-taking corporations except the central bank (S.12201),
- public money market funds (MMF) (S.12301),
- public non-MMF investment funds (S.12401),
- public other financial intermediaries, except insurance corporations and pension funds (S.12501),
- public financial auxiliaries (S.12601),
- public captive financial institutions and money lenders (S.12701),
- public insurance corporations (IC) (S.12801), public pension funds (PF) (S.12901).

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Depending on country specifics, first NACE 2-digit code, followed by SCIS will be considered and country strategies prepared. Table 5 and Table 6 (but only grey cells are relevant) summarize the selection of NACE industries that could be potentially considered for analysis of intangible capital in the public sector. While Table 5 displays the sectors, which are significantly less problematic from the perspective of the definition or division between the private and the public, Table 6 comprises NACE codes where the division between market and non-market is less clear.

Table 5: NACE-codes – public sector

O - Public administration and defence; compulsory social security	O84	Public administration and defence; compulsory social security
	O84.1	Administration of the State and the economic and social policy of the community
	O84.1.1	General public administration activities
	O84.1.2	Regulation of the activities of providing health care, education, cultural services and other social services, excluding social security
	O84.1.3	Regulation of and contribution to more efficient operation of businesses
	O84.2	Provision of services to the community as a whole
	O84.2.1	Foreign affairs
	O84.2.2	Defence activities
	O84.2.3	Justice and judicial activities
	O84.2.4	Public order and safety activities
	O84.2.5	Fire service activities
	O84.3	Compulsory social security activities
	O84.3.0	Compulsory social security activities
P – Education (problem of private sector educational activities, but public dominant, , differences beween countries)	P85	Education
	P85.1	Pre
	P85.1.0	Pre
	P85.2	Primary education
	P85.2.0	Primary education
	P85.3	Secondary education
	P85.3.1	General secondary education
	P85.3.2	Technical and vocational secondary education
	P85.4	Higher education
	P85.4.1	Post
	P85.4.2	Tertiary education
	P85.5	Other education
	P85.5.1	Sports and recreation education
	P85.5.2	Cultural education
	P85.5.3	Driving school activities
	P85.5.9	Other education n.e.c.
	P85.6	Educational support activities
	P85.6.0	Educational support activities
Q - Human health and social work activities (problem of private sector health and residential care activities, but public dominant, differences beween countries)	Q86	Human health activities
	Q86.1	Hospital activities
	Q86.1.0	Hospital activities
	Q86.2	Medical and dental practice activities
	Q86.2.1	General medical practice activities
	Q86.2.2	Specialist medical practice activities
	Q86.2.3	Dental practice activities
	Q86.9	Other human health activities
	Q86.9.0	Other human health activities
	Q87	Residential care activities
	Q87.1	Residential nursing care activities
	Q87.1.0	Residential nursing care activities
	Q87.2	Residential care activities for mental retardation, mental health and substance abuse
	Q87.2.0	Residential care activities for mental retardation, mental health and substance abuse
	Q87.3	Residential care activities for the elderly and disabled
	Q87.3.0	Residential care activities for the elderly and disabled
	Q87.9	Other residential care activities
	Q87.9.0	Other residential care activities
	Q88	Social work activities without accommodation
	Q88.1	Social work activities without accommodation for the elderly and disabled
	Q88.1.0	Social work activities without accommodation for the elderly and disabled
	Q88.9	Other social work activities without accommodation
	Q88.9.1	Child day
	Q88.9.9	Other social work activities without accommodation n.e.c.

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Table 6: NACE M, S, R which comprise institutions/organizations of "public nature" (grey coloured more relevant)

M Professional, scientific and technical activities	M69	Legal and accounting activities
	M72	Scientific research and development
	M72.1	Research and experimental development on natural sciences and engineering
	M72.1.1	Research and experimental development on biotechnology
	M72.1.9	Other research and experimental development on natural sciences and engineering
	M72.2	Research and experimental development on social sciences and humanities
	M72.2.0	Research and experimental development on social sciences and humanities
R Arts, entertainment and recreation (considering institutional characteristics, ownership, ESA, country specifics)	R90	Creative, arts and entertainment activities
	R90.0	Creative, arts and entertainment activities
	R90.0.1	Performing arts
	R90.0.2	Support activities to performing arts
	R90.0.3	Artistic creation
	R90.0.4	Operation of arts facilities
	R91	Libraries, archives, museums and other cultural activities
	R91.0	Libraries, archives, museums and other cultural activities
	R91.0.1	Library and archives activities
	R91.0.2	Museums activities
	R91.0.3	Operation of historical sites and buildings and similar visitor attractions
	R91.0.4	Botanical and zoological gardens and nature reserves activities
	R93	Sports activities and amusement and recreation activities
	R93.1	Sports activities
	R93.1.1	Operation of sports facilities
	R93.1.2	Activities of sport clubs
	R93.1.3	Fitness facilities
	R93.1.9	Other sports activities
	R93.2	Amusement and recreation activities
	R93.2.1	Activities of amusement parks and theme parks
	R93.2.9	Other amusement and recreation activities
S Other services activities (considering institutional characteristics, ownership, ESA, primarily ownership, country specifics)	S94	Activities of membership organisations
	S94.1	Activities of business, employers and professional membership organisations
	S94.1.1	Activities of business and employers membership organisations
	S94.1.2	Activities of professional membership organisations
	S94.2	Activities of trade unions
	S94.2.0	Activities of trade unions
	S94.9	Activities of other membership organisations
	S94.9.1	Activities of religious organisations
	S94.9.2	Activities of political organisations
	S94.9.9	Activities of other membership organisations n.e.c.
	S95	Repair of computers and personal and household goods
	S95.1	Repair of computers and communication equipment
	S95.1.1	Repair of computers and peripheral equipment
	S95.1.2	Repair of communication equipment
	S95.2	Repair of personal and household goods
	S95.2.1	Repair of consumer electronics
	S95.2.2	Repair of household appliances and home and garden equipment
	S95.2.3	Repair of footwear and leather goods
	S95.2.4	Repair of furniture and home furnishings
	S95.2.5	Repair of watches, clocks and jewellery
	S95.2.9	Repair of other personal and household goods
	S96	Other personal service activities
	S96.0	Other personal service activities
	S96.0.1	Washing and (dry
	S96.0.2	Hairdressing and other beauty treatment
	S96.0.3	Funeral and related activities
	S96.0.4	Physical well
	S96.0.9	Other personal service activities n.e.c.

*NACE code obtained from Eurostat (Eurostat, 2008).

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4.1.2 Occupation selection and education selection

Next, we list some key challenges and questions we are addressing with regards to occupation selection:

- In terms of identifying relevant educations:
    - it is important to identify all relevant educations for work in the field of "organizational capital". At the moment, these are considered to be all social sciences and business, but there could be some other relevant educations, primarily those related to design or marketing.
    - R&D could generally include all sciences, except ICT, while on the other hand, the consideration is, whether …
    - ICT should be or not just "computing science"
- Level of education that should be considered as "intangible" investment is an important consideration. In particular, we are interested in considering those with at least bachelor (tertiary) education and those with higher. Solutions are being tested.
- Another issue is related to the missing data regarding the occupation. Possibly these could be imputed based on education level (bachelor and higher) in combination with education type (field)

Considering the Innodrive method several changes are being considered, primarily removing some occupations as indicated in the table below. **Repeating key highlights on methodological differences with Innodrive and Spintan also here again:** *Innodrive did not analyse the role of these occupations in intangible capital as the analysis concentrated on manufacturing and business services. The Innodrive and Spintan projects suggested that in health and science sectors large part of experts should be considered as contributing to R&D in professions such as ISCO 22 (221 Medical doctors and 222 Nursing and midwifery) and ISCO 31 Science and engineering science technicions or ISCO 32 (321 Medical and pharmaceutical technicions 322 Nursing). Globalinto will continue with addition of experts 3 such as 31 Science and engineering, 32 Health associate professionals, 33 Business and administration (331, 332) and legal 34. ISCO 31 Science and engineering associate and ISCO 32 Health associate professionals (321) belong to R&D, while ISCO 33, 34 to OC. Including also 3 technicians and associate professions as professionals in the public sector would imply that the share of as innovation-type work is almost twice higher than without these additions. Given that public sector requires multiple task we also emphasie the high education requirement. Therefore we will also consider the alternative of having upper tertiary education requirement in innovation-type work in the public sector. It is also clear that the different sectors may further require the adjustment of intangible workers. Hence, further work will be done to adjust the measurement.*

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Table 7: Changing the intangible capital measures: consideration for removing

Org	331	Finance, insurance, accounting experts
	332	Sales and purchase agents
	333	Agents for business services
	334	Secretaries
	343	Experts in culture and arts
RD	221	Medical doctors
	222	Nursing and midwifery
	322	Nurses etc
ICT	351	ICT technicians
	352	Telecommunicaiotn technicians

The occupational codes differ slightly between countries, the codes have also been updated to ICSO-08 (International Labour Organization, 2012), which requires aligning the occupational codes between the old and the new classification. So far, based on data analysis done, several challenges have been identified.

1) The changes between old and new ISCO will be prepared based on appropriate manuals (International Labour Organization, 2012)

2) Countries use also national occupation classification (e.g. Slovenia uses Standard Classification of Occupations, SKD, which is based on ISCO, but is in some segments more detailed (Statistični urad Republike Slovenije, 2020). In such cases, the alignment must be made also to adjust for the cross-country differences. The analysis done so far in comparing Danish and Finnish data shows that reclassifying can also be done by education.

In the first step, for every country, a list of relevant occupations is set. For example, the currently considered classification of occupations (based on Slovenian data) are explained in Table 8 providing ISCO codes for (1) Organisational Capital, (2) R&D, (3) ICT. Here, for Slovenia, other details could be provided, since data will be available at 4-digit code:

- in HRM group (Organizational capital) the following could be added:
  o Human Resource Managers (SKP 1212) could be studied separately and similarly also
  o Training and Staff Development Professionals (Slovenian Standard Classification of Occupations, SKP 2424)
- Currently, the approach is also considering education levels, whether only tertiary or also lower education levels could be used.

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Table 8: ISCO codes for Organisational Capital

Minor ISCO Code	Minor ISCO Label
111	Legislators and Senior Officials
112	Managing Directors and Chief Executives
121	Business Services and Administration Managers
122	Sales, Marketing and Development Managers
131	Production Managers in Agriculture, Forestry and Fisheries
132	Manufacturing, Mining, Construction and Distribution Managers
134	Professional Services Managers
141	Hotel and Restaurant Managers
231	University and Higher Education Teachers
241	Finance Professionals
242	Administration Professionals
243	Sales, Marketing and Public Relations Professionals
261	Legal Professionals
331	Financial and Mathematical Associate Professionals
332	Sales and Purchasing Agents and Brokers
333	Business Services Agents
334	Administrative and Specialized Secretaries
335	Government Regulatory Associate Professionals
341	Legal, Social and Religious Associate Professionals
342	Sports and Fitness Workers
343	Artistic, Cultural and Culinary Associate Professionals

Notes: in grey are additional to Innodrive Source: ILO (https://www.ilo.org/public/english/bureau/stat/isco/isco08/),
Innodrive, own proposals.
Notes:
OC work is reclassified as R&D work if the educational field code is not ISCED 3 (Social sciences, business and law)
or ISCED 1 (Education) in 11, 12, 13, 23, 24, and 34.
OC work is reclassified as ICT work if the educational code is ISCED 48 (Computing) in 1, 12, 13, 23, 24, and 34.

Table 9: ISCO codes for R&D Capital

Minor ISCO Code	Minor ISCO Label
211	Physical and Earth Science Professionals
212	Mathematicians, Actuaries and Statisticians
213	Life Science Professionals
214	Engineering Professionals (excluding Electrotechnology)
215	Electrotechnology Engineers (excluding Telecommunications Engineers)
216	Architects, Planners, Surveyors and Designers
221	Medical Doctors
222	Nursing and Midwifery Professionals
223	Traditional and Complementary Medicine Professionals
226	Other Health Professionals
311	Physical and Engineering Science Technicians
313	Process Control Technicians
314	Life Science Technicians and Related Associate Professionals
322	Nursing and Midwifery Associate Professionals

Source: ILO (https://www.ilo.org/public/english/bureau/stat/isco/isco08/), Innodrive
R&D work is reclassified as Organizational Capital work if the educational field code is ISCED 3 (Social sciences,
business and law).
R&D work is reclassified as ICT work if the educational field code is ISCED 48 (Computing).

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Table 10: ISCO codes for ICT Capital

Minor ISCO Code	Minor ISCO Label
133	Information and Communications Technology Services Managers
215	Electrotechnology Engineers (only Telecommunications Engineers)
235	Other Teaching Professionals (only 2356 Information Technology Trainers)
251	Software and Applications Developers and Analysts
252	Database and Network Professionals
312	Mining, Manufacturing and Construction Supervisors
351	Information and Communications Technology Operations and User Support Technicians
352	Telecommunications and Broadcasting Technicians

Notes: in grey are additional to Innodrive
Source: ILO (https://www.ilo.org/public/english/bureau/stat/isco/isco08/), Innodrive, own proposals.
First based on ISCO-08 occupations are identified and classified in three groups. Based on ISCED they can be reclassified again. Then based on NACE and equivalent it is classified as public sector.

An additional issue regarding the classification of the occupations to a particular capital is not only the field of education but also the level of education. Based on ISCO classification skill level is predicted, however the issue may arise if an individual does not have an appropriate skill level, especially if skills are below the required. Education can be one of the proxies for skills and since for some countries (such as for example Slovenia), the level of education for each individual is available, we are considering also controlling for the level of education.

These were some of the further challenges that are being encountered in the preparation of the methodology and in practice primarily are linked to:

- Identification of variation in relevant sectors at 2- 3-digit levels;
- Identification of further sector-specific occupations at 4-digit levels and
- Identification of relevant sector-specific educations including doctoral degree

Analysis may require differentiation with respect to occupations at central government level versus municipal levels. To have full picture of intangible related work also the foundations and related institutions should be consider that e.g. in Finland are responsible of about 10% of total employment.

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5 Challenges ahead

The methodology is being developed as data is being analyzed and several changes are expected before the final methodological guide is available. At the moment, the key steps are:

1) Prepare and study all datasets for the countries with linked employer-employee data for the public sector (Denmark, Finland, Norway, Slovenia);
2) Prepare overview of situation in all countries and identify methodological challenges, once these general principles are being applied;
3) Analyze the data and revise methodology as data is being studied and results compared across countries and
4) Prepare final methodological guide.

Country differences in the definition of the "public sector" will be one of the most challenging aspects. While the presented NACE 2-digit code is a starting point, we will only be able to see in the empirical analysis what the most appropriate choice of sectors will be, where the following considerations should be made:

1) NACE 2-digit code, Classification of Institutional Sectors and Ownership (of primarily selected type s of institutions (e.g. sports facilities, cultural institutions, etc.) will also be considered to identify the extent of the institutions which are in nature more public, but are by relevant classifications not classified so. Data for some countries (e.g. Slovenia) will be available .
2) The aim of the project is also to prepare a more generally useful methodological guide, which could be applied to more countries. Therefore, while being aware of the country specifics, it will primarily be important to identify the possible "common approach".

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