iSport
INVESTMENTS IN SPORT

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# Investments in Sport

## Guidelines on research methodology

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# Abstract

The guidelines on research methodology provide the reader with insights into how the main study was done as well as how to perform own studies. The methodology provided here goes deeper than the manual on the web-tool provided in output 4. While the web-tool is supposed to give a first idea of how the economic impact of an infrastructure project may look like, the methodology here should give an economist a good understanding of how to conduct a proper study.

# List of Abbreviations

| | |
|---|---|
| CPA | Classification of Products by Activity, categorization of products used in the System of National Accounts |
| GVA | Gross Value Added |
| GDP | Gross Domestic Product |
| IOT | Input-Output Table (pl.: IOTs) |
| MR-IOT | Multiregional Input-Output table (pl.: MR-IOTs) |
| MR-IOT:S | Multiregional Input-Output table for sport (pl.: MR-IOTs:S) |
| PPP | Purchasing Power Parities |
| SNA | System of National Accounts |

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# 1 Assessing Economic Impact via Input-Output Analysis

## 1.1 Gross value added, intermediate goods and production value

Gross value added (GVA), called "Value added" in short,[1] is a key measure of economic activity. In national accounts it is directly linked to the gross domestic product (GDP) according to the equation:

GDP = GVA - Subsidies on products + Taxes on products

GVA typically is of more interest to the economist as it only covers production. GDP, on the other hand, includes subsidies and taxes on all products including those for final demand. If, as an example, mineral oil tax for final demand is increased, GDP increases as well although the production side of the economy is unchanged. However, GDP is often featured in the media and thus better known to non-economists.

We first outline how GVA is embedded in the concept of economic activity. To keep it simple, a single company is used for (generalizable) explanation. Economic analysis of a company first considers its output (everything which is produced) and revenue (everything which is sold), whose main difference is on inventories (products which were not sold but are stored in the inventory).[2] Revenue is used to cover a multitude of costs and to produce surplus[3] (Figure 1). Costs fall into two categories: first, intermediate goods (supplies, in the form of goods and services bought from other companies) are required. They are transformed within a given company and sold to customers. Second, there are costs incurred with the transformation. Two definitions of GVA can be derived, depending on the perspective: *supply side* or *use side*. The actual amount is the same.

First definition (supply side): GVA is the difference between revenue (light turquoise bar on the right-hand side of Figure 1) and costs for intermediate goods (plus taxes less subsidies on products, grey bars on the left). Intermediate goods are goods and services which are transformed into other goods and services within a given company. For example, wooden boards and nails are intermediate goods for a carpentry company, while hammers or saws are investments (investments are not transformed into goods, but they wear off over time). This gradual loss of value is called depreciation, or

[1] Net value added equals Gross value added minus consumption of fixed capital. It is seldom used, so "Value added" almost always refers to the gross variant.
[2] Input-Output Analysis favours actually output over revenue since the former tells us about economic activity while the latter is about sales.
[3] There is a difference between economic surplus and a company's profit, but one can neglect that for the moment.

consumption of investments or of fixed capital (see Figure 1 dark turquoise bars in the middle). If the carpentry company transforms boards, nails etc. into a table, it can sell it for a higher price than initially spent on the input materials (=intermediate goods). This additional value is called GVA. In Figure 1, GVA can be calculated as the 112 euros revenue (labelled “Output”) minus 61 euros for intermediate goods.

Second definition (use side): The resultant 51 euros have four clearly-defined components (whose relative composition may vary), reflected in the second definition: GVA is the sum of salaries & wages including social contributions, consumption of fixed capital, taxes less subsidies on production, and surplus. Thus, GVA is used to pay the four production factors work i) (wages, salaries, social contributions), ii) fixed capital (consumption of fixed capital), iii) public services (production-related taxes less subsidies), and iv) entrepreneurship (surplus).

**Figure 1: Structure of GVA (dark turquoise) as the difference between output (light turquoise) and intermediate goods (grey)**


*Source: SpEA, 2019*

High GVA means that representatives of at least one of the four factors (employees, producers of fixed capital, public sector, entrepreneurs) have a high income. Since there are always real persons involved, higher income-triggered consumption again fosters the economy. The complete circulation of resources in an economy is studied by Input-Output analysis.

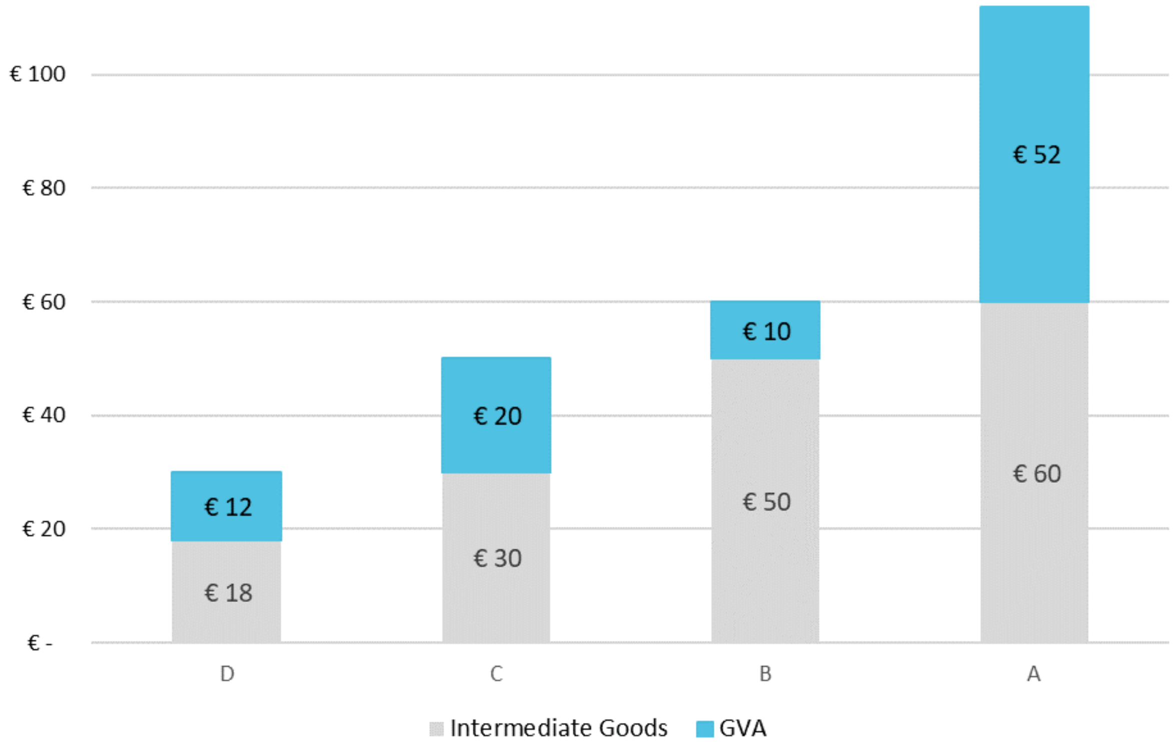
Relative contribution of the four factors in GVA varies largely, depending on the sector(s) involved. As an example, the share of wages, salaries, and social contributions in Austrian real-estate services is 8 per cent, while that of residential care services is more than 91 per cent.

Full understanding of the concepts of production value, intermediate goods, and GVA requires a closer look at the hierarchy of supply networks. Figure 2 shows an extension of Figure 1 with the suppliers of the suppliers included. At the very right Figure 2 displays the same company (A) as above, with a GVA of 52 euros and intermediate goods worth 40 euros. Company (A) obtains these intermediate goods from the supplying company B, which itself had performed some transformation. Here, 10 euros of GVA were added to 50 euros of intermediate goods. Thus, in the supplying company, GVA is generated as well. The hierarchical dependence of suppliers may continue to C, D etc. In Figure 2, of the initial 112 euros output, 94 euros derive from the directly producing company A plus the three preceding levels of suppliers. Finally, of course, all products sold/passed on represent 100 per cent GVA – one only has to go back far enough through the supply hierarchy and identify the producers. General statements on GVA can be made:

- Final output (112 euros) and GVA (52 euros) are direct effects, while everything occurring in the supply chain to the left is called indirect effects.
- A GVA chain is theoretically infinitely long [4],
- A GVA "chain" actually is rather a GVA network, as almost every company has more than one supplier, which again have multiple suppliers.
- This GVA network links several sectors, visualizable as loops of very different sizes.
- Appropriate methods are needed to make such complex networks traceable.
- The higher the share of direct GVA in a product (turquoise part of the right bar in Figure 2), the smaller the share of intermediate goods and thus of indirect GVA (and vice versa).
- The share of GVA in a product coming from the directly stimulated company is an important economic indicator.
- Any product that is supplied holds 100 per cent GVA.

[4] Even extraction of primary resources like ores or wood requires intermediate goods, e.g. diesel or financial services. Therefore, when one follows the supply chain back to primary resources, a "loop leads back" to products which are much higher in the hierarchy of the sectors. However, the sum of these infinite loops is finite.

**Figure 2: GVA is "purchased" in the form of intermediate goods**




*Source: SpEA, 2019*

Input-Output tables (IOTs) are the preferred tool for deciphering the high complexity of supply networks. Figure 3 depicts a simplified IOT of an economy producing only three goods. Such IOTs serve many purposes. Among those, IOTs

- serve to understand the structure of the economy by describing inputs (columns) into goods and the related outputs of goods (often simply called "sectors");
- serve to understand and model the relation between the sectors of an economy;
- serve to analyse the supply-networks of goods;
- serve to understand the "outflow of GVA" to other economies by importing goods from there;
- serve to understand export industries;
- are a means to model changes in an economy, i.e. the impact an additional economic activity has on the rest of the economy.

In the upper left part, the 3x3 intermediate goods matrix is shown (the intersection of the first three rows and columns reporting numbers): in the columns one can read how much each sector purchased, while in the rows the deliveries to other sectors and final users are given. Thus sector 1 bought one unit (typically, monetary units are used in current IOTs) from itself (this could be seeds bought by farmers from other farmers), three units from sector 2 and nothing from sector 3. That makes four units in total of domestic intermediate goods. An additional unit of intermediate goods was imported and there was a net one unit of taxes less subsidies on purchased goods. The total intermediate consumption of sector 1 therefore equals six units. Below come twelve units GVA (1 + 3 + 6 + 2 for the four factors). The six units of intermediate goods plus twelve units GVA sum to a production value (here called "Output") of eighteen units.

As any item that is produced will be used in some way (even if just stored), these 18 units of output of sector 1 have to be booked in the same sector's row: it sold 1 unit to itself, 2 units to sector 2 and 1 unit to sector 3, therefore it produced a total of 4 intermediate goods. In addition to that it also produced 14 units for final use (5 private consumption, 6 capital formation and changes in storage and inventories, 3 exports). The 4 units of intermediate use of good 1 plus its final use of 14 units thus equal 18 units of total use which are equal to the output of good 1. Therefore, the numbers in the lowest row are equal to the (first four) numbers of the rightmost column.

Real IOTs feature a much larger number of sectors, usually around 65 to 75, with a respectively more detailed accounting structure. IOTs for the Member States can be downloaded at Eurostat for different years.[5]

[5] https://ec.europa.eu/eurostat/web/esa-supply-use-input-tables/data/database

**Figure 3: A strongly simplified Input-Output table using exemplary numbers**

| | | Good 1 | Good 2 | Good 3 | Total | Private Consumption | Public Consumption | Final Consumption | Capital Formation, Valuables, | Exports | Final Use | Total Use |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Good 1 | 1 | 2 | 1 | 4 | 5 | 0 | 5 | 6 | 3 | 14 | 18 |
| | Good 2 | 3 | 17 | 10 | 30 | 10 | 0 | 10 | 10 | 2 | 22 | 52 |
| | Good 3 | 0 | 10 | 10 | 20 | 5 | 5 | 10 | 5 | 7 | 22 | 42 |
| Total | | 4 | 29 | 21 | **54** | 20 | 5 | **25** | 21 | **12** | **58** | **112** |
| Use of imported products | | 1 | 3 | 2 | 6 | 3 | 1 | **4** | 4 | **1** | **9** | **15** |
| Taxes less subsidies | | 1 | -2 | 2 | 1 | 1 | 1 | **2** | 2 | **1** | **5** | **6** |
| Total | | 6 | 30 | 25 | 61 | 24 | 7 | **31** | 27 | **14** | **72** | **133** |
| | Cons. fixed capital | 1 | 2 | 3 | 6 | | | | | | | |
| | Other taxes | 3 | 4 | 3 | 10 | | | | | | | |
| | Employees' comp. | 6 | 14 | 8 | 28 | | | | | | | |
| | Surplus | 2 | 2 | 3 | 7 | | | | | | | |
| Gross Value Added | | 12 | 22 | 17 | **51** | | | | | | | |
| Output | | 18 | 52 | 42 | **112** | | | | | | | |

*Source: SpEA, 2019*

Examples:

- The IOT shown indicates that sector 1 does not need any direct supplies from sector 3. However, it purchases 3 units as supplies from sector 2. This sector buys 10 units from sector 3, so in this second supply level the whole economy benefits directly and indirectly from a stimulation of sector 1.
- Several circular relations are visible. E.g. each sector purchases from itself (the diagonal from upper left to lower right, 1 – 17 – 10), known as “degenerate” or micro circles. Furthermore, sector 1 purchases from sector 2 (3 units), and reciprocally (2 units). Thus direct “there-and-back-again” circles can be found easily. An even longer circle starts at sector 1, purchasing 3 units from sector 2, which purchases 10 units from sector 3, which again purchases 4 units from sector 1.
- The IOT depicted in Figure 3 presents a single-country IOT, which is the standard type. However, the IOT on sport used for the main calculations of the iSport-project covers the EU-28. Consequently, there will be circles interlinking several European countries. This special IOT

is subject of chapter 1.5. Domestic IOTs on sport were used for the web-tool allowing national decision makers to quickly calculate domestic effects of planned infrastructure projects.

Note that in Figure 2 company C has a high GVA in relation to output (two thirds of output are GVA). Accordingly, intermediate goods amount to a comparatively small part only. Since indirect effects come from producing intermediate goods, indirect effects in this case have to be small in comparison to direct effects.

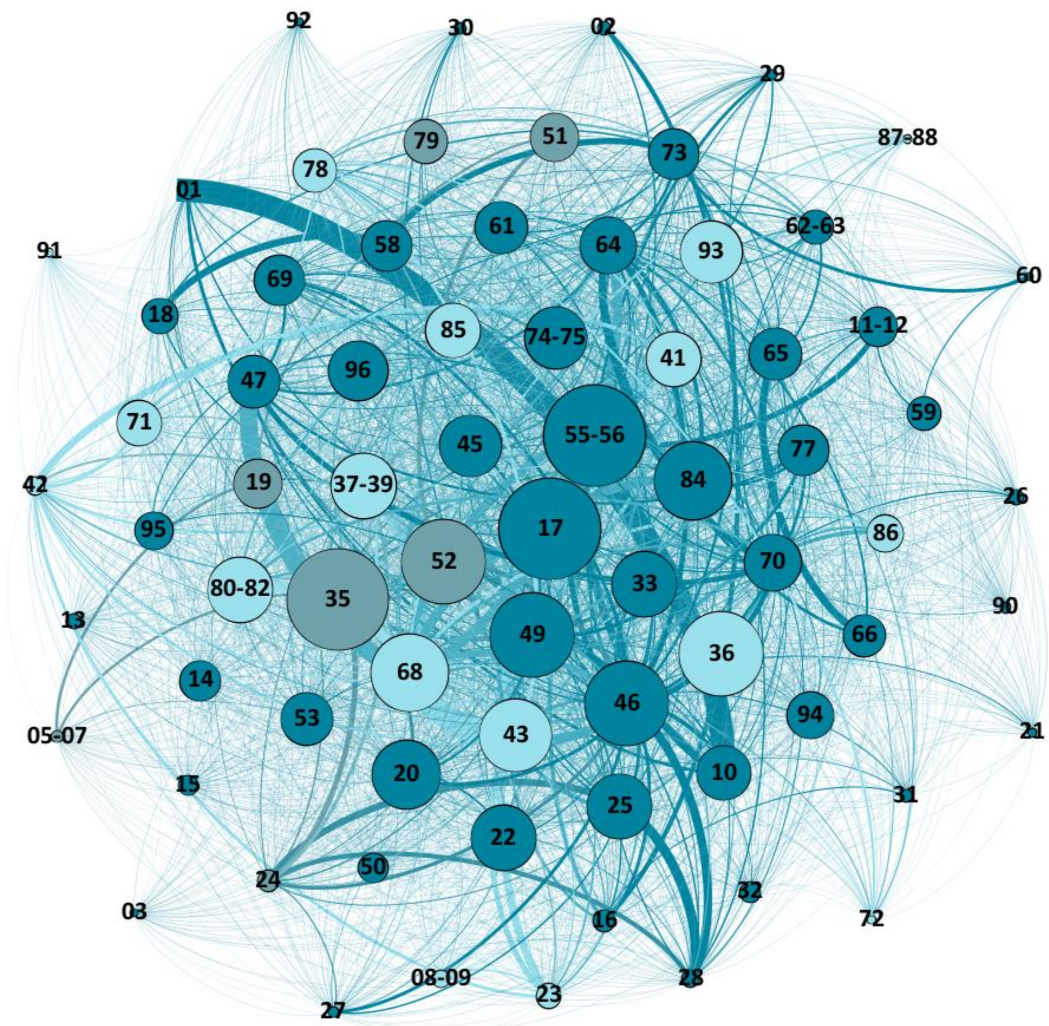
The complexity of a real IOT becomes evident in Figure 4, depicting a network graph of the Austrian IOT of 2014 before sport-related sectors were added. The nodes are the sectors; the larger they are, the more they buy and sell.[6] CPA codes are used here to label sectors[7]. Node connections represent supply flows (shown to scale, considering only those larger than 10 million Euro and ignoring self-deliveries (sector X selling to itself). Supply flows always go clockwise. From the upper left part there is a large flow (dark) linking sector 01 (agriculture) with sector 10 (production of food) at the lower right. For those sectors, deliveries in reverse direction are much smaller. The colour scheme is supposed to depict different clusters[8] of sectors which are tightly connected to each other. For the purpose of this project, the clusters are of lesser importance than the visualisation of the complexity of economic activities.

[6] Please note that the areas are not proportional. Larger circles always refer to more economic activity, though in a non-linear way to support visual perception.

[7] CPA codes are given at the end of the document or can be found in the EC's code library http://ec.europa.eu/eurostat/web/cpa-2008/overview

[8] Clustering does not provide definitive borders between groups, so using a different clustering algorithm or different parameters may lead to different clusters. Still, it serves as an aid for the overwhelmed observer.

**Figure 4: Deliveries between different sectors**

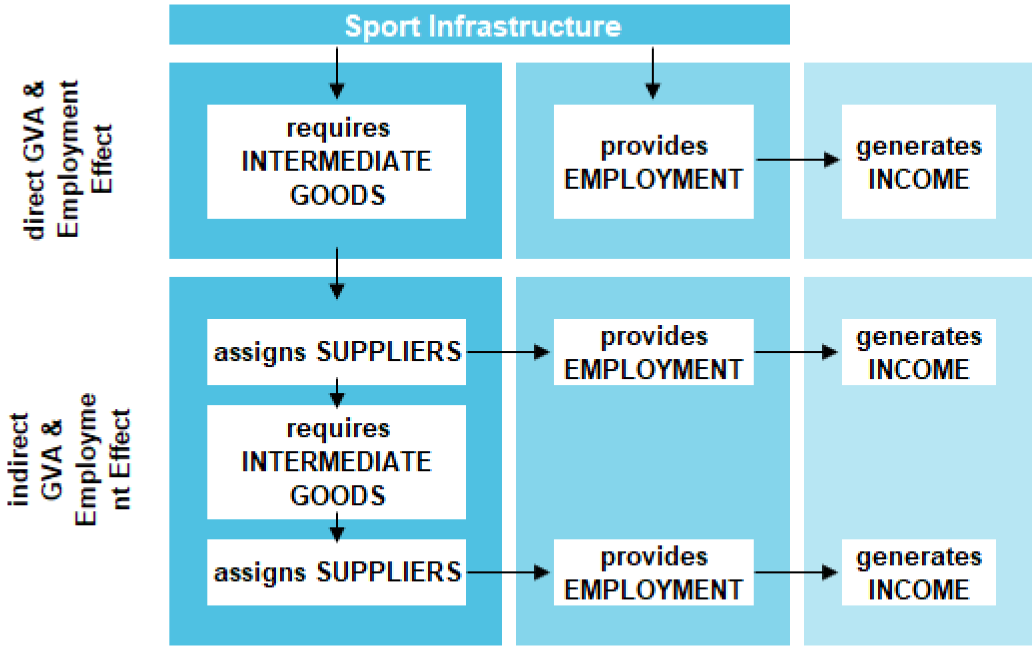



*Source: SpEA, 2019*

## 1.2 Direct and indirect effects

The project deals with the economic impact of changes in sport infrastructure: construction and operation lead to economic activity and thus to additional growth, GVA and employment. As an example, a public swimming pool is to be built. A construction company will construct the site according to an architect´s plans. All economic activities taking place in these companies are the **direct effects**. In addition, the architect needs office space, electricity and office material, while the construction company requires water, cement, bricks, tiles, steel pipes, special lawn, etc. The providers of these intermediate goods and services benefit, too. Since these supplying firms in turn need intermediate goods and services as well, a long, theoretically infinite supply chain can evolve from the direct effects. The impacts stemming from this supply network are called **indirect effects** and literally affect the whole economy. Generation of employment and GVA through economic activity also leads to taxes being paid. Figure 5 visualises the relationships between the participants in the creation of direct and indirect effects.

**Figure 5: Direct and indirect effects of a sport infrastructure**




*Source: SpEA, 2019*

Note that, as mentioned earlier, in Figure 2 company C (and to less extent also company A) has a high GVA in relation to Output. Therefore, intermediate goods necessarily contribute to a comparatively small part of output. In such sectors, direct effects have to be large while indirect are forced to be small. The ratio of total effects (direct plus indirect) to direct effects therefore is comparatively small in such sectors. This ratio is called “multiplier”. However, multipliers can also be small if many/most intermediary goods are imported. This directly leads to the next topic:

Through foreign-trade relations between countries, indirect effects feed into the whole EU-28 (and the rest of the world) as some intermediate goods and services usually need to be imported. Thus, sport infrastructure in a single EU-Member State has a positive effect on all EU-28 Member States, even if directly involved companies belong to only one or few states.

These economic effects can be calculated with an IOT. By tracing back, the production of a good, one can calculate how many goods from the originally stimulated sectors are necessary (the direct effects), how many goods from other domestic sectors (national indirect effects), and how many imports (international indirect effects). Production of all these goods goes along with according GVA and employment.

Such IOTs either depict a single country in great detail, or several countries in a less detailed way. Multiple-country IOTs feature fewer sectors per country than each of the respective national IOTs). In 2012 a consortium led by SpEA completed a Multiregional Input-Output Table for Sport (MR-IOT:S) for the EU. It is unique in three respects: it combines the wealth of detail of the national IOTs, the range of countries of the multiregional IOTs, and includes a special focus on sport. Only recently, this model was updated for 2014, the most recent year for which IOTs are available. These features make it a perfect tool for the purpose of this project. The multiregional structure allows exactly those above-mentioned assessments of economic impact - for single countries as well as on an EU-wide scale - by making use of foreign trade data. It thus enables tracing back-imported goods to their origin and calculate the indirect effects in the respective country of production. These are the EU-wide/global indirect effects. In this study the MR-IOT:S will be the basis to derive the economic impact of sport infrastructure.

Summarising, by making use of this methodology we are able to distinguish the following effects:

- Direct (national) effects: arising from economic activities in those companies which are directly stimulated by sport infrastructure construction (or establishment or expansion).
- Indirect national effects: arising in the domestic supply-networks of the directly stimulated companies. These networks can be infinitely long (but the effects not infinitely high) and can include circles (company A delivers to company B which delivers to company C which again delivers to company A).
- Indirect international effects: arising in the foreign supply-network of the stimulated companies. Somewhere in the supply network – maybe at the first level, maybe very far back, something has to be imported from another EU-Member State. This production abroad leads to an economic impact in the producing country. It is possible that foreign companies again import something from other countries. Thus, international supply circles can occur where the directly stimulated company in country A imports goods from country B which in turn imports goods from country A.
- Indirect outside-EU effects: not modelled here. Goods imported from outside the EU are not considered.

Above-listed effects are calculated regarding both value added and employment.

## 1.3 Induced effects and tax effects

Induced effects arise from employment effects cause by an economic impulse (in this case sport infrastructure expansion). Additional employment creates higher income and thus more money to spend. The additionally consumed goods have to be produced and thus create induced effects. For proper calculations, complex information on e.g.  net income, employment benefits, the savings rate, spending abroad is necessary to set up a calculation model. Unfortunately, for the majority of EU Member States, the respective high-quality data is unavailable. Given these restrictions, calculations on induced effects and tax effects had to be abandoned here. However, national experts working on comparable projects are encouraged to do these additions for their countries.

According to our experience for Austria for roughly 15 years, induced effects of 3 per cent to 8 per cent of direct plus indirect effects can be expected. From further analyses using detailed tax-models, it is also known that public social insurance benefits substantially from economic activity.

## 1.4 Satellite accounts

The System of National Accounts (SNA) treats sport in an aggregated sector[9] called “Sporting services, amusement and recreation services”. Unfortunately, it is impossible to extract sport-specific from other data in that sector. . Matters are further complicated because this sector only holds a rather specific part of sport, namely operation of sport facilities (including e.g. stadiums, swimming pools, golf courses, and bowling alleys), racetracks and amateur as well as professional sport events, plus sport clubs and fitness facilities.

However, numerous sport-related economic activities are not assigned to that sector: e.g. ski-lifts (sector: land transport), production of sport shoes (sector: leather and related products), or sport journalism (sector: publishing services). Importantly, not only is sport part of a larger, aggregated sector, it is also spread over many additional sectors.

Satellite accounts (SAs, also called Satellite system) help to address this problem. A SA is an extension to the SNA when the standard accounts (the “sectors”) follow a categorisation different to the one needed, or if sectors not sufficiently resolved. In our case, a Sport satellite account (SSA) focusses on sport.

Figure 6 shows a variant of IOT from Figure 3, with a SSA inserted as dark-turquoise row and column. The SSA thus is an extension to the normal IOT. Sport originally was part of “Good 3”.[10] As sport was removed from the original sector “Good 3”, the new values shown in “Good 3*” are respectively

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[9] In fact, it is not a sector but a product in case of CPA-based IOTs or an economic activity in the more seldom NACE-based IOTs.

[10] Typically, sport is distributed to many different sectors, like the production of shoes, construction or recreation services. For the sake of simplicity, a single sector, Good 3, is used here instead.

smaller, i.e. SSA values were subtracted. The sums over both sectors ("Good 3*" and "Sport") equal that of "Good3" in the original table. Figure 6 examines the same economy as Figure 3, but with a more detailed view of the sport-related sectors.

That IOT extended by the SSA to analyse sport (IOT:S) follows the same regulations and principles as any standard IOT described in the SNA – it "only" has an additional sector. Therefore, the same methods as described above can be applied. Filling the SSA, the orange row and column, with data requires a lot of data and careful handling as data from the companies' income statements and balance sheets have to be mapped into the economic definitions in the SNA.[11]

**Figure 6: A strongly simplified IOT showing the satellite in orange and the original sector in light blue**

| | | Good 1 | Good 2 | Good 3* | Sport | Total | Private Consumption | Public Consumption | Final Consumption | Capital Formation, Valuables, Inventories | Exports | Final Use | Total Use |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Good 1 | 1 | 2 | 1 | 0 | 4 | 5 | 0 | 5 | 6 | 3 | 14 | 18 |
| | Good 2 | 3 | 17 | 8 | 2 | 30 | 10 | 0 | 10 | 10 | 2 | 22 | 52 |
| | Good 3* | 0 | 8 | 10 | 0 | 18 | 4 | 4 | 8 | 5 | 7 | 20 | 38 |
| | Sport | 0 | 2 | 0 | 0 | 2 | 1 | 1 | 2 | 0 | 0 | 2 | 4 |
| Total | | 4 | 29 | 19 | 2 | **54** | 20 | 5 | **25** | 21 | **12** | **58** | **112** |
| Use of imported products | | 1 | 3 | 2 | 0 | 6 | 3 | 1 | **4** | 4 | **1** | **9** | **15** |
| Taxes less subsidies | | 1 | -2 | 3 | -1 | 1 | 1 | 1 | **2** | 2 | **1** | **5** | **6** |
| Total | | 6 | 30 | 24 | 1 | 61 | 24 | 7 | **31** | 27 | **14** | **72** | **133** |
| | Cons. fixed capital | 1 | 2 | 2 | 1 | 6 | | | | | | | |
| | Other taxes | 3 | 4 | 2 | 1 | 10 | | | | | | | |
| | Employees' comp. | 6 | 14 | 7 | 1 | 28 | | | | | | | |
| | Surplus | 2 | 2 | 3 | 0 | 7 | | | | | | | |
| Gross Value Added | | 12 | 22 | 14 | 3 | **51** | | | | | | | |
| Output | | 18 | 52 | 38 | 4 | **112** | | | | | | | |

*Source: SpEA, 2019*

In order to produce more precise results for the original EU-28, their IOTs:S were merged into a substantially more complex model described in the next section.

[11] Just as an example, consumption of foreigners is not considered an export, but consumption of private households instead, even though it is paid in foreign money. The totals of the columns "private consumption" and "exports" are thus easily misinterpreted.

## 1.5 The multiregional Input-Output table

For this project, a Multiregional Input-Output table for sport (MR-IOT:S) for the EU-28 was used. Multiregionality and SAs are not necessarily related, in fact their combinatorial analysis is unique. Before explaining how these two modelling-approaches were combined, a closer look at MR-IOTs is useful.

The 28 economies of the European Union are connected by intra-EU foreign trade. Consequently, national IOTs can be linked into a multiregional IOT. Calculating these links between the regions (i.e. Member States) is a complex economic task for which several methods were proposed. The three most important ones are:

- The Interregional Input-Output Model (IRIO) by Isard (Isard, 1953);
- the Multiregional Input-Output Model (MRIO) by Chenery and Moses (Moses, 1955) and Hartwig (Hartwig, 1970);
- the Balanced Regional Model by Leontief (Leontief, 1963).

The major advantage of Isard's model is its ability to cover the whole variety of effects of each sector and each region. This benefit however entails a big disadvantage/challenge: the enormous effort of data collection. The number of Input-Output flows is determined by $(m \times n)^2$ with m being the number of regions and n the number of sectors. Even in a small model with five regions and ten sectors, 2,500 values have to be determined. For Europe an interregional Input-Output model would (as a minimum) covers 28 regions and 107 sectors (standard 65 plus 42 sport-related), that is $(28 \times 107)^2$ or more than 8,980,000 values.

The structure of the model according to Leontief corresponds to that of Isard but involves a very different, more sophisticated interpretation, using different definitions of markets. Because empirical tests showed that this model is only useable for a limited number of regions and sectors and should not be used for longer periods (not longer than three or five years) it is not applicable for this study and therefore will not be discussed in more detail.

For these reasons, efforts have been made to develop less complex multiregional models, like the one developed by Chenery and Moses for the US economy. The MRIO, which has been steadily improved and refined in the last decades, in its most detailed version covers the United States 51 regions and 79 sectors. Formally the MRIO resembles the model of Isard, but with respect to the content it differs in that it implies a stability hypothesis. The table itself is set up in two steps: as a first step the intraregional tables are created (one table for each region), in a second step data on import and export flows are collected/inserted.

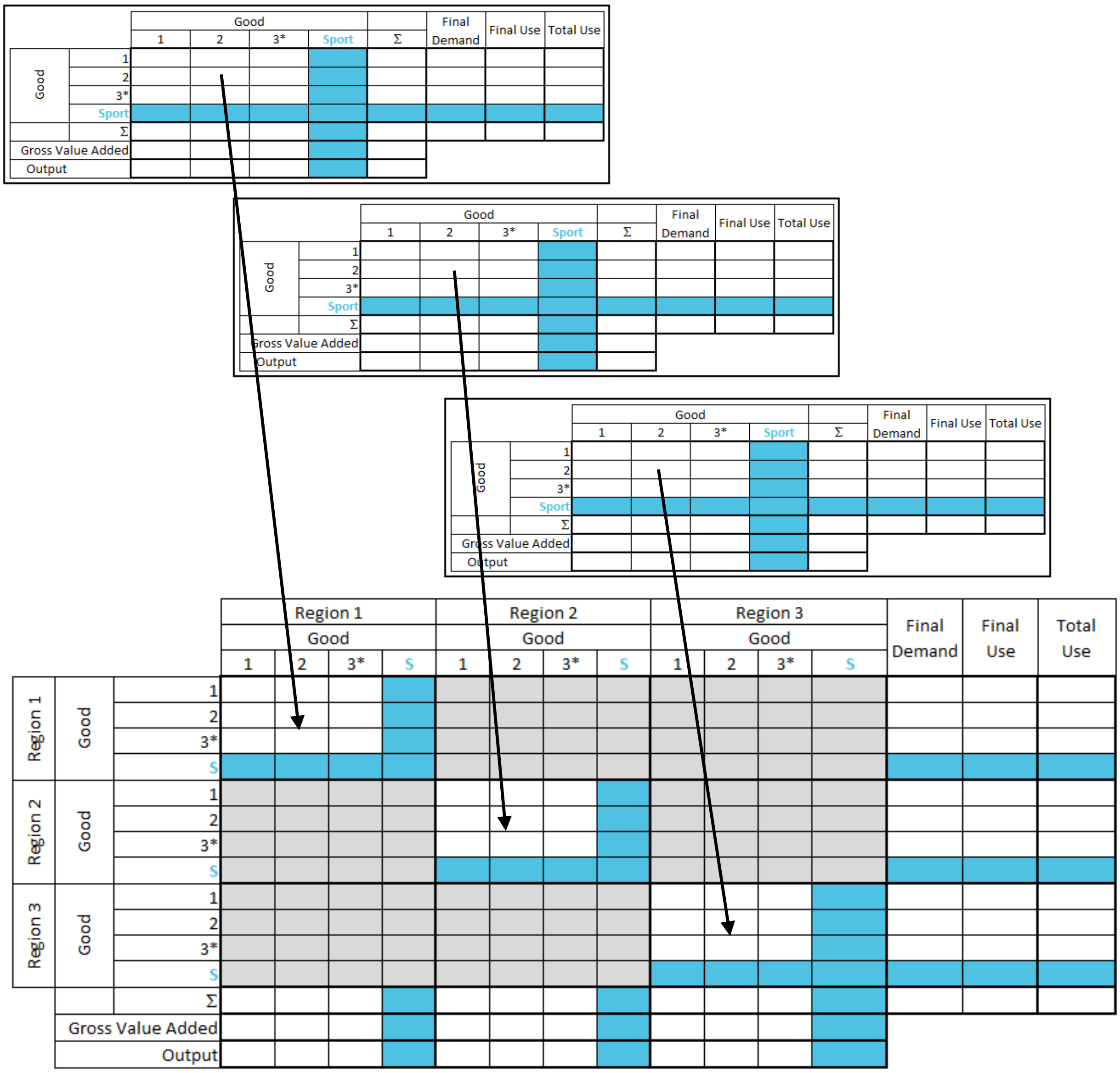
The model is extendable to any number of regions. Its big advantage is the much lower complexity of the table stays compared to Isard's model. The amount of data necessary to complete the table is determined by $n \times m^2 + m \times n^2$ (n intermediate goods matrices being m x m large plus import/export data for all m goods between the n x n countries). Thus, in the example above (28 regions and 107 subsections) approximately 404,000 data entries are required. This is around 4.5 per cent of those needed in Isard's model. Because of this opportunity for simplification, it was decided to use the MRIO model of Chenery and Moses in the context of this study. To nevertheless allow the use of domestic national IOTs as base data and thus improve resolution of the final table, an extension was implemented.

As mentioned earlier, instead of standard IOTs, the 28 IOTs:S were used. From a methodological point of view, this makes no difference as it only increases the number of sectors, but neither affects the mathematics nor the economic interpretation. The principal layout of the MR-IOT:S can be seen in Figure 7. The upper section displays the separate national IOTs:S with the SSAs in white and turquoise. In the MR-IOT:S, the national intermediate good matrices are arranged around the main diagonal (upper left to lower right) again in turquoise (sport) and white (non-sport). These are all deliveries from "Region X" to the same "Region X". Foreign trade is grey. As in the standard IOTs, GVA and output can be found at the lower part of the table, final demand, final use and total use are on the right. [12]

The foreign trade part holds the interregional imports and exports. E.g. the light orange values of the fourth column which are below the dark orange part show purchases of region 1's sport sector from the different sectors in region 2 and region 3. Light orange values in the fourth row to the right of region 1 are exports of region 1's sport sector to different sectors in region 2 and region 3. Thus, one can follow supply purchases from sector to sector over all regions, leading to an enormous increase of the already high complexity.

[12] Final demand is more complex than before though, as goods for final demand in one region may come from a different region. So, there actually is a whole final demand matrix instead of just a column-vector.

**Figure 7: The layout of the MR-IOT:S. National IOTs:S (upper part) are merged via foreign trade into a single table**




*Source: SpEA, 2019*

The MR-IOT:S used for this project features 28 countries each having 107 sectors of which 42 are sport-relevant. The intermediate goods matrix thus has 28 x 107 = 2,996 rows and columns, making a total of 8,976,016 cells – for the intermediate goods matrix alone. Depending on the software, a print-out of a single excel-cell is roughly 12 mm by 5 mm in size, thus has an area of around 60 $mm^2$. Printing out the intermediate goods matrix would require 538,560,960 $mm^2$, i.e. approximately 539$m^2$. This area corresponds to more than twice the size of a doubles-match tennis court (á 260.87 $m^2$)[13].

[13] https://en.wikipedia.org/wiki/Tennis_court reports a tennis court width of 10.97m for the doubles-field and a length of 2 x 11.89m. Playing singles, the court measures 8.23m in width.

Still, as the methods developed for national Input-Output analysis are independent with the economic boundaries (all services, just sport services, or just a single sport infrastructure) and number of sectors, they can be applied to this MR-IOT:S. Therefore, for the purpose of this project, the model is appropriate.

## 1.6 National Sport Satellite Accounts

National SSAs in Europe so far exist for twelve countries: Austria, Belgium, Croatia, Cyprus, Germany[14], Estonia, Lithuania, the Netherlands[15], Poland[16], Portugal, Switzerland[17], and the UK[18].

Manuals on creating SSAs were published by Statistics Netherlands (CBS) and the University of Applied Sciences of Arnhem and Nijmegen[19], SpEA and SIRC. The three different approaches originally pursued were finally merged into a single document[20].

[14] See Ahlert, Repenning, an der Heiden (2019)
[15] See CBS (2015)
[16] See https://www.msit.gov.pl/pl/sport/badania-i-analizy/rachunek-satelitarny-sp/580,Rachunek-Satelitarny-Sportu.html
[17] See http://www.ruetter-soceco.ch/wordpress/project/wirtschaftliche-bedeutung-des-sports-in-der-schweiz-2014/
[18] See https://www.gov.uk/government/collections/sport-satellite-account-for-the-uk-statistics
[19] See CBS, HAN (2012)
[20] See SpEA, SIRC, HAN (2015)

# 2 Research Topics

Most of the following research questions will be handled by standard Input-Output analysis methods applied on the MR-IOT:S as described above. Mathematical and economic introductions can be found in the literature[21], Miller, Blair (2009) is a good starting point for a trained economist. The main difference will be that the MR-IOT:S contains sport-specific sectors for every Member State. Through the foreign-trade relations between the Member States, EU-wide results can be obtained, thus overcoming limitations of the usually applied, purely domestic IOTs.

A web-tool was produced in the course of the iSport project which allows all three types of assumptions studied below to be applied. Only the number of sectors from where investments are purchased is limited for technical reasons. Decision makers and researchers can use the tool for a quick estimate of the economic impacts of possible sport infrastructure projects. The complete SSA taken from the MR-IOT:S or more recent research (as for Austria and Croatia) is behind the calculations and allows the quantification of a wide range of indicators discussed here. For further-reaching analyses, a dedicated SSA maintained by an expert is suggested.

## 2.1 Virtual Infrastructure

The first research output is an overview of the 28 Member States and their economies' properties with the focus on the sport-related construction sector. It is assumed that a sum of one million euros is invested in every single Member State into the sport-related construction sector only. No other sectors are stimulated directly, which certainly unrealistic as architects or furniture need to be paid as well. However, the biggest part of investments falls into the construction sectors which are examined closely here.

Labour productivity, measured as GVA per employee, is the starting point. One may assume that labour productivity in sport-related construction is related to labour productivity in the whole economy. However, this is checked empirically, revealing some interesting insights. At the same time, comparison of these two values enables judgement on below- or above-average labour productivity in sport infrastructure construction.

Employment is a closely related and highly important aspect. Since construction typically employs numerous workers, investments into sport infrastructure may be a strong employment driver.

[21] See Miller, Blair (2009)

However, employment per million euros of investment differs largely between Member States. In countries with low labour productivity the sport construction sector pays lower wages and employs more persons. The shape and exact distribution of Member States is shown in the study.

The impact of additional wages and salaries is two-fold. First, it leads to additional consumption enabled by a higher income. Second, the economy benefits as well since these consumed goods and services at least partially derive from domestic companies. Unfortunately, the size of these induced effects cannot be calculated in the course of this study since a complex behavioural and tax model would be required for every Member State to quantify the result. Such models have not been implemented for the majority of the Member States. In addition, wages and salaries on a sectoral basis were also not available for all Member States.

In order to make results more comparable, wages will also be calculated in terms of Purchasing Power Parities (PPP) which are also available at Eurostat[22]. Since wages may differ, but the price levels between the Member States do so too, this step allows to sharpen the quantification of the income effects. Price levels are typically lower in Member States with low labour productivity. Therefore, the income effect there is higher than when using absolute amounts.

To study the foreign trade relations between Member States, different approaches will be used. Firstly, a matrix of import-/export-values for sport-related construction will be developed. While showing the exact numbers of foreign trade, it is difficult to appropriately visualise the economic proximity between *all* Member States in one image. Therefore, another, more experimental, method will be applied: the Fruchterman-Reingold[23] algorithm allows mapping the Member States according to certain "proximity indicators", foreign trade in our case. Described in short, Member States can be imagined as nodes which are separated by virtual springs and brought closer by foreign trade. The more intensive their mutual trade, the closer they are to each other. A two-dimensional map can thus be drawn based on import-export data.

Indirect effects, therefore effects generated within the supply network, are comparatively simple as long as domestic effects are considered. However, once the network crosses a border, two different approaches can be chosen. Imagine Member State A constructing a swimming pool and purchasing pressure-resistant glass produced in Member State B. Obviously, the GVA from the production of this

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[22] Eurostat variable `prc_ppp_ind`

[23] Fruchterman, T. M. J., & Reingold, E. M. (1991): Graph Drawing by Force-Directed Placement. Software: Practice and Experience, 21(11), available at: http://citeseer.ist.psu.edu/viewdoc/download;jsessionid=19A8857540E8C9C26397650BBACD5311?doi=10.1.1.13.8444&rep=rep1&type=pdf

glass can be assigned to Member State B, where it is economically generated ("Member State generating the GVA"). An alternative view is that without Member State A constructing the pool, Member State B would not have benefitted. Therefore, one can also attribute the GVA to the Member State originally ordering the infrastructure ("Member State causing the GVA"). Both interpretations are considered in the study. For the domestic decision makers, these considerations are less interesting, but from the EU-perspective they are of importance.

## 2.2 Real Infrastructure

After the first step of assuming a virtual one million euros investment exclusively in the construction sector of every Member State, the exact opposite is researched: real data. Data on 91 investment projects of the partner states were collected summing to a total of more than 476 million euros. If possible, data on a football stadium, a grass-roots infrastructure and an elite facility were considered. Single projects differed substantially in investment volume as well as in the sectors from where investment goods were purchased.

For future research it is important to point out the necessity of sectoral data as well as on information on the whether the investment goods and services were bought domestically or imported. One of the major results of the study was that the sectoral distribution may fundamentally affect the results.[24] Of course, goods and services bought abroad do not generate domestic effects. Taking these two information points into the calculations is an absolute necessity.

Results in terms of GVA and employment, direct, indirect and EU-wide, were calculated for every partner state and every infrastructure type (football, grass roots, elite). A "big picture" of sport summarizes the results.

It is suggested for oncoming research to compare the national results with other Member States and to conduct at least the same analyses. Interesting information may also be obtained from the multipliers, therefore the ratio between total effects (direct plus indirect) to direct effects.

## 2.3 Normalised infrastructure

After the two above analyses on virtual and real infrastructure, the need for a normalisation is obvious. Real data are very well and, by definition, empirical, but they have the drawback of being hard to compare. It was noted before that the different infrastructure project were of substantially different

[24] The result was well expected, but shown to emerge here as well.

sizes. Obviously, a 10 million euros investment has a larger impact than one for 250,000 euros, no matter in which Member States they are built. However, the smaller one may be more “efficient” in generating domestic GVA and employment. Thus, the results of the real infrastructure project were normalised to one million euros. One can thus make statements like “Per one million euros invested, project A yields more GVA than project B” independent of the projects’ overall investment sums.

These results are of utmost importance for policy makers when they have a limited budget for many different investments possibilities. The biggest ones are by no means always the most efficient GVA- and employment producers.

Future researchers are advised to undertake such calculations as well in order to supply their high-level decision makers – apart from the economic insights.

# 3 Practical Realisation

There are four major steps into which the analyses could be divided and which are to be followed by future researchers:

a) Data gathering,
b) Data analyses,
c) Policy recommendations, and
d) Reporting results.

Step a) was performed by every participating country. The following analyses were carried out SpEA. The model and methods described above were used in order to analyse direct and indirect output, GVA, and employment for the domestic economies as well as for the EU as a whole. Reporting the results was a matter of the domestic experts together with SpEA and SIRC.

## 3.1 On Data Gathering

Data on exemplary sport infrastructure was found and provided in such a way that the following analyses can take place. Optimal requirements for data are:

1) Three sport infrastructures per Member State:
    a. One football stadium,
    b. One grassroots sport facility (country-specific),
    c. One elite sport facility (country-specific).

    The basic idea of the football stadium is to show similarities and differences of such comparable investments. As a hypothesis, one can assume that employment effects in Portugal are higher than in Austria due to the differences in wages. In order to make results even more comparable, the effect per million euros invested are reported as well as absolute results. Country-specific stories became visible for all participants.

2) Investment data have to be in terms of money usage. I.e., the it has to be clear how much money was spent on what. The minimal level of detail must include:
    a. Real estate ((shadow) rents or purchase price of land),
    b. Domestic construction costs,
    c. Domestic furnishings and equipment,
    d. Domestic architectural services,

e. Other domestic costs,
f. Imports,
g. Total costs,
h. Duration of constructing the facility.

Data on imports must include the country of origin (not necessary for purely domestic research) and the goods or services purchased abroad (i.e.: what was bought for how much and from where).

If possible, a more detailed structure of the investment costs in terms of CPA categories (see Table 1) is very reasonable.

It is important to only indicate direct investment costs. If one knows e.g. how much a construction company paid for fuel, this data must not be included in order to avoid double counting. An expert may use this information in the satellite account, but once this is set-up, direct costs are to be used exclusively.

**Table 1: List of CPA categories**

| | | |
|---|---|---|
| 1 | CPA_A01 | Products of agriculture, hunting and related services |
| 2 | CPA_A02 | Products of forestry, logging and related services |
| 3 | CPA_A03 | Fish and other fishing products; aquaculture products; support services to fishing |
| 4 | CPA_B | Mining and quarrying |
| 5 | CPA_C10-12 | Food, beverages and tobacco products |
| 6 | CPA_C13-15 | Textiles, wearing apparel, leather and related products |
| 7 | CPA_C16 | Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials |
| 8 | CPA_C17 | Paper and paper products |
| 9 | CPA_C18 | Printing and recording services |
| 10 | CPA_C19 | Coke and refined petroleum products |
| 11 | CPA_C20 | Chemicals and chemical products |
| 12 | CPA_C21 | Basic pharmaceutical products and pharmaceutical preparations |
| 13 | CPA_C22 | Rubber and plastic products |
| 14 | CPA_C23 | Other non-metallic mineral products |
| 15 | CPA_C24 | Basic metals |
| 16 | CPA_C25 | Fabricated metal products, except machinery and equipment |
| 17 | CPA_C26 | Computer, electronic and optical products |
| 18 | CPA_C27 | Electrical equipment |
| 19 | CPA_C28 | Machinery and equipment n.e.c. |
| 20 | CPA_C29 | Motor vehicles, trailers and semi-trailers |
| 21 | CPA_C30 | Other transport equipment |
| 22 | CPA_C31_32 | Furniture and other manufactured goods |

| | | |
|---|---|---|
| 23 | CPA_C33 | Repair and installation services of machinery and equipment |
| 24 | CPA_D | Electricity, gas, steam and air conditioning |
| 25 | CPA_E36 | Natural water; water treatment and supply services |
| 26 | CPA_E37-39 | Sewerage services; sewage sludge; waste collection, treatment and disposal services; materials recovery services; remediation services and other waste management services |
| 27 | CPA_F | Constructions and construction works |
| 28 | CPA_G45 | Wholesale and retail trade and repair services of motor vehicles and motorcycles |
| 29 | CPA_G46 | Wholesale trade services, except of motor vehicles and motorcycles |
| 30 | CPA_G47 | Retail trade services, except of motor vehicles and motorcycles |
| 31 | CPA_H49 | Land transport services and transport services via pipelines |
| 32 | CPA_H50 | Water transport services |
| 33 | CPA_H51 | Air transport services |
| 34 | CPA_H52 | Warehousing and support services for transportation |
| 35 | CPA_H53 | Postal and courier services |
| 36 | CPA_I | Accommodation and food services |
| 37 | CPA_J58 | Publishing services |
| 38 | CPA_J59_60 | Motion picture, video and television programme production services, sound recording and music publishing; programming and broadcasting services |
| 39 | CPA_J61 | Telecommunications services |
| 40 | CPA_J62_63 | Computer programming, consultancy and related services; Information services |
| 41 | CPA_K64 | Financial services, except insurance and pension funding |
| 42 | CPA_K65 | Insurance, reinsurance and pension funding services, except compulsory social security |
| 43 | CPA_K66 | Services auxiliary to financial services and insurance services |
| 44 | CPA_L68B | Real estate services excluding imputed rents |
| 45 | CPA_L68A | Imputed rents of owner-occupied dwellings |
| 46 | CPA_M69_70 | Legal and accounting services; services of head offices; management consultancy services |
| 47 | CPA_M71 | Architectural and engineering services; technical testing and analysis services |
| 48 | CPA_M72 | Scientific research and development services |
| 49 | CPA_M73 | Advertising and market research services |
| 50 | CPA_M74_75 | Other professional, scientific and technical services and veterinary services |
| 51 | CPA_N77 | Rental and leasing services |
| 52 | CPA_N78 | Employment services |
| 53 | CPA_N79 | Travel agency, tour operator and other reservation services and related services |
| 54 | CPA_N80-82 | Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services |
| 55 | CPA_O | Public administration and defence services; compulsory social security services |
| 56 | CPA_P | Education services |
| 57 | CPA_Q86 | Human health services |

| | | |
|---|---|---|
| 58 | CPA_Q87_88 | Residential care services; social work services without accommodation |
| 59 | CPA_R90-92 | Creative, arts, entertainment, library, archive, museum, other cultural services; gambling and betting services |
| 60 | CPA_R93 | Sporting services and amusement and recreation services |
| 61 | CPA_S94 | Services furnished by membership organisations |
| 62 | CPA_S95 | Repair services of computers and personal and household goods |
| 63 | CPA_S96 | Other personal services |
| 64 | CPA_T | Services of households as employers; undifferentiated goods and services produced by households for own use |
| 65 | CPA_U | Services provided by extraterritorial organisations and bodies |

*Source: SpEA according to Eurostat*

## 3.2 On Data Analyses

Once data is gathered and prepared, is fed into the MR-IOT:S as described in the section on theory. The results will be:

- Direct effects in the stimulated companies and sectors,
- Indirect effects in the supply network of the directly stimulated sectors.

Both dimensions will be calculated for

- GVA and
- Employment

For the

- domestic and
- EU-wide economy.

Thus, there will be 2 x 2 x 2 = 8 different dimensions to the result. This scheme applies to all three investments of a researching country. In order to provide a better overview, results may be aggregated. Indirect results which spread over the EU are less interesting to domestic decision makers, but are clearly important for the iSport project. Multipliers will show how well the effects distribute over the economies.

As described above, the virtual, the real normalised model were used to explain differences and similarities in participating countries. For domestic research, the real and the normalised model may be the most interesting ones, but this remains up to the experts.

## 3.3 On Policy Recommendations

Finally, all the knowledge gathered during the project was used to derive policy recommendations. The current situation of recommendations in the researched countries can be described as highly heterogeneous. Future researchers are encouraged to derive their own recommendations and compare them with the ones found here. Setting-up a network of researchers exchanging their recommendations, and adding/revisiting/adopting them seems like a good idea in order to make the situation more systematic.

## 3.4 On Reporting Results

These results are be the basis for a wider, text-based analysis using the experts' knowledge on their countries' sport. That is to include the all sport-related topics and serves to draw the "big picture of sport" in that country. In a similar vein like for the policy recommendations, a group of experts communicating on their results seems worthwhile.

# 4 Literature

Ahlert, G., Repenning, S., An der Heiden, I. (2019): „Die ökonomische Bedeutung des Sports in Deutschland – Sportsatellitenkonto (SSK) 2016“. GWS Themenreport 2019/1, Osnabrück

Bale, J. (2003): “Sports geography”, 2nd ed. New York: Routledge

CBS (2015): “Methodological manual for a sport satellite account”, Statistics Netherlands, HAN – Hogeschool van Arnhem en Nijmegen

Isard, W. (1953): “Regional commodity balances and interregional commodity flows”, American Economic Review, 43 (1).

Hoekman, R. (2018): “Sport policy, sport facilities and sport participation – A socio-ecological approach”, Dissertation

Leontiev, W. (1963): “Die multiregionale Input-Output-Analyse”, Arbeitsgemeinschaft für Forschung des Landes Nordrhein-Westfalen, Heft 123, Westdeutscher Verlag, Köln

Macintyre, S. (2007): “Deprivation amplification revisited; or, is it always true that poorer places have poorer access to resources for healthy diets and physical activity?”, International Journal of Behavioral Nutrition and Physical Activity, 4(32)

Miller, R.E., Blair, P.D. (2009): “Input-output analysis”, Cambridge University Press

Moses, L.N. (1955): “The stability of interregional trading patterns and input-output analysis”, The American Economic Review, Vol XLV, Dec. 1955, Number Five

SpEA, SIRC, HAN (2015): “Sport satellite accounts”, manual on behalf of the European Commission Directorate General Education and Culture. SpEA – SportsEconAustria, SIRC – Sheffield Hallam University Sport Industry Research Centre, HAN – Hogeschool van Arnhem en Nijmegen

Varian, H. (2010): “Intermediate Microeconomics”, W.W. Norton & Co

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