



**“CONCEPTUALIZING AND MEASURING INTANGIBLE CAPITAL
USING EXISTING SURVEY DATA SOURCES IN THE EUROPEAN
STATISTICAL SYSTEM”**

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CONCEPTUALIZING AND MEASURING INTANGIBLE CAPITAL USING EXISTING SURVEY DATA SOURCES IN THE EUROPEAN STATISTICAL SYSTEM

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Abstract. Intangible capital is becoming increasingly important in economic research, especially due to its contribution to firm productivity growth. At the moment there is no official definition nor measurement approach or systematic measurement to capturing intangible investment. This paper presents a methodological exercise, which proposes conceptualization and measurement of intangible capital based on existing survey data sources in the European statistical system. Detailed conceptualization is presented, followed by an application of the proposed methodology to Slovenia, which is part of the European statistical system. The results show that the majority of components could be measured, although there are challenges in the existence of a clear and unified definitions of categories and lack of data on selected values of investments. Using existing Eurostat data would allow an efficient collection of data, minimizing time and cost effort of NSIs and respondents, and higher data quality. However, relying on different surveys and merging data opens several problems. In the long run, problems such as periodicity, definitions and do call for a preparation of a unified survey on intangible investment that could replace one-off (national) surveys.

Key-words. Measurement of intangible capital, survey, official statistical surveys, case of Slovenia



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1 Introduction

Corrado et al. (2006) proposed a definition of intangible capital that is now prevalent in economic literature and comprises three broader categories, which are: (1) computerized information, (2) innovative property and (3) economic competencies. While the core categories of the intangible capital are now widely accepted, their measurement still represents a significant challenge to statisticians and economists at large. Generally, registries or surveys can be used as sources of data on intangible capital. Several projects besides Corrado (2006), such as INTAN, COINVEST, INNODRIVE; SPINTAN, and GLOBALINTO, have proposed new measures to evaluate the size and contribution of intangible capital by using existing national accounts data at sectoral level or developing registry-based methodologies to create microdata sets, which led to a number of empirical studies, focusing on the size of intangible investments, cross-country differences and linkages to productivity and other performance indicators in private and public sector (Corrado et al., 2009a, 2009b, 2019; Corrado, Haskel, et al., 2016; Corrado, Jaeger, et al., 2016; Ilmakunnas & Piekkola, 2014; Piekkola, 2011; Roth, 2010, 2020; Roth & Thum, 2013; van Ark et al., 2009). Registry based sources, which have been within INNODRIVE (Piekkola, 2011) and GLOBALINTO (Piekkola et al., 2021) innovatively used to develop measures of intangible capital, using occupation-based measurement approaches on linked employer-employee datasets, are extremely important, because of their accuracy and level of detail, however, such data are often not available.

Instead of using the existing sectoral and micro-level registry data another option to measure intangible capital is to use **survey data** collected directly from businesses. Several important contributions have been made so far relying on one-off survey data collection. Among them for example NESTA & ONS (2009; 2010): Investment in Intangible Assets Survey (UK), Eurobarometer survey on “Investing in Intangibles: Economic Assets and Innovation Drivers for Growth”, the ISFOL & ISTAT “Rilevazione statistica sugli investimenti intangibili (in English: Statistical survey of intangible investment)” (Italy), EIB »European Investment Survey« as well as some regionally focused collections, e.g. Prašnikar et al. (2010-2015) survey of intangible capital in the private and public sector. Most recently, the Globalinto survey was conducted in seven European economies to capture the value of intangible investments and also measure the impact of Covid-19 on intangible investment (Globalinto, 2021).

Such **one-off surveys are extremely valuable** due to several reasons. First, they offer a benchmark for estimates based on secondary data sources. Second, they have the flexibility to collect data on aspects that are not covered in other sources, for example on motivations and obstacles to invest; they thus provide an opportunity to test new research hypotheses. The collected data are extremely important to researchers and policy-makers, especially in view of increasing importance of intangible capital's contribution to economic performance. Such surveys can also adapt the content to topics that are relevant in a specific period (e.g. financial crisis or epidemic) or country. Finally, these surveys are also very important for development of methodological framework, which is a particularly pressing issue as the measurement of intangibles is complex (Bavdaž et al., forthcoming in 2022) and the concept is still evolving.

However, these **one-off surveys suffer** also from several **deficiencies**. First, these surveys either lack international comparability or longitudinal perspective, because the wide majority of them represent one-off national surveys. The European Investment Bank *Investment Survey* is the only survey with international coverage and recurring data collection on key variables from 2016 onwards. None of the surveys is repeated on a regular basis to provide a panel of data that would allow observing the dynamics in intangible investment over periods of time. Furthermore, the sample size and structure are not necessarily optimal and often do not cover the entire economy or companies by size (e.g. the Globalinto survey includes companies with at least 20 employees). For understanding the nature of SMEs, which

form most business enterprises, this is a great challenge. Unless we settle for rough estimates of intangible investment amounts, data collection also represents a notable burden to the businesses. Finally, the costs of these surveys are likely to soar when attempting to achieve sufficiently high survey quality, especially when conducted in several countries or at the EU level, because of difficult recruitment with time-consuming search and hindered reach of the knowledgeable respondents. Systematic and repeated data collection outside official statistics is practically impossible to be conceived.

On the other hand, national statistical institutes (NSIs) in Europe regularly publish methodologically harmonised indicators across (the majority of) EU economies. Harmonised indicators are the result of a combination of input and output harmonisation approaches. Input harmonisation strives to standardise all steps of the survey life cycle, that is from questionnaire and sampling design, data collection and post-collection procedures (e.g. editing, imputation, weighting, calibration) while output harmonisation focuses on the required set of target variables respecting quality criteria. In the European Statistical System, at least the concepts and definitions of variables and the classifications are subject to agreements/legislation in all statistical domains (Baldacci, Japic, Stoop, 2016). Accommodating some flexibility in particular steps of data collection is usually due to national specifics (e.g. availability of alternative data sources such as registries). Setting up a new data collection is a lengthy process involving different stakeholders and experts from participating countries that gather national experiences and international expertise, as well as conduct various analyses and tests to ensure methodological soundness in line with the European Statistical System Code of Practice (2018). Once set up and running, data collection is continuously evaluated and revised as needed. The expertise that NSIs collectively have (in terms of sampling, questionnaire design, access to businesses, data collection, data processing and data management, and supported with methodological research that is often conducted in co-operation with academia), places NSIs at the leading edge of business data collection methodology (Bavdaz et al., 2019). Data collection of NSIs is therefore expected to be highly professional and achieving best possible results within the usual limitations of time, money and staff.

While at the moment Eurostat does not conduct a survey on intangible investment and intangible capital, there are several other surveys of Europe-wide character that gather relevant information on some component of intangibles, namely the Community Innovation Survey (CIS), the survey on ICT usage and e-commerce in enterprises (ICT), and the Continuous Vocational Training Survey (CVTS). The purpose of this paper is to evaluate the usefulness of existing survey data, collected by NSIs under the umbrella of Eurostat, for capturing intangible investment in the EU.

The paper relies on firm-level data for Slovenia to **develop and propose a methodology**, that follows the Corrado et al. (2006) definition of intangibles, and captures intangibles using several different survey sources, available in all or most EU economies. These are survey on (1) ICT usage and e-commerce in enterprises to capture computerised information, (2) Investment in fixed assets in enterprises to capture innovative property and (3) Community Innovation Survey (harmonized questionnaire) and Continuous Vocational Training Survey (harmonized questionnaire) to capture economic competencies. The paper directly compares the results of such results to the results of the Globalinto survey, which also allows a critical evaluation of the proposition.

In continuing, the paper first provides a review of the literature, that defines the components of intangible capital and studies the available data sources. Next, the Slovenian case is presented in more detail, first providing the research design, and presenting the data, followed by the presentation of the results and comparison of the results against the existing most recent Globalinto survey data to evaluate the differences in the estimation of intangible investments.

2 A proposed measure of intangible capital using various existing Slovenian/Eurostat firm-level (survey) data

1.1 Definition of intangible capital

In modern business practise, capital is distinguished into two co-ordinate categories of assets, tangible and intangible (Veblen, 1908), where *"Intangible assets" are immaterial items of wealth, immaterial facts owned, valued, and capitalized on an appraisalment of the gain to be derived from their possession.*" (Veblen, 1908). The concept of intangible assets developed gradually, but capturing intangible assets and investment and the study of the link between intangible assets and investment to productivity was most profoundly marked by the seminal work of Corrado et al. (2006), which divide the intangible capital into three types: computerized information, innovative property and economic competencies (Table 1).

Table 1: Intangible assets classification

Type of intangible asset	Further classification
Computerized information	Software
	Databases
Innovative property	R&D, including social sciences and humanities
	Mineral exploration and evaluation
	Copyright and license cost
	Development costs in financial industry
	New architectural and engineering designs
Economic competencies	Brand equity (advertising expenditure, market research)
	Firm specific human capital (continuing vocat. training, apprentice training)
	Organizational structure (purchased, own account)

Source: Corrado et al., 2006.

The categories are further divided into several subcategories. Computerized information is divided into software and databases. Innovative property is further divided into 5 sub-categories, ranging from R&D to design, while economic competencies are divided into brand equity, firm specific human capital and organizational structure. This definition is the prevalent definition of intangible investment, although some extensions have been made.¹

1.2 Mapping of relevant questions from the surveys on intangibles onto the available Slovenian/Eurostat firm-level (survey) data

Most past surveys on intangibles (including H2020 Globalinto (2021), ONS (UK), Italian survey on investment into intangible assets, and Innobarometer) structured survey questions on intangibles around six components that can be mapped to the three types of intangibles proposed by Corrado et al. (2006). For each of the six components of intangibles these surveys investigated the following:²

- First, whether the company invested at all in the specific component of intangible assets, where the following components were examined (the relation to Corrado et al. (2006) is indicated in brackets):
 - Software (mapped to Computerized information)
 - R&D (mapped to Innovative property)
 - Training (mapped to Economic competencies)

¹ Prašnikar, 2010; Prašnikar & Knežević Cvelbar, 2012; Prašnikar, Redek, & Memaj, 2012

² Early approaches also focused on depreciation rate. But the more recent surveys (Globalinto, EIB Investment survey) do not incorporate these issues because of low reliability of results, therefore, we decided to omit this aspect from the analysis.

- Reputation and branding (mapped to Economic competencies)
- Design (mapped to Innovative property)
- Organization or business process improvement (mapped to Economic competencies)
- If applicable, what the business expenditure was on investment into each specific component of intangible assets provided by external providers;
- If applicable, what the expenditure was on investment into each specific component of intangible assets within the company.

The analysis in continuing is built as a case study based on governmental surveys conducted by the Slovenian NSI with a follow up at the level of the European Statistical System (ESS). The decision to take Slovenia as a starting point was based on several factors. First, statistics production in the ESS is based on national statistics production, which means that data is collected and processed at the national level while Eurostat only prepares relevant EU and Euro aggregates. A study of data collection should therefore start at the national level, in an ESS member. Second, most relevant topics are treated in surveys with more input harmonization, which means that the choice of the country is not so consequential. For topics that are covered differently in different countries, we had to choose one approach as the benchmark approach. Slovenia was chosen because of access to the microdata for research purposes, in-depth methodological knowledge about data collection practices used by the Slovenian NSI as well as close connections between academia and NSI experts. The analysis is limited to the corporate sector (generally, also referred to as 'business economy' in structural business statistics or 'business enterprise sector' in R & D official statistics), because further link to firm performance will be examined using firm-level financial statements data.

The analysis proceeds in the following manner

- For every component of intangible capital, survey questionnaires are canvassed to identify relevant survey questions and links are established to the relevant indicator or a set of relevant indicators in the Slovenian official statistics.
- Indicators and underlying data collection approaches are then identified at the EU-28 level that are similar (or, preferably, the same) as in Slovenia and would consequently allow the creation of a comparable "intangible capital component" variable.

Currently used questionnaires also allow the measurement and understanding of other relevant aspects (motivations, expected results, problems in investment, etc.). These additional aspects are not discussed here in detail but would represent significant value added to the researchers when studying intangibles.

1.2.1 *Computerized information*

Computerized information aims, according to Corrado et al. (2006) definition, to cover two key components: **software and databases**. Following the definition and by assessing currently available data sources, we aim: (1) to determine whether the company invested in software and databases (internally and/or purchased externally); (2) to quantify the size of the investment.

In Slovenia, the relevant data to comprise "computerized information" can be found in two different questionnaires:

- Questionnaire for the survey *Investment in fixed assets in enterprises* (in Slovenian. *Vprašalnik za statistično raziskovanje Investicije v osnovna sredstva*; the analysis included the version for 2018). This is a country specific survey running annually from 1967 in enterprises and organizations with 20 or more employees. It also includes units with less employees having more than 1 million EUR investment according to VAT data. All activities, except for NACE sections T (households) and U (extraterritorial), are covered. The sample size for enterprises (corporate

sector) is about 3000 (out of around 60 thousand), while the sample for the public sector comprises around 2000 units (Statistični urad Republike Slovenije, 2018b, 2018a).

- Questionnaire for the survey *Use of information-communication technology (ICT) in enterprises* (in Slovenian *Vprašalnik za statistično raziskovanje Uporaba informacijsko-komunikacijske tehnologije (IKT) v podjetjih*; the analysis included the version from 2019³).

The ICT surveys are based on the annual Eurostat model questionnaires (Link to Circa server). Three specific data sources can be considered at Eurostat level as well:

- Community survey on ICT usage and e-commerce in enterprises
- Community Innovation Survey (Eurostat, 2019a)
- data on investments from ESA2010 (as a possible third source, but typically not available as firm-level data)

The questionnaire for statistical survey **Investment in fixed assets in enterprises** collects detailed data on values of expenditures. In Slovenia, these data are provided at firm level. Eurostat provides computerized information data only at an aggregated and not firm-level data. National statistical institutes transmit data to Eurostat according to the plan, reported in the European system of accounts - ESA2010, Transmission programme of data (Europäische Gemeinschaften, 2014). Therefore, for Slovenia only the following blocks of questions, which are relevant for the computerized information component will be studied (see also Table 2):

- C1 purchased computer software (software)
- C2 purchased computer databases
- C4 own developed computer software and its own developed databases

The questionnaire for statistical survey **Use of information-communication technology (ICT) in enterprises** provides a lot of other relevant information. It is important to note that the data are being collected on the basis of an EU regulation and comparable within the EU.⁴ The internal development efforts and the purchases of ICT services externally could be (some again indirectly) evaluated via the following indicators (based on Yes/No questions unless indicated otherwise) (Statistični urad Republike Slovenije, 2019). In principle, the same set of variables could be included also at Eurostat level. The relevant variables are

- employment of ICT specialists,
- internal or external training to refine or acquire ICT related skills of personnel or ICT specialists,
- own or external maintenance of ICT infrastructure, own or external support in the use of ICT, own or external development, upgrading or adapting of ICT; and ensuring of the safe use of ICT and data protection,
- own or external activities of safe use of ICT,
- employment of ICT specialists, who were also involved in the development of computer software or databases (in addition to the Yes/No question, also the number and amount of time spent as % of all working hours).

³ (Statistični urad Republike Slovenije, 2019) The survey **Use of information-communication technology (ICT) in enterprises** has been conducted since 2004, but the questionnaire is changing in structure and topics along with the development of the technology. The survey covers companies with 10 or more employees in economic activities NACE C-N, except for financial services (K). The sample is stratified by size and activity.

⁴ Collected on the basis of Regulation (EC) No. 808/2004 of the European Parliament and Council concerning Community statistics on the information society. See also explanation in Chapter 4.1.2.

Table 2: Summary of indicators and data sources on computerized information

	Slovenia*	Eurostat
Coverage of the concept	Yes	Partial. Expenditure values not available at firm level except for purchased software in industry & construction; otherwise only very aggregated items via ESA2010. Expenditure included in CIS survey but only as part of a broader category (Expenditure for acquisition of machinery, equipment, software & buildings)
Presence of this type of investment	Yes (based on values)	Identified indirectly and partially (based on employment of ICT specialists involved in the development of computer software or databases, and purchased software in industry & construction).
Value invested in purchase	Yes	Partial. SBS variable 15 44 1 Investment in purchased software for industry & construction. Methodological challenges if using indirect calculation from national accounts. Expenditure included in CIS survey as part of a broader category (Expenditure for acquisition of machinery, equipment, software & buildings).
Value invested in own development	Yes	No. Methodological challenges if using indirect calculation from national accounts.
Depreciation	No	No
Sample size	Around 3000 units for survey Investment in fixed assets in enterprises, around 1800 units for ICT survey and around 2800 for CIS.	Varies by country
Periodicity	Annual survey on investments. Annual survey on ICT usage in firms, but questions change in time. Bi-annual CIS.	Multiannual SBS for relevant variables. Annual survey on ICT usage in firms, but questions change in time Bi-annual CIS.
Firm level data available	Yes, sample	Yes for ICT usage and Investment in purchased software for industry & construction. No for N1173G Computer software and databases

*SORS – Statistical office of the Republic of Slovenia

1.2.2 Innovative property

In this analysis, similarly as in the case of computerised information, we assess existing data sources:

- To determine whether the company invested in the aforementioned components of innovative property (internally and/or purchased externally) (as defined by Corrado et al., 2006);
- To quantify the size of the investment;
- To estimate the depreciation of intangible assets of innovative property.

To capture the value of innovative property, two different survey questionnaires can be used in Slovenia:

- Questionnaire for statistical survey Innovation activity in industry and selected services (slo. Vprašalnik Inovacijska dejavnost v industriji in izbranih storitvenih dejavnostih) (Statistični urad Republike Slovenije, 2017b)
- Questionnaire for statistical survey Investment in fixed assets in enterprises (slo. Vprašalnik za statistično raziskovanje Investicije v osnovna sredstva, za leto 2018⁵)

From the questionnaire for statistical survey *Investment in fixed assets in enterprises* (Statistični urad Republike Slovenije, 2018b), the following variables provide information about investment expenditure into innovative property:

- C5 entertainment, literary and other artistic originals
- C6 studies, project documentation
- C7 trademarks, concessions and goodwill
- C8 patents, licenses for the use of patents and scientific research and development works

Comparing these categories to Corrado et al. (2006) categories (Table 3) shows that although the match between the definition and the survey on investment in fixed assets is not perfect, it is relatively good. Providing that a unified definition of intangible investment at the EU level existed, this questionnaire could easily be extended in Slovenia to fit better with either the existing Corrado et al. (2006) definition.

⁵ (Statistični urad Republike Slovenije, 2018b)

Community Innovation Survey has been conducted in Slovenia since 1997 when data referred to the period 1994–1996 (slo. Inovacijska dejavnost v industriji in izbranih storitvenih dejavnostih). The 2010 and more recent survey questionnaires (Statistični urad Republike Slovenije, 2017b) provide information on the following relevant variables:

- In-house R&D
- External R&D
- Acquisition of machinery, equipment, software & buildings
- Acquisition of external knowledge
- Training for innovative activities
- Market introduction of innovations
- Design
- Other innovation activities
- Total expenditure for innovation activities

Since the existing questionnaire design does not overlap completely with the Corrado et al. (2006) definition (Table 3, text above), a consensus would be needed regarding the categorization the (1) Acquisition of machinery, equipment, software & buildings and (2) Training for innovative activities

Table 3: Sources for expenditure on innovative property in Slovenia

Corrado et al. (2006) category	Slovenian data source	
	Category	Data source Slovenia/Eurostat
R&D, including social sciences and humanities	C8 patents, licenses for the use of patents and scientific research and development works C7 trademarks, concessions and goodwill	Survey Investment in fixed assets in enterprises (Slovenia)
	In-house R&D External R&D Other innovation activities	Community Innovation Survey (Slovenia and Eurostat)
	Acquisition of external knowledge	Community Innovation Survey (Slovenia and Eurostat)
Mineral exploration and evaluation	C6 category (studies, project documentation) but only for companies in relevant NACE section B. For other companies (e.g. from manufacturing or other industries), division based on existing survey data is impossible to envision.	Survey Investment in fixed assets in enterprises
Development costs in financial industry	In-house and external R&D, paying attention to avoid double counting.	Community Innovation Survey (Slovenia and Eurostat)
New architectural and engineering designs	Design	Community Innovation Survey (Slovenia and Eurostat)

Generally, the CIS-based Slovenian survey provides abundant data on innovation and investigates other aspects, relevant both for innovation activity as well as investing into innovative property in general such as innovation types, motivations, cooperation, obstacles to innovation and other. Many of the listed variables are not only relevant for understanding the complexity of innovation, similar factors will drive also investment into other intangible resources (Prasnikar et al., 2017). Consequently, CIS, being also a firm-level database, can serve as an important source of information for understanding intangible capital.

Similarly as in Slovenia, innovation data in the EU is mostly collected using the Community Innovation Survey (CIS), which is generally conducted every two years (last in 2020) but compiling CIS data is voluntary and is not available for all countries for all years. The following categories are available to

assess the expenditure on innovative activities (question 5.2 in CIS2014 questionnaire, available at (European Commission, 2019)):

- In-house R&D (Include current expenditures including labour costs and capital expenditures on buildings and equipment specifically for R&D)
- External R&D
- Acquisition of machinery, equipment, software & buildings (Exclude expenditures on these items that are for R&D)
- Acquisition of existing knowledge from other enterprises or organisations
- All other innovation activities including design, training, marketing, and other relevant activities
- Total of the above innovation activities

From the perspective of studying intangible investment into innovative property, Eurostat collects and publishes also a selection of other indicators, for example innovation types. The following are relevant and available at Eurostat as well (European Commission, 2019): product and/or process innovative enterprises, information and cooperation in the innovation process, obstacles to innovation and for example also expenditure data (as follows from the questionnaire). Eurostat innovation data are consequently quite well suited for the study of investment in innovative property. A particular problem is only the lack of micro data for the countries, where CIS is either not used or data are not available for research purposes.

A specific challenge remains also the question on depreciation, which is not covered. But it could be added to the innovation survey relatively easily, perhaps as a categorical question following the Eurobarometer survey from 2013 (less than 1 year, 1-2 years, 2-5 years, 5-10 years, more than 10).

1.2.3 *Economic competencies*

The categories of economic competencies according to Corrado et al. (2006) comprise brand equity (advertising expenditure, market research), organizational structure (purchased, own account) and firm specific human capital (continuing vocational training, apprentice training). The aim of this analysis is, similarly as in the case of the previous two components of intangible investment, to rely on existing resources:

- To determine whether the company invested in the aforementioned components of economic competencies (internally and purchased externally);
- To quantify the size of the investment;
- To assess the depreciation of intangible assets of economic competencies.

Due to the complexity of the innovation in economic competencies, each component is discussed separately. At the end of this section, a summary table provides the main findings.

Brand equity investment can be found in two important data sources (as listed)⁶:

- Questionnaire for statistical survey Investment in fixed assets in enterprises (slo. Vprašalnik za statistično raziskovanje Investicije v osnovna sredstva, za leto 2018⁷)
- Questionnaire for statistical survey Innovation activity in industry and selected services (slo. Inovacijska dejavnost v industriji in izbranih storitvenih dejavnostih (INOV) (Statistični urad Republike Slovenije, 2017b)

The first source *Investment in fixed assets in enterprises* provides values for selected broad types of intangible investment, with the possible exception of C7 (trademarks, concessions and goodwill). The

⁶ When the questionnaire for structural business statistics was tested, also the »Marketing expenditure« variable was included, therefore attempts have been already made to assess these as well.

⁷ (Statistični urad Republike Slovenije, 2018b)

second possible source is the *Community Innovation Survey*. The 2010 and more recent survey questionnaires provide several relevant values to answer the questions (following the Globalint, UK and Italian intangibles survey):

- Whether the company invested in brand equity (if the reported value is zero, it did not)
- How large this expenditure was.

CIS provides data on marketing innovation in some more detail by a few Yes/No questions. These binary variables limit the analytical options for researchers, but they do provide some additional insights that at least allow the differentiation between companies. The questions ask whether the company (Eurostat, 2019a):

- Made significant changes to the aesthetic design or packaging of a good or service;
- Invested into new media or techniques for product promotion;
- Introduced new methods for product placement or sales channels;
- Introduced new methods of pricing goods or services.

For **organizational structure**, we only consider the Community Innovation Survey (Inovacijska dejavnost v industriji in izbranih storitvenih dejavnostih (INOV) (Statistični urad Republike Slovenije, 2017b)). Unfortunately, the survey does not capture expenditure on organizational changes, rather it only captures a few categories of organizational innovation through three Yes/No questions. These questions ask whether the company introduced:

- New business practices for organising procedures;
- New methods of organising work responsibilities and decision making;
- New methods of organising external relations with other enterprises or public organisations.

With the available data collected at the moment, therefore, two aspects cannot be clearly determined:

- The amount invested in organizational structure within the company;
- The external purchases of consulting that helped in adjusting organizational structure;

The Corrado et al. (2006) definition defines the **firm-specific human capital** as investments into continuing vocational training (CVT), and apprentice training. The main source of data for firm-specific human capital investment in Slovenia is the statistical survey Continuing vocational training in enterprises (slo. Izobraževanje in usposabljanje zaposlenih v podjetjih (ŠOL-ZAP), (Statistični urad Republike Slovenije, 2015, 2017a)) and the questionnaire is highly harmonized with the standardized Eurostat approach this allowing easy comparability (with few exceptions)⁸. A slightly bigger challenge is the periodicity of these surveys, since CIS is conducted every two, while CVTS every 5 years. This survey provides information about: provision of CVT courses and other forms of CVT in companies; CVT strategies; participants in CVT courses; costs of CVT courses; time spent in CVT courses; characteristics of CVT courses; assessment of CVT activities. From the perspective of evaluating the firm-level investment into this intangible component (as in the case of UK and Italian surveys), the survey provides relevant data on:

- Whether the company conducted any CVT;
- Expenditure on CVT internally;
- Expenditure on purchased services for CVT.

With regards to conducting CVT, this survey uses Yes/No questions on whether the company conducted:

- CVT courses:
 - o CVT courses – internal;
 - o CVT courses – external;

⁸ Survey done in line with Regulation No 1552/2005 for the implementation of CVTS 3 resulted in the limitation of comparability problems between countries, which was a problem in CVTS 2 (despite the agreed implementation guidelines). For CVTS 3, CVTS 4 and 5 most countries conducted their surveys in line with the regulations (Eurostat, 2019b).

- Other forms of CVT:
 - o Other forms of CVT - guided-on-the-job training;
 - o Other forms of CVT - job rotation, exchanges or secondments;
 - o Other forms of CVT - training at conferences, workshops, trade fairs and lectures;
 - o Other forms of CVT - learning/quality circles;
 - o Other forms of CVT - self-directed learning.

The questionnaire also provides information that allows the estimates of CVT costs, internal and external (although this break down is not published). Also, a number of other details, relevant for the understanding of the CVT dynamics in companies are provided, for example: CVT strategies in companies; organization of CVT activities; participants' characteristics in CVT courses; characteristics of CVT courses; and assessment of CVT activities. But depreciation again remains a challenge.

Table 4: Economic competencies data sources in Slovenia and at Eurostat

Corrado et al. (2006) category	Slovenian data source	
	Category	Data source (Slovenia/Eurostat)
Brand equity (advertising expenditure, market research)	Expenditure on: <ul style="list-style-type: none"> - C6 studies, project documentation (include research and development work under C8) - C7 trademarks, concessions and goodwill 	Survey Investment in fixed assets in enterprises in Slovenia Not available at Eurostat
	Expenditure on: <ul style="list-style-type: none"> - Market introduction of innovations - Design Additional information provided on marketing innovation, but only Yes/No questions.	Community Innovation Survey (Slovenia and Eurostat)
Organizational structure (purchased, own account)	Very limited information, only data on whether companies invested into organizational structure change (Yes/No questions)	Community Innovation Survey (Slovenia and Eurostat)
Firm specific human capital (continuing vocational training, apprentice training)	Does company provide CVT Internal CVT costs External CVT costs A lot of additional CVT details No depreciation data	Survey Continuous education and training in companies (Slovenia and Eurostat)

3 Research design

The aim of the study is to explore the ability to generate the data on intangible investments / capital in companies by relying on existing surveys, which are already available across the EU, which would allow generation of intangible investment data from existing data collected, without further burdening the respondents or the national statistical offices. In comparison to one-off intangible investment surveys, the coverage would also be broader. To do so, we focus on the case of Slovenia, but explore also the ability to extend the analysis to other countries, depending on the availability of the data. The key research question is "which variables can be constructed and how" from existing data. Despite the fact that existing surveys focus on a number of elements, which can be useful also in understanding of intangible investment, our goal is primarily to answer those questions, which are covered in all existing one-off surveys. These are:

- determine whether the company invested in the selected components of intangible capital (internally and purchased externally) and;
- what the size of the investment was.

The analysis relies on the data for Slovenia as a case example. Slovenia has excellent national statistical sources, which is also aligned with the Eurostat approach, which makes the case relevant for the majority of EU economies. All data, collected at firm level, can be merged using firm identifiers. In addition the data can also be merged with other firm-level data (e.g. financial statements), which allows deeper analysis by firm demographics and performance. Data is also available to researchers.

The following **questionnaires** were used:

- Questionnaire for statistical survey Investment in fixed assets in enterprises (slo. Vprašalnik za statistično raziskovanje Investicije v osnovna sredstva, za leto 2018⁹)
- Questionnaire for statistical survey Innovation activity in industry and selected services (slo. Vprašalnik Inovacijska dejavnost v industriji in izbranih storitvenih dejavnostih) (Statistični urad Republike Slovenije, 2017b) (at Eurostat level the Community innovation survey)
- Questionnaire for statistical survey Use of information-communication technology (ICT) in enterprises (slo. Vprašalnik za statistično raziskovanje Uporaba informacijsko-komunikacijske tehnologije (IKT) v podjetjih, 2019¹⁰) (at Eurostat level the Community survey on ICT usage and e-commerce in enterprises)
- Continuing vocational training in enterprises (slo. Izobraževanje in usposabljanje zaposlenih v podjetjih (ŠOL-ZAP), (Statistični urad Republike Slovenije, 2015, 2017a)) (highly comparable with Eurostat)

The analysis focused on only year 2016 because of the large changes in the questionnaire about the “Use of information-communication technology (ICT) in enterprises” as well as significant restructuring of the questionnaire on “Innovation activity in industry and selected services”. The second important reason was the fact that the “Continuing vocational training in enterprises” is explored only every 5 years, so at the time, the most recent available data is for 2015. Since innovation study is conducted biannually, years 2014 and 2016 were the two possible options and we opted for the more recent one.

Sample surveyed varies significantly across different surveys, being lowest in the investigation of the Use of information-communication technology (ICT) in enterprises and largest in the investigation of the Investment in fixed assets in enterprises (Table 5). The AJPES database contains the entire population of private sector enterprises (excluding sole proprietors with less than 50 000 euros revenue). 240 companies appeared in all databases.

The final sample comprised 240 companies, of which 190 or 79.2% had 250 or more employees, 18.3% had between 50 and 249 employees, while only 6 companies had 50 or less employees. The majority of companies were from manufacturing (NACE C), 85% in total, while the rest were from services, mainly from NACE J (Information and communication), D (Electricity, gas, steam and air conditioning supply) and E (Water supply; sewerage; waste management and remediation activities). A comparison of the sample, obtained by merging of different surveys, differs for example from the sample that was constructed for one-off surveys, with larger focus on manufacturing and larger companies. However, the total sample size was larger in this case. For comparison, the Globalinto survey for Slovenia included only 215 companies (and industry division was also imbalanced, however, it was 30% services).

⁹ (Statistični urad Republike Slovenije, 2018b)

¹⁰ (Statistični urad Republike Slovenije, 2019) The survey **Use of information-communication technology (ICT) in enterprises** has been conducted since 2004, but the questionnaire is changing in structure and topics along with the development of the technology. The survey covers companies with 10 or more employees in economic activities NACE C-N, except for financial services (K). The sample is stratified by size and activity.

Table 5: Research design

Approach	
Research goal	Existence and size of investment in <ul style="list-style-type: none"> - Computerised information <ul style="list-style-type: none"> o software o databases - Innovative property: <ul style="list-style-type: none"> o R&D, including social sciences and humanities o Copyright and license cost o Mineral exploration and evaluation o Development costs in financial industry o New architectural and engineering designs - Economic competencies <ul style="list-style-type: none"> o Brand equity o Organizational structure o Firm specific human capital
Databases/questionnaires	
Questionnaires used	<ul style="list-style-type: none"> - Investment in fixed assets in enterprises - Innovation activity in industry and selected services - Use of information-communication technology (ICT) in enterprises - Continuing vocational training in enterprises - Additionally AJPES data with firm-level financial statements data
Data (original survey data sample size in bracket)	
Sample size by survey	<ul style="list-style-type: none"> - Investment in fixed assets in enterprises (5578 companies) - Innovation activity in industry and selected services (2336 companies) - Use of information-communication technology (ICT) in enterprises (1537 companies) - Continuing vocational training in enterprises (4801 companies) - Additionally, AJPES data with firm-level financial statements data (124 474 observations in 2016) - 240 companies were included in all relevant databased (while up to 3300 in at least one)

The final sample characteristics are described in Table 6, which also provides a comparison to the Globalinto sample. The Globalinto results will be used as a benchmark to assess the potential of using such an approach to capture intangible investments at firm level. The final official-statistical-survey-based sample (in continuing "sample") comprised 240 companies. Large firms represented 79.2% of the sample and medium 18.3 (the rest were small firms, according to the Slovenian firm-size definition). Almost 86% of companies were from manufacturing, although other sectors from services were included as well. In comparison to the Globalinto sample, the survey sample was significantly different in structure from the perspective of size, since in the Globalinto sample, the large companies represented around a quarter of all firms, quite the opposite than in the survey sample, where also the share of manufacturing was larger. Size (and industry) differences also impacted other descriptive statistics. The sample studied had a significantly lower revenue per employee (175 in comparison to 235 thousand euros), but companies were much more export oriented, which is typical for large Slovenian manufacturing companies. Statistical surveys' sample on average exported 68% of sales, while the Globalinto companies "only" around 45%. The sample had a bit lower share of researchers among all employees, which is expected in the sample structure (large manufacturing companies have a dominant share of production workers).

Table 6: Final sample description and comparison to Globalinto sample for Slovenia

	Sample	Globalinto survey
Share of large firms (250+)	79.2	23.3
Share of medium-sized firms (50-249)	18.3	76.7 (20+ employees)
Share of manufacturing	85.8	61.4
Other included sectors	D, E, G, H, J, M	D, G, J, K, M
Revenue per employee (mean, median in bracket)	175067 (144352)	235385 (814308) (year 2019)
Share of exports to EU countries	0.51 (0.59)	0.35 (0.31)
Share of exports in revenue	0.68 (0.83)	0.45 (0.31)
Share of internal and external researchers among all employees*	0.096 (0.0365)	0.13 (0.164)
Share of internal researchers among all employees	0.053 (0.028)	n.a.

*Total employment was obtained in both cases from financial statements data.

4 Results: Investigation into intangibles using official survey data and comparison to Globalinto survey

The goal of this empirical analysis is two-fold:

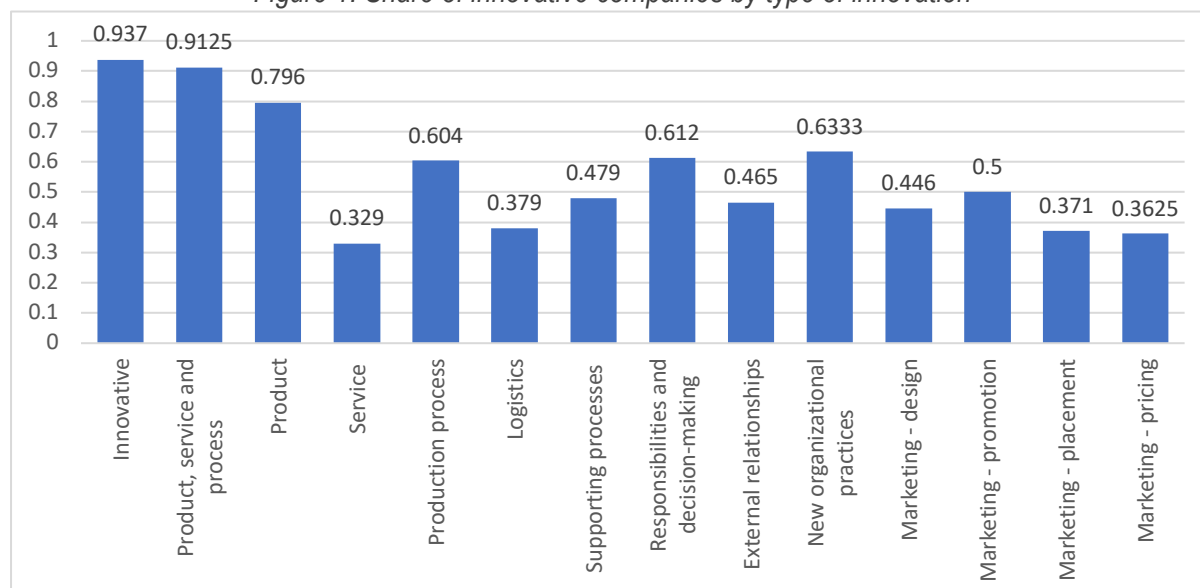
- 1) To investigate, whether intangibles can be constructed based on existing official statistical surveys and determine also, which variables (of those, standardly included in one-off surveys) are missing and cannot be approximated.
- 2) What the differences are between the data from surveys that were prepared with special focus on intangibles investigation and the data obtained from merging data from existing surveys

4.1 R&D and Innovative activity

The CIS (Slovenian) questionnaire examines product, process, organizational, market and logistic innovation in a lot of detail and provides information that allow relatively complete coverage of intangible category innovation as well as other categories (as described in continuing), but also provide abundant details on organization of innovative processes, sources of information, obstacles, etc.. The core questions in the questionnaires in one-of surveys are usually much more focused and are particularly interested in whether there was internal or external innovation activity, and what the expenditure on each was (same questions also apply to other intangible categories).

Using the Yes/No questions that investigate whether companies conducted in the previous 2 years different types of innovation, it is possible to construct a variable, that shows whether the company was innovative or not. The data (Figure 1) shows that almost 94% of companies were innovative, implying that they reported some sort of innovation (product, process, service, logistics, marketing or organizational). More than 90% of companies had either product/service or process innovation. Sixty percent reported process innovation, close to 40% logistics, between 46 and 63% had organizational innovation, most common being implementation of new organizational practices. Among marketing innovation, promotion innovation/changes was most common, while pricing methods changed least frequently.

Figure 1: Share of innovative companies by type of innovation



Data: (Statistical Office of the Republic of Slovenia, 2021)

Globalinto questionnaire and other questionnaires investigate, whether, as said, the company had internal, external R&D and or purchased knowledge externally. This is not the first focus of the CIS-based questionnaire, but it is possible to assess whether companies had internal/external R&D through the questions that require specifying the expenditure on R&D (internal, external). Almost 97 percent of companies reported internal R&D, even more among large companies, but it was conducted on a regular basis only among 86% of companies. External R&D was reported in 78% of companies and again, the share was larger among large companies. Knowledge purchase was less common, CIS-based data shows that it was present in around 46% of large and 27% of medium companies. The shares of companies with external, internal R&D or knowledge purchase in the Globalinto sample was smaller, however, since in the CIS-based data large companies dominate, it is more relevant to compare the data for just large companies. The differences are still significant, with the exception of knowledge purchases. This difference could also be explained partially via sample structure (manufacturing dominates in CIS-based survey). In Globalinto data, the percentage among manufacturing companies is 71.2%.

However, there is a methodological challenge in capturing R&D from CIS-based survey. Namely, the estimated share of companies that had external/internal R&D is based on shares of companies that reported expenditure on internal or external R&D. But, in CIS-based questionnaire the R&D investment expenditure questions refer only to product and service innovation and not to process innovation, logistics, or organizational improvements. These are in intangible analysis included in a separate category of organizational improvements, while in CIS-based these costs were not provided.

Table 7 provides also estimates of the shares of expenditure for internal, external R&D and knowledge purchase. The shares of revenue for internal R&D for large companies are in both samples relatively consistent. Also, both datasets show that the SMEs spend a larger percentage on internal R&D. The differences in the role of external R&D and knowledge purchase are more significant, however these expenditures are in both cases much smaller than the share for external.

Table 7: Comparison between the estimated results from official innovation survey and Globalinto intangible survey

Share of companies with R&D by R&D type						
	Survey data			Globalinto		
	Survey all	Large	Medium	Globalinto survey all	Large	SME
Internal R&D	0.9686	0.979	0.9	0.656	0.74	0.63
Internal R&D regularly	0.861	0.852	0.88	0.667	0.757	0.634
External R&D	0.78	0.855	0.4	0.367	0.52	0.321
Knowledge purchase	0.435	0.465	0.267	0.265	0.380	0.230
Innovation cost as share of revenue						
Share of cost for internal R&D	0.0172	0.0163	0.025	0.0414	0.0179	0.0485
Share of cost for external R&D	0.0054	0.0040	0.0156	0.0059	0.0081	0.0053
Share of cost for knowledge purchase	0.000534	0.0006	0.000*	0.0035	0.0023	0.0039

*27 medium companies, 187 large

Data: (Globalinto, 2021; Statistical Office of the Republic of Slovenia, 2021)

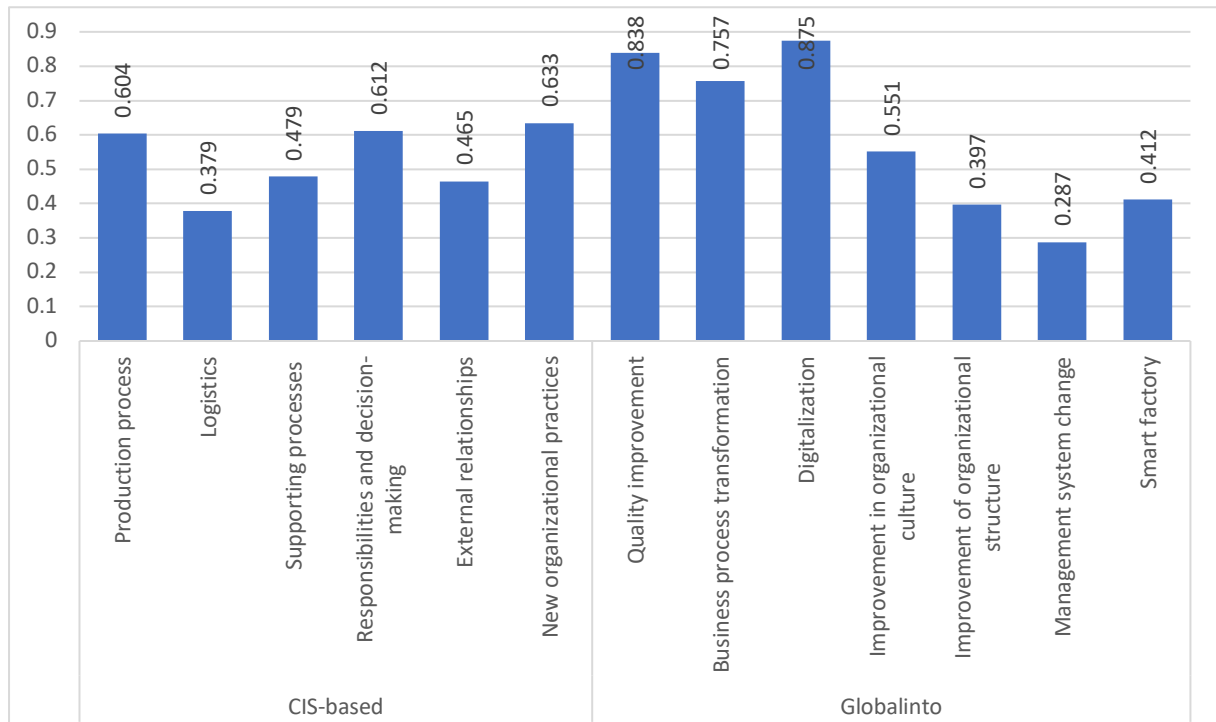
4.2 Organizational improvements

The data on organizational improvements is available only in the Innovation survey (CIS). While the questions on the presence of innovation by type do in fact cover the relevant topics, the challenge are the expenditures. The survey data shows that the CIS questionnaire covers the presence or improvements in organizations in the following categories:

- Improving production processes;
- Improving logistics;
- Improving supporting processes;
- Improving the division of responsibilities and decision-making;
- Improving external relationships and
- Implementing new organizational practices

Figure 2 presents different categories of organizational improvements that are included in both surveys. The categories do not overlap completely, however the focus in both is on the changes in organizational structure (responsibilities and decision-making), and business process transformation (production, logistics, supporting, new practices). In the CIS-based survey 63% of companies reported using new organizational practices and 61% reported new responsibilities' and decision-making division. In Globalinto data around 75% reported business process transformation. Especially the large companies dominated. For example, around 2/3s improved production processes in comparison to only 35% of medium companies, and 67% improved division of responsibilities and decision-making in comparison to only 32% of medium companies. Although there is a difference, the difference is not very high, especially considering the sample structure and the significantly lower shares of companies reporting change among medium companies.

Figure 2: Shares of companies with specific organizational innovation in CIS-based survey and Globalinto



Data: (Globalinto, 2021; Statistical Office of the Republic of Slovenia, 2021)

Also the data on the expenditure on organizational improvements is not comparable, since it is in the Innovation questionnaire only available in an aggregated manner in the category of “other investment” activities. The data shows that on average, companies spent 0.05% of revenue on “other innovation activities”, where the maximum reported amount in the category “other” was 1.03% of revenue (Table 8). This implies that this cost refers to changes in production processes, logistics, organizational innovation (as defined in CIS) and marketing innovation. Globalinto data is much more detailed and shows that on average, companies spent around 1% in total for both internal costs as well as external costs.

Table 8: Comparison of data on improved organization and processes in CIS-based survey and Globalinto survey

	Survey data			Globalinto		
	All	Large	Medium	All	Large	Medium
% of companies that improved organization (reported at least one organizational change)	0.845	0.878	0.735	0.632	0.780	0.588
% of revenue for internal advisors	n.a.	n.a.	n.a.	0.00576	0.00968	0.00457
% of revenue for external advisors	n.a.	n.a.	n.a.	0.00519	0.00163	0.0063

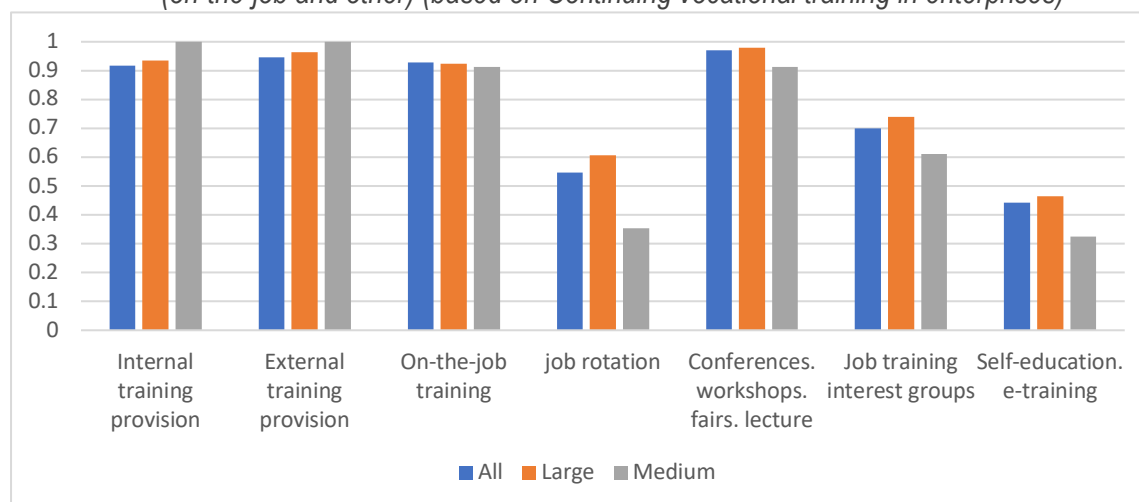
Data: (Globalinto, 2021; Statistical Office of the Republic of Slovenia, 2021)

4.3 Training

Details on training are provided in the questionnaire on the Continuing vocational training in enterprises. The questionnaire provides abundant data on the organization of training, participants, types of training and costs. The intangible investment analysis requires primarily the analysis of costs for external and internal training provision as well as types of training. Results from both questionnaires show significant

differences in the level of detail provided and in the evaluation of expenditure, while they are very similar in the evaluation of the percentage of companies that invests in a certain intangible “training” category.

Figure 3: Percent of companies with selected training types (external and internal) and training by types (on-the-job and other) (based on Continuing vocational training in enterprises)



Data: (Statistical Office of the Republic of Slovenia, 2021)

Table 9 shows that according to the results based on the Continuing vocational training in enterprises almost 92% of companies provided internal and almost 95% also external training, where the share of training providing companies is higher among medium companies, where all provided training. This is also observed in Globalinto data – a larger proportion of medium companies provided training.

Table 9: Comparison between survey data Globalinto data in the availability of training and expenditure on training

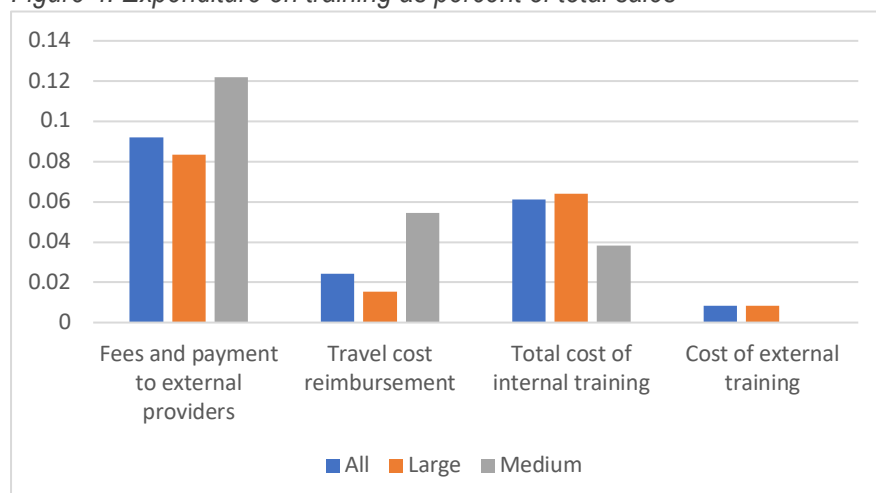
	Availability of training (share of companies providing training)		Expenditure as % of revenue	
	Internal training provision	External training provision	Internal training provision	External training provision
	Survey data			
All	0.917	0.946	0.0612	0.0921
Large	0.934	0.964	0.0639	0.0835
Medium	1	1	0.0382	0.122
	Globalinto			
All	0.897	0.716	0.591	0.327
Large	0.96	0.8	0.675	0.182
Medium	0.878	0.691	0.316	0.370

Data: (Globalinto, 2021; Statistical Office of the Republic of Slovenia, 2021)

The expenditure data differ significantly (Table 9). While the data for external training provision is 2-4 times higher in Globalinto, the data for expenditure on internal training provision is about 10-times higher in Globalinto data. The main reason is that the statistical questionnaire requires companies to provide only data for payment of internal teachers/workers in the company, whose work is either in total or partially devoted to organizing and implementing training within the company. Globalinto questionnaire had no limitations, while also the lowest reported number was 0.1 percent (methodological limitation), which in this case could contribute to the difference as well.¹¹

¹¹ 34 out of 215 companies reported spending 0.1% of revenue on internal training and 31/215 reported spending 0.1% on external training.

Figure 4: Expenditure on training as percent of total sales



Data: (Statistical Office of the Republic of Slovenia, 2021)

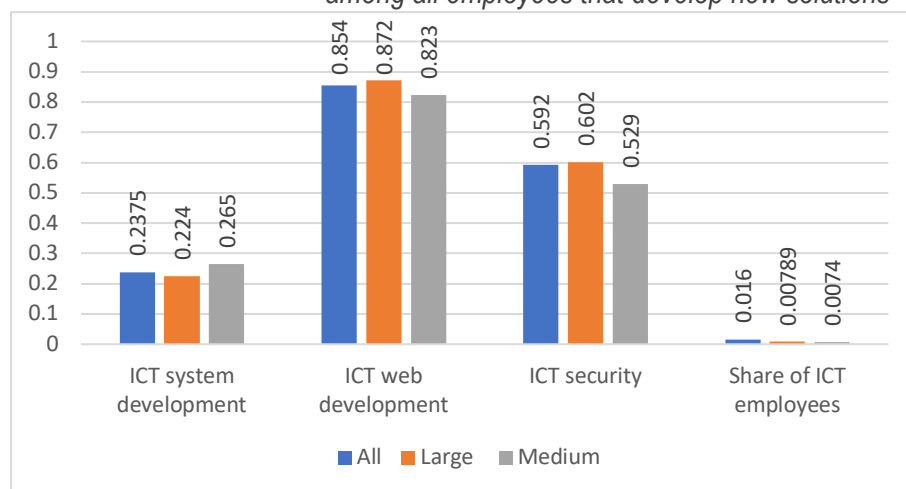
4.4 Use of ICT

According to the definition of intangible capital (computerised information) contains software and databases, which is used also in Globalinto. To make the comparison, we used the following variables/questions from the questionnaire on the use of ICT in companies:

- Whether the company was employing ICT employees,
- Whether the company by itself or by employing external providers
 - o Developed, upgraded or adjusted software and business ICT systems (e.g. ERP, CRM)
 - o Developed web-based solutions;
 - o Dealt with security issues

Figure 5 provides selected details from the official ICT use in companies survey. Only about a quarter of companies (more medium than larger) had internal system development, however the share of companies that report own ICT web development and security development was much larger. On average 85% reported own web development and 60% reported own security development. However, the share of own ICT employees among all employees that were involved in development was very small.

Figure 5: Share of companies with internal development of ICT solutions and share of ICT experts among all employees that develop new solutions*



Data: (Statistical Office of the Republic of Slovenia, 2021)

*Share even 33% among small companies, which are not reported here, but they impact the average.

Table 10 provides a comparison between official ICT survey data and Globalinto data. The differences between the results are quite significant, however, at least partially these differences can be explained by the sample structure. In both cases, large companies invested more in ICT both in terms of the share of companies that reported ICT development – 84.8% of large companies in the Globalinto survey and 75% in official statistical survey. The expenditure data cannot be compared, since ICT survey only considers software purchases and not also system development, web development, security development. Nonetheless, the expenditure on just software is about 50% of the expenditure reported in Globalinto survey and it is in both cases significantly higher in large companies.

Table 10: Comparison between survey data and Globalinto data

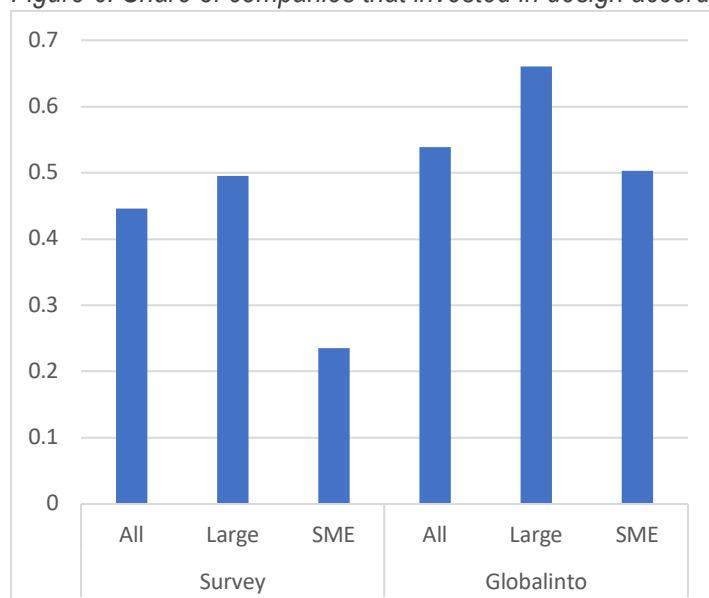
	ICT system development, Web development/Security development	Hardware purchases as % of revenue	Software purchases as % of revenue
Survey data			
All	0.746	0.173	0.267
Large	0.750	0.167	0.305
Medium*	0.765	0.205	0.124
Globalinto			
	System development /database development purchases (share of companies)		System development /database development purchases in % of revenue
All	0.561		0.574
Large	0.848		0.796
Medium	0.465		0.507

Data: (Globalinto, 2021; Statistical Office of the Republic of Slovenia, 2021)

4.5 Design

Design is directly included in the innovation questionnaire (Figure 1). 44.6 % of companies invested in design and the average investment in design in Globalinto survey was 0.024% of revenue, while the median company invested 0%. The innovation questionnaire does not provide any information on whether the design was conducted internally, or external help was hired.

Figure 6: Share of companies that invested in design according to survey data and Globalinto data



Data: (Globalinto, 2021; Statistical Office of the Republic of Slovenia, 2021)

4.6 Branding

Innovation questionnaire also provides information on other marketing activities, promotion, placement and pricing, but not actual investments in branding. About 50% of companies invested into promotion, 37% and 36% used new methods of pricing. With regards to the evaluation of intangible capital which is “branding” the innovation questionnaire does not provide suitable information that could help researchers evaluate the investment into brand development. But since it is obviously closely related to other marketing activities, the question could be added into the section on marketing innovation. The results from the CIS-based statistical questionnaire are quite similar to the results of the Globalinto questionnaire, where around 44% of all companies reported investing into branding (50% among large companies).

Table 11: Investment in marketing and branding in Globalinto and CIS-based questionnaire

	Survey		
	All	Large	Medium
Marketing – design (share of companies that reported it)	0.446	0.495	0.235
Marketing – promotion (share of companies that reported it)	0.5	0.536	0.382
Marketing – placement (share of companies that reported it)	0.371	0.398	0.147
Marketing – pricing (share of companies that reported it)	0.3625	0.367	0.323
Cost of introducing new products to the market (% of revenue)	0.719	0.828	0.323
	Globalinto		
Branding (share of companies that reported it)	0.442	0.5	0.424
Cost of internal and external branding activities	0.464	0.828	0.354

Data: (Globalinto, 2021; Statistical Office of the Republic of Slovenia, 2021)

The CIS-based statistical questionnaire also does not provide a cost estimate for branding innovation, but it does provide an estimate for marketing innovation (related to all activities to promote introducing products to the market). Companies however do report spending on introducing new products to the market, which on average amounted to 0.7% of revenue.

Globalinto questionnaire focuses in accordance with the intangibles’ definition only on branding, The mean company invested 0.46% of revenue into marketing innovation, larger companies invested double the amount, 0.8%.

5 Discussion

This paper presents a simple, yet important methodological experiment in measuring intangible investment components. The purpose was (1) to investigate, whether it is possible to construct measures of intangible investment, as defined by the Corrado et al. (2006) paper, using official statistical surveys and at the same time determine also, which variables (of those, which are standardly included in one-off surveys) are missing and cannot be approximated. Since this would be a novel, not yet tested approach, it is important to also benchmark the results against existing, one-off surveys that were prepared methodologically with the focus on measurement of intangible assets. In this case, the Globalinto database was used, since this is the most recent survey, which also gave good results if assessing the cross-country differences. In addition, the Globalinto data was also used further empirical analysis of firm performance (Bonfour et al., 2021), which again provided good results, and contributes to the reliability of the results.

In continuing, the discussion first focuses on the problem of conceptualization of broader intangibles’ measures, focusing on the differences between the definition and the data available in the official statistical surveys, implemented by Eurostat and Slovenian statistics. The purpose of the methodological

exercise was to establish, which of the categories could be measured using official surveys. In reality, due to the limitations of the length of the surveys, the ability of the researchers, to go into the depth of every category is limited. Therefore the one-off surveys, which were carried out in different countries, examined the existence of intangible investment in a specific category, its size and source (internal and external) with some possible extensions (managerial aspects, Covid, depreciation, etc.). Consequently, to assess the practical value of the available data, the data from the methodological exercise is compared to the results from the Globalinfo survey, carried out in 2020-2021.

Methodological evaluation. The study explored what parts of the conceptual framework suggested by Corrado et al. (2006) can be covered without any changes to data collection. Following Canibano et al. (1999) several issues must be addressed: (1) all core components (of intangibles) of intangible capital must be identified, (2) robustness of the definitions and the measurements must be addressed, (3) the origin of the data must be checked.

Assessing the fit with the Corrado et al. definition. As Table 12 suggests, three surveys based on Eurostat model questionnaires provide many relevant variables. The use of model questionnaires is a key part of input harmonization, which makes national microdata highly comparable. Given the expertise of NSIs in data collection and their privileged access to businesses, the collected data are expected to be of high overall quality. These findings are promising. Four issues, however, make this solution suboptimal. First, these surveys have different implementation characteristics. Most critical, their periodicity ranges from annual (ICT) to every five years (CVTS). Activity coverage is more similar and ranges from the broadest in ICT to more selective in CIS. In terms of size, the smallest companies are left out everywhere so that a threshold of 10 employees usually applies. Second, some urgently needed variables (state!) are only available through statistical areas where harmonization in the ESS leans towards output. In particular, many countries collect data on investment as part of the structural business statistics (SBS) surveys while some countries (e.g. Slovenia) have separate data collection because available administrative sources make the SBS survey unnecessary. Although the data are collected, their availability and comparability at micro level might be challenging. Third, even after considering these extra sources, some gaps remain. Fourth, gathering data from different sources is likely to open the question about data consistency. We learn from an in-depth Dutch study that differences in seemingly the same variables may appear in separate surveys even for the same company as a result of different procedures of data collector and different procedures within company (Snijkers et al., forthcoming 2022). Inconsistent reporting was also shown for UK data on R&D expenditure (Martin, forthcoming).

Lack of unified and widely accepted statistical definition of intangible investment. Regardless of the acceptance of Corrado et al. (2006) definition at the moment, the concept of intangibles is still evolving, resembling a moving target. Therefore, this exercise or any other similar exercises could only be suitable also only as a one-off experiment, in particular if the “widely accepted” definition of intangibles among economists changes. But this is true also of other concepts as today’s world is changing at an unprecedented rate. Also in statistics and in established surveys. One of the best examples in official statistics are the questionnaires on the “Use of ICT in companies”, which have changed significantly in the past 10 years. If in the past, the focus was more on the use of computers and availability of (high-speed) internet, the questionnaire at the moment (while keeping a lot of the “old questions”) focuses also on the use of different technologies from the Industry 4.0 (use of social media, cloud work, big data, e-business, RIP and other).

Table 12: Conceptualization of the measurement and the possible use of existing Eurostat (survey) data

	Computerized information	Innovative property	Economic competencies
Database / Survey	ICT usage in enterprises Structural business statistics data	Community Innovation Survey	Community Innovation Survey Continuous Vocational Training Survey
Problems	Comparability- Complete lack of information on expenditure value or only multiannual availability for some sectors Changing survey structure Lack of data on depreciation rates	Lack of data on depreciation rates (critical?) Categories for which data is collected not aligned best with Corrado et al. (2006) definition	Lack of data on expenditure Lack of data on depreciation rates
Recommendation	Extending ICT questionnaire with questions on expenditure values of purchased software and databases, and internal expenditure (now own development is focus) Adding 2 questions on depreciation period (software, databases) if depreciation is seen as critical	Harmonizing at the level of EU the intangible investment categories and extending existing surveys (CIS included) to fit the new definition while at the same time maintaining the existing categories Adding questions on depreciation period (for each innovative property type)	Adding organizational innovation expenditure and brand expenditure / marketing innovation expenditure (more clearly as a separate category) in CIS Clearly separating brand investment in CIS and also dividing costs into external and internal

Mapping intangibles definition onto the questionnaires. The analysis also showed that besides the lack of a unified and statistically accepted definition, an additional challenge in the evaluation of intangibles using official statistical surveys is also the overlap of the intangibles' categories and the official statistical questionnaires or the lack thereof. What is primarily missing is the details on the values of investments, both totals as well as separation to own and purchased (as was seen also in the case of Slovenia) as well as a lack of the data on some categories (e.g. brands). Depreciation is also missing. However, the official statistical surveys offer abundance of data on other relevant factors, such as motives, obstacles, state support.

The paper discussed in detail the variables construction and time as well as geographical coverage, but primarily **applies the methodology to the case of Slovenia**. By relying on firm-level survey data from the statistical surveys as well as detailed data from the Investment in fixed assets in enterprises (which is not available in all countries) from 1996 on, we construct measures of intangible capital and examine the intangible investment patterns in Slovenia as evident from these sources. To evaluate the approach, the results are contrasted against the established approaches from the already mentioned analyses. Table 13 summarizes key results.

Generally, we can conclude that the approach has potential, especially if researchers could agree on the relevant variables. The focus was in particular to establish whether companies invested in a specific intangible category or not and what the (internal and purchased) investment was. As Table 13 shows, only branding is a more significant challenge, but given the extent of data on marketing innovation, the problem could be solved by including also a question on marketing innovation cost into the CIS and adding directly also brand innovation activities.

Otherwise, a more significant challenge remains the lack of clear definitions also in the one-off surveys, such as Globalinto, which becomes more apparent when trying to compare the surveys and the results.

For example, what types of organizational improvements should be included – should also for example process innovation and logistics innovation be included. In addition, the detailed analysis of costs in the innovation questionnaire does not include all types of CIS innovation types.

Table 13: Comparison between Globalinto results and official surveys

	Surveys and Globalinto	Challenges in comparison
Sample	Focus on manufacturing and selected services Large(er) companies	Official surveys significantly more manufacturing Official surveys predominantly large companies
Innovative activity	Expenditure on internal and external R&D, purchased knowledge Share of those with R&D expenditure as proxy for those that are investing in innovative capital	In Globalinto focus on internal/ external R&D and not innovation types Lack of a clear definition of what the purpose of this internal and external R&D should be
Organizational improvements	Possible to assess whether companies improved organization	Definition of the types of improvements that represent »organizational capital« investment (e.g. process innovation, logistics and CIS organizational innovation) Lack of cost data in CIS questionnaire
Training	Internal and external training provision Expenditure on internal and external training	Differences in the definition of relevant training or the lack of very clear specification in Globalinto survey (e.g. apprenticeships, scholarships)
Use of ICT	Evaluation of the share of companies that developed/purchased ICT	Lack of data on value of purchases and own ICT development in CIS Evolving definition/ not unified definition of what consists relevant ICT spending (types of software, support to users or just development)
Design	Share of companies investing in design	Unclear definition of »which« design is relevant Lack of expenditure data for design in CIS
Branding	Poor overlap	CIS provides data on marketing innovation, which is not the same as branding Lack of data on branding expenditure, CIS only provides data on cost of introducing of new products to market Possibility to use »Structural business statistics data«
Comparison of results	If samples were similar by structure, results would show a much more consistent picture (which is visible in particular when comparing large manufacturing companies)	Timing of surveys Different definitions Big differences in selected variables Lack of data in particular on branding and division of expenditure to external and internal investment

Empirical results also highlight that these definitional challenges impose a restriction on the comparison of data as well, however, in terms of shares of companies that do or do not invest, the problem is smaller than in the case of values. Clearer, and unified definition could help address this challenge.

It is also true that one-off intangible capital surveys provide very different estimates (also from for example industry-based estimates) and for example from the official aggregate data on the share of R&D in GDP. Therefore, the question remains also, whether it makes sense to compare survey results at all. Instead, perhaps trends would provide a more consistent picture.

In addition to the challenges mentioned, several other considerations, which are related to the conceptualization or definition of intangibles themselves and consequently also their measurement must be mentioned. Especially when measurement is intended as input for productivity estimates and decompositions. For example, in the measurement of ICT work, the Corrado et al. definition focuses on

software and databases. Globalinto questionnaire also focused on these two, internally and externally provided. However, software and databases are a very broad term and especially with the imminent need for digitalization the role of general purpose technology is also very important as well as support activities, the activities of ICT department (employees), which often do not have any “tangible output” such as database, software upgrade or any new ICT tool. However, the role of the ICT employees and their efforts, their time invested is extremely important. These are insufficiently captured. A similar challenge are brands and marketing at large. Innovation questionnaire focuses on different aspects of marketing (price, promotion, etc.), however, this in fact does not reflect the true efforts invested into sales or marketing – which is done by whole departments. Similarly could be true for organizational capital. Again “organizational” innovation data is available, but this does not correctly capture the extent of the efforts of managers in the firm and its performance. Therefore, a fundamental concern of survey-based approach is also if the efforts or investments in intangibles are not underestimated – in particular in an exercise like this. Therefore, an occupation-based approach such as Globalinto approach provides a very good alternative. Such approach is also very important in detailed understanding of the contribution of intangibles to growth, since investment is evaluated based on employees, their time and cost (wages). Often, intangible work in particular, causes no obvious “financial” cost (e.g. what percentage of sales was invested) but is in fact the “invisible work” done within regular job tasks with no additional cost. Therefore, including the employee structure as an alternative estimation approach is very important. Nonetheless, surveys such as Globalinto and other may provide a good, cross country comparison and evaluation of the differences. But the use in econometric analysis should be done with caution.

Despite a number of open challenges, in the short run relying on such data and perhaps amending the existing questionnaires/methodologies by a few questions/modifications would allow an efficient collection of data, minimizing time and cost effort of NSIs and respondents, ensuring also higher data quality. In addition, such an approach would also allow researchers to use additional information from the surveys (original databases), which often also include variables that explain motivations, expected benefits, related phenomena etc. This would allow a more detailed study and understanding of the intangible capital accumulation. Further, relying on existing Eurostat data ensures high quality and harmonisation and good cross-country coverage. However, in the long run, the periodicity, definitions and also efforts by firms and statistical offices do call for a preparation of a unified survey on intangible investment.

6 Conclusion

The paper presented a methodological exercise in trying to measure intangibles investment based on existing official statistical surveys. It has done so both from a theoretical perspective as well as applying the methodology to Slovenia. The results pointed to several opportunities as well as open issues, not only on the side of official surveys but also one-off surveys.

The paper makes several contributions to the field, but primarily (1) Proposes an approach to capture the value of intangible assets using existing surveys and data collected at the European, which already offer a significant amount of relevant data. Alternatively, with relatively minor adaptation of several questionnaires significantly more could be done. (2) The periodicity would remain the major obstacle (as not all surveys are conducted annually) as well as the voluntary basis for implementation of some surveys and a non-harmonized approach or methodological differences between countries in the preparation of some relevant indicators, however this would still be a major improvement compared to one-off surveys. (3) The proposed methodology is implemented and evaluated in Slovenia, which offers abundant and high-quality micro-data.

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