32nd Voorburg Group Meeting

New Delhi, India

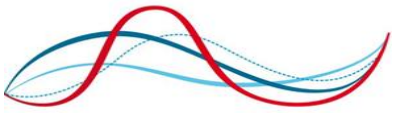
23 – 27 October, 2017

Mini-Presentation for SPPI on

Architectural and Engineering Activities and Related Technical Consultancy

(ISIC Rev. 4 code 7110)

Croatian Bureau of Statistics



Maja Dozet,

Josipa Kalčić Ivanić

Services Statistics Department

CONTENTS

1. INTRODUCTION

Development of the SPPI in Croatia for Architectural and engineering activities began in 2014 in the scope of one of the Eurostat projects. According to the requirements of the project, the development of methodology and the production of SPPI for M 71 is confined only to the group M 71.1. In accordance with this regulation, CBS focused the comparative study and analysis on the activity group M 71.1 Architectural and engineering activities and related technical consultancy, while the activity group 71.2 Technical testing and analysis was excluded from the observation. The first pilot survey was carried out for the third quarter of 2014 and SPPI surveying continued in 2015 as a regular quarterly survey. In April 2016, SPPI on M 71.1 was disseminated nationally for the first time.

The methodology of data collection is designed considering its characteristics of output, market and data availability, but respecting general methodological guidelines and the EU regulation on STS and common conceptual framework of SPPI production as designed within this project and by CBS.

2. DESCRIPTIONS AND CHARACTERISTICS OF THE INDUSTRY

2.1 DEFINITION OF THE INDUSTRY

Definition of service

Architectural and engineering activities and related technical consultancy include the provision of architectural services, engineering services, drafting services, building inspection services, surveying and mapping services.

Although activities related to architectural services and engineering services are classified into the same activity group 71.1, types of services they offer are quite different. Architectural services refer to the aesthetical and functional design of buildings, cities and landscapes, while engineering services deal with the technical design of buildings and other products and services, often involving technical consultancy. Engineering services are diverse, covering a wide range of various projects. Furthermore, some of these services are closely related to the construction sector. Substantial differences in the services provided also have considerable effects on the economic performance of these two activities (71.11 and 71.12), in particular on the pricing mechanism.

For the activity M 71.1, a decision was made that one survey will be carried for all enterprises from this group of activity, mainly because of the unclear boundary in classifying the units into the activities M 71.11 and M 71. 12 and related problems with the Business Register. Also,

architects mainly provide architectural services but sometimes companies employ engineers as well, especially in construction services.

Classification issues

For national purposes, the Croatian Bureau of Statistics uses the Statistical Classification of Economic Activities in the European Community NACE Rev.2.

The industry division M 71 Architectural and engineering services is classified according to NACE Rev. 2 classification as follows:

M 71 Architectural and engineering activities; technical testing and analysis

71.1 Architectural and engineering activities and related technical consultancy

71.11 Architectural activities

This class includes:

- architectural consulting activities: building design and drafting; town and city planning and landscape architecture

This class excludes:

- activities of computer consultants, see 62.02, 62.09

- interior decorating, see 74.10

71.12 Engineering activities and related technical consultancy

This class includes:

- engineering design (i.e. applying physical laws and principles of engineering in the design of machines, materials, instruments, structures, processes and systems) and consulting activities for: machinery, industrial processes and industrial plant; projects involving civil engineering, hydraulic engineering, traffic engineering; water management projects; projects elaboration and realisation relative to electrical and electronic engineering, mining engineering, chemical engineering, mechanical, industrial and systems engineering, safety engineering

- elaboration of projects using air conditioning, refrigeration, sanitary and pollution control engineering, acoustical engineering etc.

- geophysical, geologic and seismic surveying

- geodetic surveying activities: land and boundary surveying activities; hydrologic surveying activities; subsurface surveying activities; cartographic and spatial information activities

This class excludes:

- test drilling in connection with mining operations, see 09.10, 09.90

- development or publishing of associated software, see 58.29, 62.01

- activities of computer consultants, see 62.02, 62.09

71.2 Technical testing and analysis

2.2 MARKET CONDITIONS AND CONSTRAINTS

Importance of the industry

Activity M 71 is one of the seven subsectors (divisions) consisting sector M Professional, scientific and technical activities of the NACE Rev. 2 classification. In terms of turnover, the strongest division in sector M is M 71 (Architectural and engineering activities; technical testing and analysis), producing 37.8% of turnover but with 31.8% of employment. It is worth noting that the highest share of employment (33.7%) and enterprises (40.2%) were observed in the division M 69, but with only 28.2% of turnover. This indicates the above average labor productivity in M 71 and below average labor productivity in M 69.

Table 1: Distribution of turnover, enterprises and employees for sector M in Croatia, 2014

NACE Rev. 2 code	Activities	Turnover	Number of enterprises	Number of persons employed
		In %	In %	In %
M 69	Legal and accounting activities	**28.2**	**40.2**	**33.7**
M 70	Services of head offices; management consulting activities	**11.9**	**14.2**	**11.9**
M 71	**Architectural and engineering services; technical testing and analysis**	**37.8**	**24.5**	**31.8**
M 72	Scientific research and development services	**5.5**	**0.9**	**3.6**
M 73	Advertising and market research	**10.1**	**9.7**	**9.3**
M 74	Other professional, scientific and technical activities	**3.6**	**9.5**	**6.6**
M 75	Veterinary activities	**2.9**	**1.1**	**3.1**
Total	Sector M	**100.0**	**100.0**	**100.0**

Source: Structrural Business Statistics, 2014, Croatia

Table 2: Share of M 71 in non-financial services (sectors G, H, I, J, L, M, N and S division 95, NACE Rev. 2), 2014

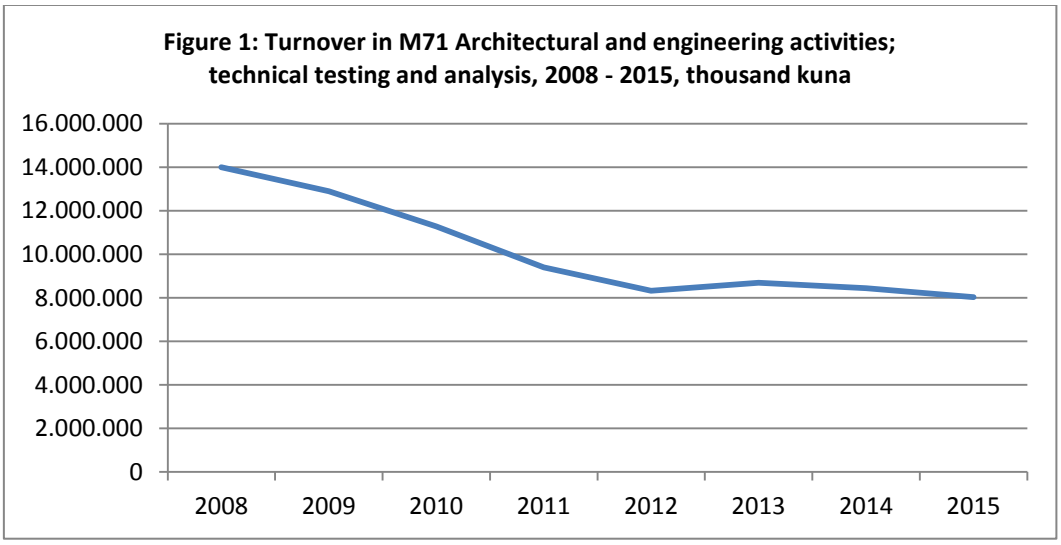
NACE Rev. 2	Number of businesses	Turnover	Number of persons employed
M71.1	7.6 %	5.5%	5.4%
M71.2	0.6%	1.5%	1.2%
M 71	8.2%	7.0%	6.6%

Source: Structrural Business Statistics, 2014, Croatia

Share of M 71 in nonfinancial services (sectors G, H, I, J, L, M, N and S division 95) in 2014 was 8.2%. Using the data on (gross) value added by sections (Statistical Yearbook 2016, p. 218) and the turnover data for section M by divisions for M 71, we estimate that division M 71 contributed about 2.3% to GDP in Croatia in 2014.

Market situation

Croatia became a member of the EU in July 2013, in the midst of the six-year long recession. Joining the single market and being able to absorb EU grant funds helped the recovery that started in 2015. During the recent crisis, the construction sector in Croatia was among the strongest affected economic activities, which also have an effect on architectural and engineering services sector. Under the crisis-drained construction sector, new challenges and opportunities needed to be adapted. These opportunities are primarily related to the work that comes from achieving the EU's development priorities and its investment plans as well as Croatian development orientations, with the possibility of financing investments from European cohesion and structural funds.



Source: SBS, 2008-2015, CBS

Architectural and engineering services in Croatia are regulated by the Act on Architectural and Engineering Services in Physical Planning and Construction (NN, Nos 152/08, 124/09, 49/11 and 25/13).
Based on the Statute of the Croatian Chamber of Architects and Civil Engineers, in 2013 this institution adopted new Official Scale of Fees for Services by Architects and Engineers. This Scale of Fees arranges architects' and civil engineers' fees for the services relating to the elaboration of area planning documents, project/design elaboration, technical consultancy and construction supervision services. These rates are a starting point and they provide the basis for each tender offer.

Concentration within the industry

In Table 3, the actual coverage of statistical units in terms of NACE Rev.2 classes is given for this activity.
Activity class M 71.12 is more important than M 71.11 as the majority of enterprises (83.6%) of M 71.1 are classified into class M 71.12. Similar pattern was present in 2014, with 84.4% of persons employed and 89.5% of turnover in class 71.12.

Table 3: Coverage of statistical units for M 71.1 by NACE Rev.2 classes of activities

NACE Rev.2	*Turnover*		*Enterprises*		*Persons employed*	
	(mil kuna)	*%*	*Number*	*%*	*Number*	*%*
M 71.11	724	10.5	903	16.4	2.838	15.6
M 71.12	6.153	89.5	4.616	83.6	15.353	84.4
M 71 .1	6.877	100,0	5.519	100,0	18.191	100.0

Source: Statistical Business Register, 2014, Croatia

In Table 4, the distribution of enterprizes by size according to the number of enterprises and their turnover for classes M 71.11 and M 71.12 in Croatia is presented for 2014.

Table 4: Distribution of enterprises and turnover by size of enterprises for M 71.11 and M 71.12

NACE Rev.2	*Persons employed*	*Enterprises*		*Turnover*
		Number	*%*	*%*
71.11	0-4	776	85.9	40.0
	5-9	101	11.2	21.7
	10-19	18	2.0	5.7
	20-49	8	0.9	32.6
	Total 71.11	**903**	**100.0**	**100.0**

71.12	0-4	3.307	71.6	24.1
	5-9	1.001	21.7	18.8
	10-19	201	4.3	18.3
	20-49	84	1.8	17.6
	50-99	17	0.4	6.2
	100-249	3	0.1	1.1
	250 and more	3	0.1	13.9
	Total 71.12	**4.616**	**100.0**	**100.0**

Source: Statistical Business Register, 2014, Croatia

Type of consumers of the services

The actual compilation of SPPI in Croatia relies on B2All concept. Architects and engineers provide services to households, businesses, government and for export. In pilot SPPI survey, the analysis of the type of users of the services was made and it could be assumed that the largest share of turnover is generated by services to businesses and the government. Relying on the suggestion of the Croatian Association of Engineering Services, a question on the share of export services in turnover is included into the questionnaire form. In the pilot survey, the total turnover of export services in 2014 accounted for 35% of total turnover in M71.1, which represents a significant share of this industry's output.

Horizontal/vertical integration, trends and product structure

The sector of architectural and engineering activities is characterized by a huge variety of different services offered in many sub-sectors. Many of those services are input to almost all industrial and construction sectors. In most cases, planning, design, construction operation and maintenance are classified into disciplines and executed in phases, in an adversary environment and with little interaction between phases and disciplines.
Vertical integration in the architectural and engineering industry exists when companies provide both architectural and engineering services, especially in large companies.
Architects are primarly engaged in the provision of design service. They may also undertake a number of secondary activities including project management, securing of building permits, as well as research and surveying of sites. Engineers are primarly engaged in the provision of design, analysis and consulting services for building and non-builing related projects. They may also undertake some architectural services as a secondary activity.

Other industries, having output of the primary products

Architectural and civil engineering services are closely connected with the construction sector and some engineering services are connected with industrial sector and therefore are confronted with some similar changes in environmental regulations or market conditions. Also, total construction cost is one of the price determing factors for architectural and many engineering services.

2.3 SPECIFIC CHARACTERISTICS OF THE INDUSTRY

When big and complex projects need to be implemented, large engineering or architectural companies sometimes engage sub-contractors, when they don't have a sufficient number of their own qualified experts. Sub-contractors are often small engineering or architectural companies.
Certified architects and certified engineers may perform their services in their own certified sole-practice office, a joint-practice office and/or within a legal person registered for carrying out professional tasks. Certified architects and/or certified engineers may perform their services together in a joint-practice office or within a legal person.
In Croatia, architectural services are provided mostly by rather small companies with a few employees. In activity 71.12 there are some large companies providing engineering services, but small companies dominate.

3. MEASUREMENT OF THE SPPI

3.1 GENERAL FRAMEWORK

Objectives of key users

From 2016, SPPIs for M71.1 are regularly sent to Eurostat. In the same year, SPPI results were nationally disseminated for the first time and data are now regularly published in quarterly dynamics. The results of that survey are effectively used in the national accounts as deflators. It must be pointed out that SPPI for M71.1 together with other industries will also be used in the compilation of the ISP (index of services production). Some reporting units also occasionally use the SPPI for M71.1 for the purpose of escalating their contracts.

Concept of National Accounts, measurement issues

The concept and the methodology used are consistent with the European System of National and Regional Accounts (ESA 2010). The classification of business entities by activities is in line with the NKD 2007, which is directly comparable to the NACE Rev. 2 classification. The product classification, which was used for the calculation of GVA in current and constant prices by activities, is harmonised with the National Nomenclature of Industrial Products and Services, which is comparable to the PRODCOM classification. The GDP estimates include all activities within the ESA 2010 production boundary and cover the total territory of the Republic of Croatia. The estimates are prepared on an accrual basis. The calculation of the GVA at current prices is based on data from regular surveys of the Croatian Bureau of Statistics, the Croatian National Bank, the Croatian Financial Services Supervisory Agency, the Croatian Regulatory Authority for Network Industries and the Croatian Institute for Pension Insurance (CBS, 2017, GDP, Notes on methodology). Deflators used in the quarterly GDP calculation for architectural, engineering and related technical consultancy services is a combination of the input indicator method (wages rate, number of employees) and SPPI.

3.2 MEASUREMENT ISSUES

Product structure in industry

The framework for the selection of services by reporting units is a classification scheme of services groups. This classification is closely related to CPA and only some inevitable modifications were introduced due to market and output characteristics in Croatia. The relation between the classification of service groups and CPA is given in Table 5 below.

The purpose of the classification scheme by service groups is twofold:

- first, the table designed on the basis of this scheme is used for collecting data on the structure of turnover of the surveyed activity by service groups
- second, this classification together with the information on turnover reported by service groups is a starting point for the specification of services for which representative priceswill have to be collected.

Table 5 Relation between service groups in SPPI M 71.1 questionnaire and CPA classification

Service groups in SPPI M 71.1 questionnaire	CPA classification code
Plans and drawings for architectural purposes	71.11.10
Architectural services for residental building projects	71.11.21
Architectural services for non-residential building projects	71.11.22
Historical restoration architectural services	71.11.23
Architectural advisory services and professional supervision	71.11.24
Urban and land planning services	71.11.31
	71.11.32
Project site master planning services	71.11.33
Landscape architectural services and landscape architectural advisory services	71.11.41
	71.11.42
Engineering advisory services	71.12.11
Engineering professional supervision services	71.12.11
Engineering services for building projects	71.12.12
Engineering services for power projects	71.12.13
Engineering services for transportation projects	71.12.14
Engineering services for waste management projects (hazardous and non-hazardous)	71.12.15
Engineering services for water, sewerage and drainage projects	71.12.16
Engineering services for industrial and manufacturing projects	71.12.17
Engineering services for telecommunications and broadcasting projects	71.12.18
Engineering services for other projects	71.12.19
Project management services for construction projects	71.12.20
Geological, geophysical and related prospecting and consulting services	71.12.3

The comparison of definitions of service groups in the SPPI questionnaire to the CPA classification shows similar relation. Nevertheless, compared to CPA for M 71.1, the naming of SPPI service groups in Croatian is slightly modified, following the recommendations of

professional associations of architects and engineers in Croatia regarding the use of terminology of this profession in daily practice.

Figure 2 below shows that in terms of turnover, the strongest groups of services in the SPPI survey of M71.1 in 2015 were Engineering professional supervision services with 17.07% of turnover share; Geological, geophysical and related prospecting services with 15.54% of turnover share; Engineering services for transportation projects with 10.44% of turnover share and Engineering services for building projects with 10.32% of turnover share. Engineering professional supervision services have the biggest turnover share because many engineers supervise a wide range of services. Many civil engineers supervise the construction of roads, buildings, airports, tunnels, dams, bridges, water supply and sewage systems. Marine engineers supervise the construction of everything from sailboats to tankers. Geological, geophysical and related prospecting services also have a significant turnover share. It is due to the fact that a geodetic project encompasses all geodetic services that are necessary for the construction of objects and their registration in the cadastre and land registry. Also, in the past, illegally built buildings in Croatia were removed only occasionally. However, this changed in June 2013, when the deadline for the submission of legalisation requests expired. As Croatian government is determined to bring discipline into construction, to improve Croatia's landscape, and to ensure discipline in paying communal and related fees, after 30 June 2013, all buildings without adequate permits should be removed. The initial step in legalization is to define whether the object can be legalised in accordance with existing law, and if the conditions are met, the preparation of technical documentation follows (architectural shots, geodesic study, evidence of mechanical resistance). This process is still relavant in Croatia.

Figure 2: SPPI survey, share of M71.1 turnover by group of services, %, 2015

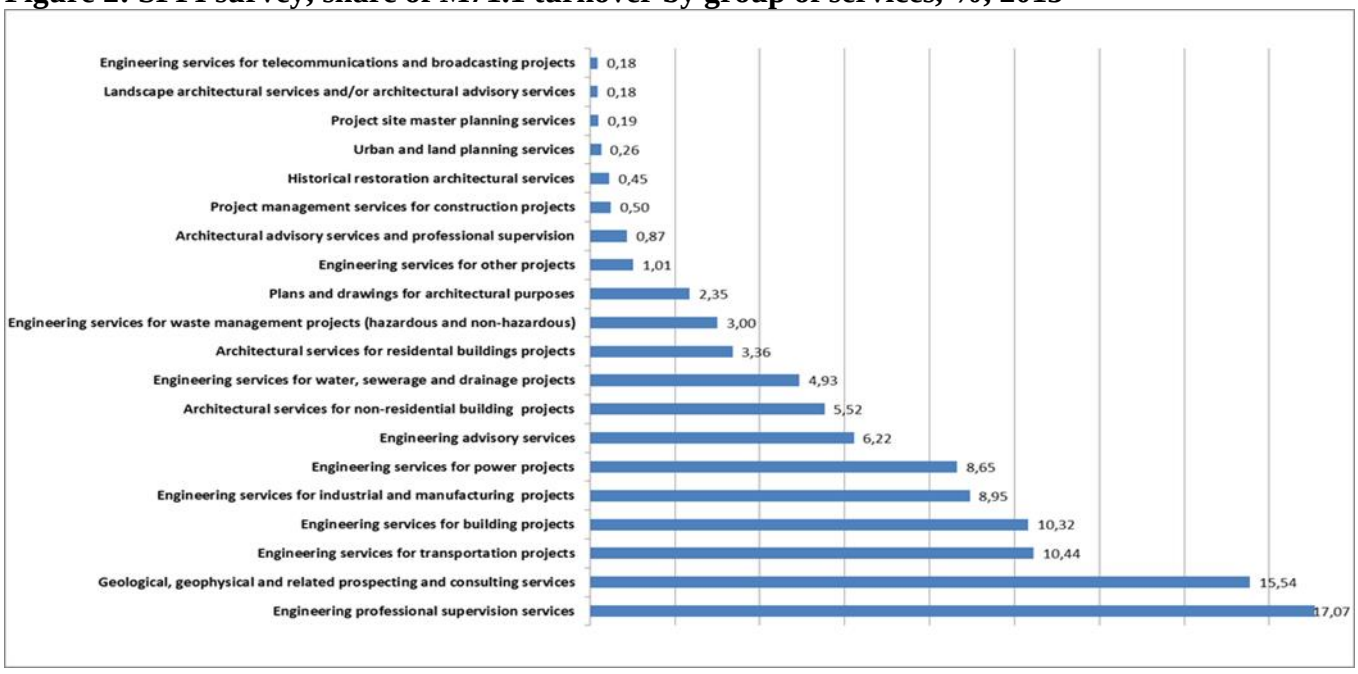


Figure 3 below shows similar pattern as turnover share. In terms of number of services in the SPPI survey of M71.1 in 2015, the strongest groups of services were Enginering professional supervision services with 50 services, Geological, geophysical and related prospecting services with 39 services, Engineering services for transportation projects with 24 services and Architectural and engineering services for building projects with 23 services each.

Figure 3: SPPI survey, number of services by group of services, 2015

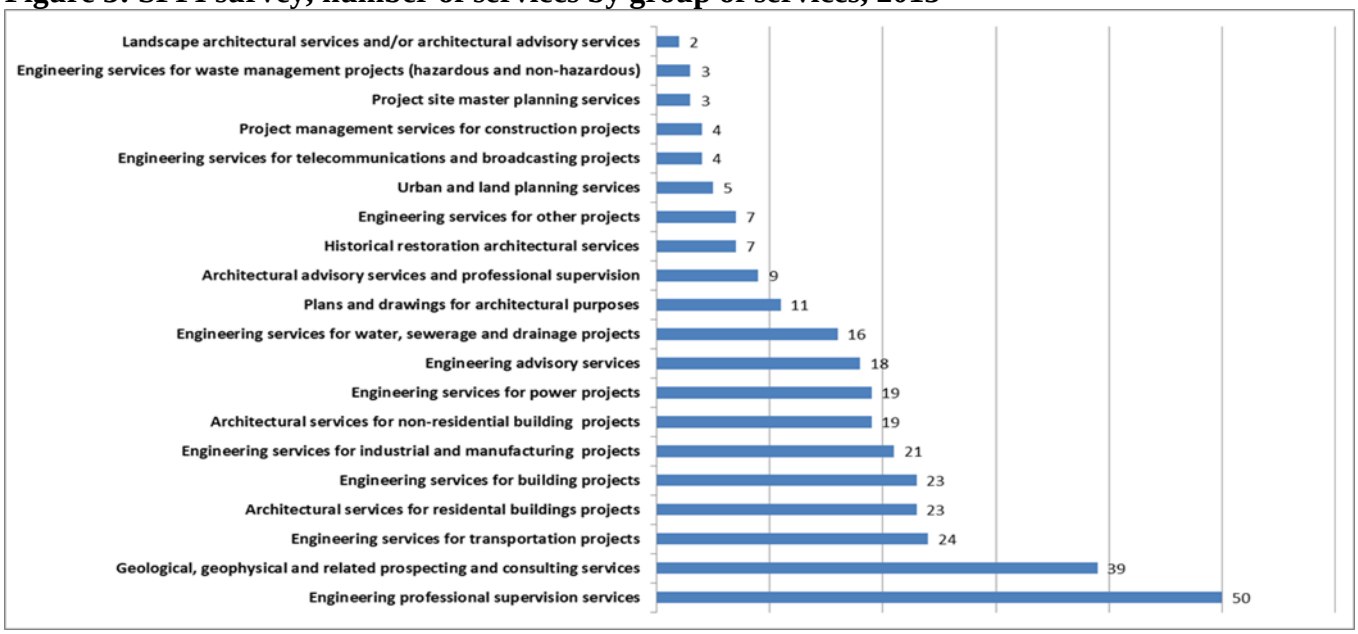
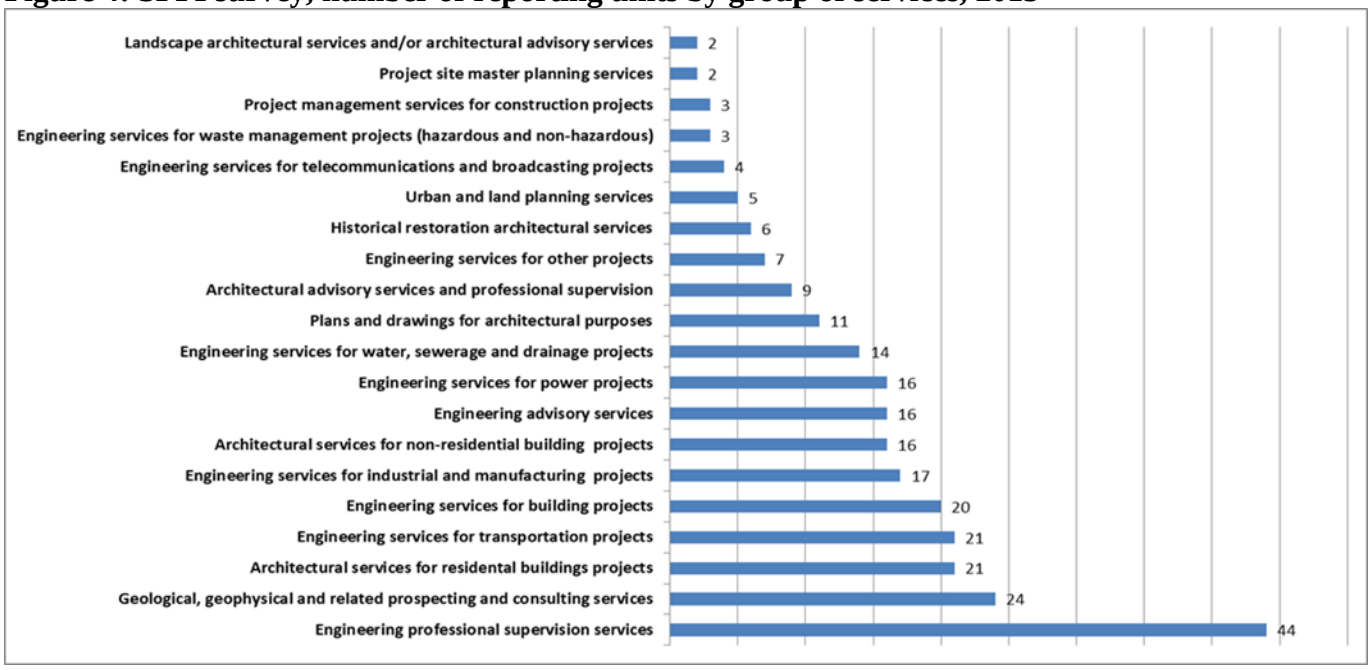


Figure 4: SPPI survey, number of reporting units by group of services, 2015



Type of SPPI, sampling unit – Industry/Product

Methodology used for the compilation of SPPI in Croatia is based on the product approach.
Product based indices are created from service groups selected by sampled reporting units. In the questionnaire form, reporting units have to provide information on the prices of representative services for each of the service group, for which they reported data on the turnover share. Price movements for those services are then aggregated to form service groups. The price index for the activity as a whole is calculated by using price indices of service groups.

Other data sources

The SPPI surveys in Croatia are conducted mostly through web-based questionnaires.
The turnover and price data used in the compilation of the SPPI for M71.1 are collected using a quarterly survey as it is, for now, the best solution because of difficulty in capturing changes in productivity in this industry and also because of a lack of other data sources.

Sampling design

The sample design for units selected for the survey for M 71.1 took into account market and other relevant characteristics of the studied activity.
Due to the dominance of small enterprises in M 71.1, sample design is conceived as combination of probability sampling (for small enterprises) with census (for medium-sized and large enterprises). The sample construction and sample selection are described below.

Sample frame construction
The sample frame consists of all units from the Statistical Business Register satisfying the following criteria:

- That their main activity is Architectural and engineering activities and related technical consultancy (NACE Code 71.1).
- They have at least two employees.
- Their turnover is not 0.

The above stated threshold criteria provided that only a small part of the population was excluded from the frame and consequently from the sampling procedure.

Sample selection

- Random sample selection was based on usual design in case of business surveys, which is the stratified one-stage sampling. Strata were determined according to the NACE activity (4-digit NACE code) and size classes. Two size classes were defined for stratification purposes: large units (size class 1) and small units (size class 2). An important feature of the selected sample design is the fact that all large units are sampled with certainty. The class of large units was selected by taking units that satisfy at least one of the following criteria: more than 20 employees and more than 50 mln kuna of turnover.

Table 6: Share of large units selected in the sample for M71.1

Nace code	Size class	Number of units	Employees	Turnover
71.11	1	1.7%	11.9%	38.5%
71.12	1	4.7%	33.5%	44.7%

Among small units, the random sample was selected using the procedure with the following key characteristics:

- Proportional allocation was taken as the basic approach
- In a certain stratum, 10 units were included in the sample if the proportional allocation provides less than 10 units
- Systematic PPS sampling was used. Number of employees was used for implicit stratification. Turnover was used as a size variable in PPS approach.

Table 7: Units selected in the sample by strata for activity M 71.1 for SPPI survey, 2014

NACE group	Activities	Size class	Frame	Sample	Share
71.11	Architectural activities	1	7	7	100.0%
71.11	Architectural activities	2	411	15	3.6%
71.12	Engineering activities	1	97	97	100.0%
71.12	Engineering activities	2	1976	70	3.5%
	Total			**189**	

Sampling weights

Selection of units into SPPI survey using probability sample demanded appropriate amendment of SPPI index compilation in terms of defining the weights. Initial weights based on turnover data of the surveyed activity are modified by grossing up factors, which take into account PPS, response rate and overcoverage.
This procedure is also implemented in IT application for automatic generation of modificators and modified weights.

Stratification
All procedures for the calculation of weights are carried out according to strata, which are subgroups of a sample . In the case of SPPI for activity 71.1, stratification is given by two size classes (1 – large units; 2 – small units) and two activity groups, which means four strata:

Table 8: Strata for M 71.1

Size class	Activity group
1	7111
1	7112
2	7111
2	7112

Input data
Data available before the data collection

- At the level of microdata
  - Sampling weight w_s
  - Size class
  - Activity group
  - Turnover (from register): TURN
- At the level of aggregates
  - Sum of turnovers from the frame for each stratum (turnover of non -selected units from the frame is also included).

Table 9: Turnover frame according to strata for M 71.1

Size class	Activity group	TURN_FR
1	7111	233 689
1	7112	2 533 542
2	7111	319 192
2	7112	2 768 661

Data available after the data collection

- At the level of microdata
  - Status of the reporting unit (response, refusal, non-contacted, ….)

Procedure for the calculation of grossing up weights
Procedure for the calculation of weights is carried out through the following steps:
First step: correction for non-response

- Each observed unit is classified into one of the following response groups (RG) according to its status: Responses (RG = 1), Non-responses (RG = 2) and Out of scope (RG = 3)
- For each stratum, defined by the combination of activity group and size classes, the following numbers are calculated:

- Number of responses (RG = 1) N_{RG1}
- Number of non-responses (RG = 2) N_{RG2}
- Number of out-of-scope units (RG = 3) N_{RG3}

- Non-response factor is calculated for each stratum h: $NR_h = \frac{N_{RG1}+N_{RG2}+N_{RG3}}{N_{RG1}+N_{RG3}}$.
- Non-response factor is assigned to each of the units in group responses. The first weight is calculated for each unit with RG = 1: $w_1 = w_{si} \cdot NR$

Second step: calibration

- The calibration weight is calculated through the following steps:
  - For each stratum, weighted sum of turnover of all units is calculated. Sampling weight is taken as the weighting variable: $TURN_{tot} = \sum w_{si} \cdot TURN_i$
  - For each stratum, weighted sum of turnovers of out-of-scope units is calculated. Sampling weight is taken as the weighting variable: $TURN_{RG3} = \sum_{RG=3} w_{si} \cdot TURN_i$
  - For each stratum, weighted sum of turnovers of responding units (RG = 1) is calculated. Weight w_1, calculated in the previous step, is taken as the weighting variable: $TURN_{RG1} = \sum_{RG=1} w_1 \cdot TURN_i$
  - Taking into account the sum of turnovers from the frame, provided in the input data, the calibration factor is calculated as follows: $CLB = TURN_{FR*} \cdot (1 - TURN_{RG3}/TURN_{tot})/TURN_{RG1}$
- In each stratum, the grossing-up weight is calculated for each responding unit (RG = 1) as $w_g = w_1 \cdot CLB$.

Final stage

The grossing-up weights are multiplied in the final stage for each responding unit by SPPI weights at the level of group of services in enterprise (wg_h) . SPPI weights (wg_h) are updated annually; data on turnover share according to the group of services, are collected for a previous year by using the survey carried out during the first quarter each year.

3.3 DESCRIPTION OF PRICING METHODS AND CRITERIA FOR CHOOSING THE METHOD

Definition of services being priced

Architectural services

- The tasks of the architectural profession in performing design tasks are:

- developing architectural designs for buildings, water supply and sewage disposal installations in buildings;

- developing landscape planning designs for all construction works as well as landscape architecture designs;
- developing architectural designs of the current state of buildings and landscape architecture facilities;
- determining the fulfilment of the basic requirements for a construction work for buildings and landscape architecture facilities
- developing parts of removal design for all construction works within the framework of the tasks for which the architectural profession is authorised to design;
- developing architectural designs of the current state of buildings and landscape architecture facilities.

Engineering services

- The tasks of the civil engineering profession in performing design and design auditing tasks are:

- developing construction designs for all construction works, water supply and sewage disposal installation designs;
- determining the fulfilment of the basic requirements for a construction work for all construction works;
- developing parts of removal design for all construction works;
- developing civil engineering designs of the current state of all construction works;
- audit of the main design and removal design for all construction works with regard to mechanical resistance and stability.

- Geodetic services encompass the acquisition of specific geolocated data about buildings, facilities, sites and topography, the elaboration of drawings and maps, the drawing-site transition process, and the geo-technical surveillance during construction performance.
- The tasks of the mechanical engineering profession in performing design tasks is:

- developing mechanical engineering designs for mechanical installations, equipment and facilities in all construction works, including the supporting systems, auxiliary devices, installations and the accompanying parts of load-bearing mechanical structures of mechanical equipment, and developing the water supply and sewage disposal system design;
- developing parts of removal design for all construction works within the framework of the tasks for which the mechanical engineering profession is authorised to design
- developing mechanical engineering designs of the current state for all construction works.

- Electrical engineering services comprise projects from all spheres of electrical engineering, e.g. the electric-power supply, electric power drives, controlling, regulation, automatics, lighting, grounding and other. Every domain usually requires a separate project. Only for minor and simpler constructions the projects are grouped to a single, unified project study.
- Professional construction supervision, i.e. the purpose of technical investor consultancy services is to enable the building realization concept, which is defined by the building permit before and during the construction performance and by a construction performance in compliance with the regulations in effect. The organization of technical consultancy and supervision services and the number of appointed experts, responsible for the supervision and technical consultancy service performance (supervision engineers), depend on the type of building (work), its

complexity and volume. If required, specialized experts or institutions can, occassionally, be engaged in resolving certain issues.

Price determining characteristics of the service

A main aspect of architectural services is their uniqueness. Engineering services may encompass a wide variety of services. While in engineering services for building projects there is a wide range of unique projects, engineering services related to power, transportation, waste management, water, sewerage, industrial and telecommunication projects often include relatively homogeneous types of services and they are considered to be fairly tangible areas for measuring prices.

Prices for services relating to the architectural services and civil engineering are influenced by many factors, such as:

- level of qualifications of the staff (licensed architect or engineer, draftsman, etc.)
- customer type (private households, private enterprises and public institutions)
- hours worked
- type of building
- size of facility
- duration of the contract
- construction costs
- value of building
- the degree of complexity of the building, structure or installation (I for the simplest, II for simple, III for average, IV for above-average and V for very high complexity)
- Official Scale of Fees for Services by Architects and Engineers

The Assembly of the Croatian Chamber of Architects and Civil Engineers brought in 2013 the new Official Scale of Fees for Services by Architects and Engineers. This Scale of Fees arranges the architects' and civil engineers' fees for services related to the area of planning documents elaboration, projects/design elaboration, technical consultancy and construction supervision services. Minimum and maximum rates allowed for intermediate points of calculation units (CU) stated in the tables presenting fees must be established by the default formula according to the type of service. These rates are a starting point and they provide the basis for each tender offer.

Architects and engineers use a fee strategy to calculate their prices for the provision of services for construction projects. Fees for services are established by reference to the chargeable construction cost of the building, the building complexity degree and the table of service fee percentages. Prices are also often based on hours worked.

In professional construction supervision, where a supplier is contracted to supervise the execution of a project in respect of design details, a special fee may be agreed for this service in writing. The fee can be contracted freely as a time-based fee.

The mechanical installations design performance profile encompasses services referring to new plants, reconstruction and maintenance. Prices for services relating to mechanical installations design are established by reference to the chargeable plant installation type costs, the plant complexity degree and to the table of service fee percentages.
Prices for services relating to geodetic surveying for design and construction purposes are established by reference to the chargeable construction costs, the survey complexity degree and to the table of service fee percentages. Prices for other geodetic/technical services are freely negotiable. Unless a price is agreed in writing at the time of contract award, it must be charged on a time basis.

Price methods chosen

There is a number of approaches that reporting units can apply to determine the prices for services.
For architectural and engineering services for building projects in Croatia, the most often methods used are Percentage fee and Time-based methods.
Percentage fee is a pre-defined percentage fee for the service, which is calculated as a percentage of the value of investment. When using this method, reporting units are asked to estimate the price of the final service output by multiplying the percentage and the value of investment.

Example:

Service group	Pricing method	Identification number; description of services and of major elements that determine the price	Price per unit of measure, in kuna, excluding VAT		Reason for change or absence of price
			Previous quarter	Current quarter	
Architectural services for residential building projects	Percentage fee	Contract No. 123, architectural design of a family house, gross building area of 500 m^2, degree III of complexity, for private client A, 2% of investment value	45 546.00 kn	45 320.00 kn	Change in costs affected the price

Time-based methods are used in all groups of architectural and engineering services. For some groups
of services, the Time-based method is the only possible method, for example in Professional construction supervision or Engineering consultancy services.
In Croatia, the Time-based method considers three different types:

- Hourly charge-out rate – actual average price per unit of time: the price is obtained as a result of dividing the turnover coming, during the reporting period, from services of persons of

given qualifications and experience, by the number of units of time worked by these persons during the same period. This method represents the simplest case, where transaction prices are available by labour categories.

- Hourly list rates - average price list per unit of time**:** price per unit of time based on internally pre-defined staff category. Modifications of prices are necessary for time -based services when prices are "list prices". For current periods, i.e. for every quarter of a given year y, if the code of the pricing method indicates that the "price" provided by the company corresponds to the price list, a corrected price is calculated. The data used are time invoiced, $\mathbf{TI^q}$, and worked, $\mathbf{TW^q}$**,** as reported in the quarterly survey:

  Price = List Price x (TI^q/ TW^q)

- Wage rates – if charge-out rates are not directly available, respondents are asked to provide data on wages per unit of time by staff category. Modifications of wages are necessary and the data used are the following: time invoiced, $\mathbf{TI^q}$, time worked, $\mathbf{TW^q}$ and margin rate $\mathbf{r^q}$ obtained from the quarterly survey.

  Price = Wage data x (TI^q/ TW^q) x (1/100) x (100 +r^q)

When services are relatively homogeneus, another method used is a Direct use of prices of repeated services.

Direct use of prices of repeated services is the price of repeated delivery of the same service or a very similar service provided to clients at least once per quarter. This method is often used in engineering services for power, transportation, waste management, water, sewerage, industrial and telecommunication projects and in geodetic services, but only when services are not complex and when they are relatively homogeneous. This method is conducted mostly by rather small companies. In complex projects, time-based methods are mostly used.

Index estimation procedure

The SPPI survey is conducted through a web-based questionnaire. IT application covers all phases of the SPPIs production: it has the functionality of data collection through web-based questionnaires, plausability checks, data editing and calculation of the index.
The base period in SPPI is the last quarter of a previous year. Enterprise turnover of the previous year of the surveyed activity is a basis for compilation of weights and it is annually updated.
A SPPI number is a specific measure of average price movement of a certain group of products (services). Index calculation of SPPI is performed through the following steps:

- In the first step, compilation of ratio (individual price index for a service of a service group for enterprise) is done.

$$Ip_{sge}^{qy/4y-1} = \frac{\mathrm{p}^{qy}}{\mathrm{p}^{4y-1}}$$

- The next step is a calculation of a simple (unweighted) price index for services within the same service group at a company level. The Jevon's formula is used here.

$$Ip_{ge} = \sqrt[n]{Ip_{sge1}} Ip_{sge2} \ldots\ldots Ip_{sgen}$$

I = 1, 2, …, sgen; number of services s within service group g in enterprise e

- Then the calculation of price index for service groups is performed, using price indices of service groups by companies (as elementary aggregates) and weighting them by share of turnover of that group in a company's turnover for that activity. Arithmetic weighted average is used as a compilation formula, which approximates the Laspeyre's index.

$$Ip_g^{qy/4y-1} = \frac{\sum_{e=1}^{E} Ip_{ge}^{qy/4y-1} W_{ge}}{\sum_{e=1}^{E} W_{ge}}$$

- Finally, the last step is to calculate the price index for the activity as a whole, using price indices of service groups and corresponding weights calculated as a sum of turnover for group of services by companies.

$$Ip^{qy/4y-1} = \frac{\sum_{g=1}^{G} Ip_g^{qy/4y-1} W_g}{\sum_{g=1}^{G} W_g}$$

Symbols used:
s = 1, 2, ..., nge (number of services for group g in enterprise e)
e = 1, 2, ... , E (number of enterprises producing service within group g)
g = 1, 2, ... , G (number of group of services g in activity SPPI)
qy = quarter q of year y
q-1y= previous quarter of year y
q4y-1= 4th quarter of previous year (base period)
Wge = weight at period y-1 for group g in selected price reporting unit e
Wg = weight at period y-1 for group g
psge = price of product s of group g in selected price of reporting unit e.

It is worth noting that weights are changed yearly. Thus, SPPI series are calculated using the chain-linking approach. Such an approach reduces bias inherent to Laspeyre's formula and also facilitates yearly updates of samples of reporting units and services.

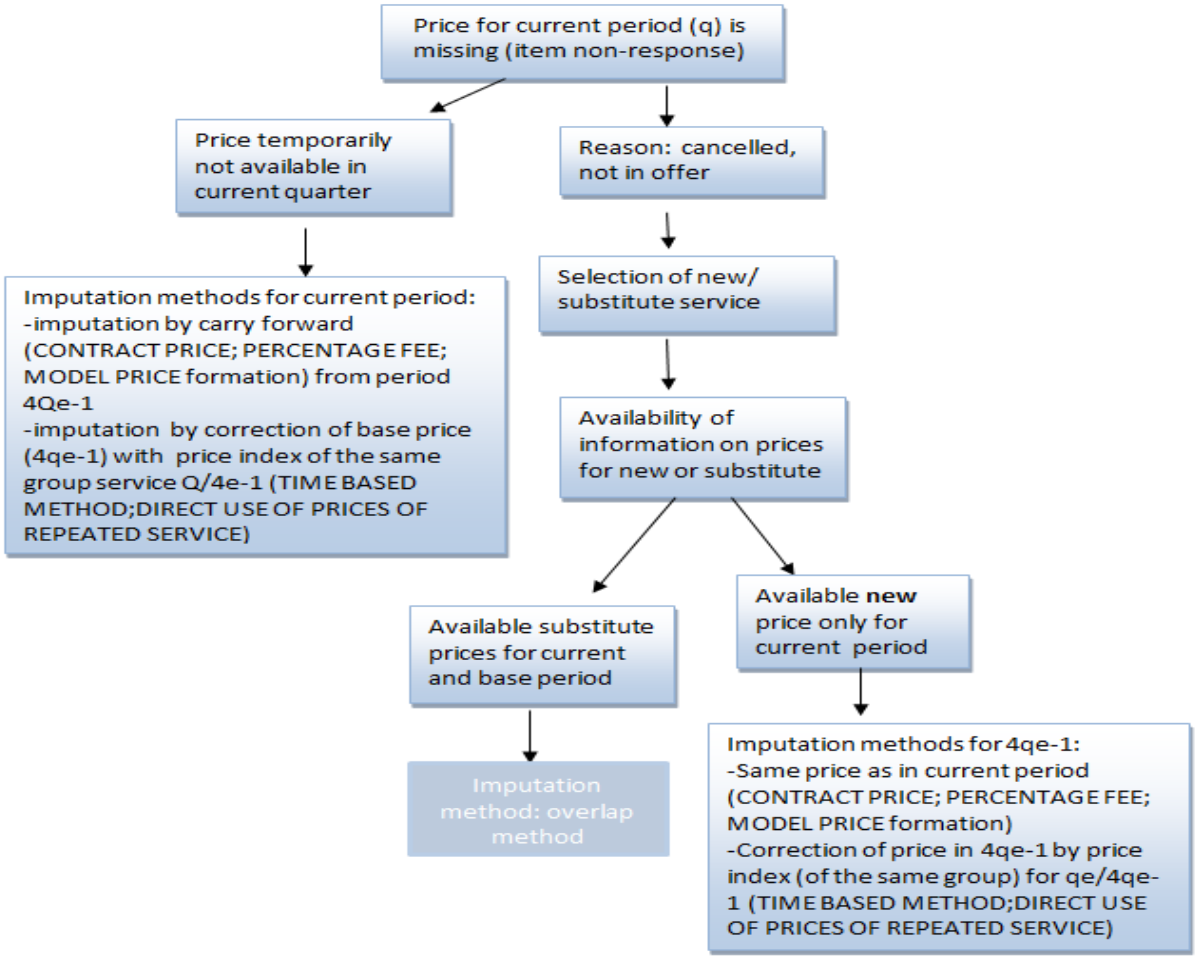
Estimation of missing prices

In a situation when the reporting unit, which was active in the first quarter and correctly completed the report, is not in the position to report the current price of a service later. Such a situation occurs when:

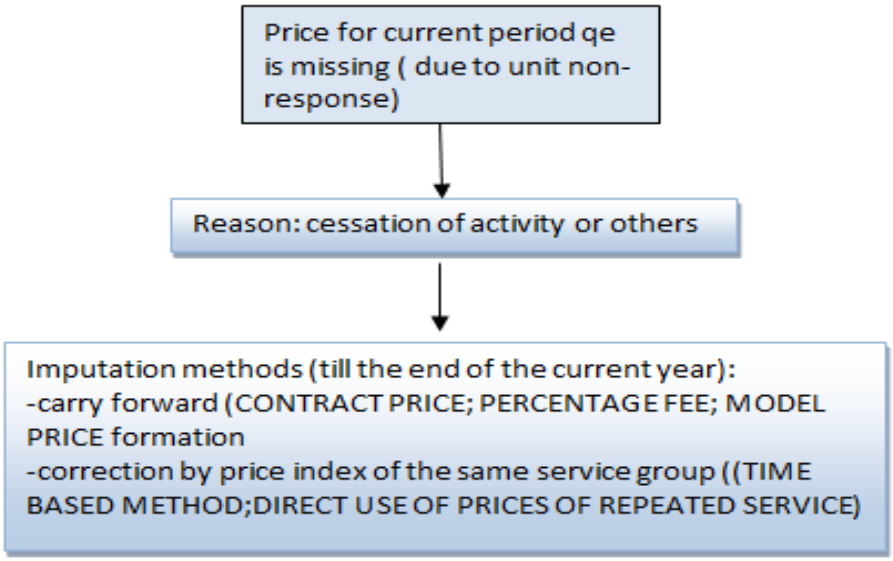
- Price for current period is missing due to temporary or final (ultimate) exclusion of the service from production (item non-response)
- Reporting unit did not complete the survey because it ceased the activity or stopped to cooperate; (unit non-response); in this case, CBS does not receive the questionnaire.

In graphs 1 and 2, instructions are given for imputation procedures for these two situations. In SPPI processing system, imputations for missing prices are implemented automatically.

Graph 1: Price for current period is missing (item non-response)



Graph 2: Price for current period is missing (unit non-response)



Quality adjustment methods

Assurance of price comparability over quarters in the sense that a price ratio reflects a genuine change of price (without any other impact such as quality change) is one of the key methodological challenge of data collection phase. Services in this industry are often complex, with many components included and there is a wide range of unique projects. This is helped by several rules implemented on the web-based questionnaire form: when a reporting unit reports a representative service, this service has to be specified by service code, by detailed factors that are relevant for its price formation and by pricing method used for reporting the price. Also, the reporting unit has to provide information on price in current and previous periods, on unit of measure referring to the reported price and on reason of price changes or reasons for data missing.
Web applications for SPPI surveys have several types of automatic data check at micro level (individual web questionnaire (WQ):
- Errors: At data entry, essential errors are identified, which forces the reporting unit (RU) or administrator to eliminate them; if not, the WQ cannot be successfully completed.
- Warnings**:** in the process of filling in WQ, RU is informed on deviations from methodological guideline and on inconsistencies, but these failures are tolerated and WQ can be completed and submitted anyway.
- Logical and numerical control (LNC): LNC of selected variables after complete data entry.
- Control at questionnaire level **(**search WQ**)**
- Administrator's individual investigation of WQ with selected characteristics.

Frequency of collection

Prices are collected quarterly and they are used as an estimate of the average price throughout the period. SPPI data are transmitted to Eurostat 80 days after the end of the reference quarter and disseminated nationally 90 days after the end of the reference quarter.

3.4 EVALUATION OF COMPARABILITY OF PRICE DATA WITH OUTPUT DATA

Services Department in CBS is currently producing a number of STS indicators for the services sector as required by the STS Regulation 1165/98 and its amendments. In order to achieve coverage of service activities in STS, which reflects the increased importance of services and which must meet users' needs in a better way, lot of changes have been proposed by the new "STS package" as a part of FRIBS (Framework Regulation Integrating Business Statistics), such as:

- Production of new variable, the Index of Service Production (ISP), on monthly basis
- Obligatory monthly data collection on turnover and index calculation even for small countries, instead of quarterly periodicity used so far.

Since 2017, the CBS has supplemented the quarterly dynamics of conducting turnover survey with a monthly dynamics of turnover changes in service activities. The data are based on the Monthly Report on Trade and Other Services and administrative data sources (data bases of value added tax reports). The short-term indicator „turnover from activities of other services" encompasses sections from G to N. Architectural and engineering activities, together with Technical testing and analysis, are collected and disseminated nationally on monthly basis at the two-digit level.
For calculation of ISP, when the deflation of the monthly turnover in service activities is in question, the fact is that most of the service price indices are available only at the quarterly level and if we use them for deflation purposes there is a need to disaggregate them into three monthly indices. In CBS, two methods will be used for disaggregation, depending on the data availability. For a certain activity group, as well as for architectural and engineering services for which the quarterly deflator is on disposal, sufficiently correlated auxiliary index, applying the model-based approach in using this auxiliary information, will be used. Otherwise, linear interpolation method will be used.

4.EVALUATION OF MEASUREMENT

Classification of service groups for M 71.1 is defined for Croatia respecting not only comparability with CPA but also taking into account other countries' experiences and, above all, studying the specifics of that industry in Croatia. With this regard, most critical points of architectural and engineering services were discussed with representatives of professional associations and different types of enterprises.
Methodology used for compilation of SPPI is based on the product approach. Product-based indices are created from service groups selected by sampled reporting units. Advantages of product approach instead company approach are the following: price indices by group of services are available (important for imputation and data quality control) and this approach is conceptually in line with national accounts. A disadvantages of this approach is that more data from reporting units are needed, which leads to a high burden on reporting units. Due to dominance of small enterprises, more data are sometimes a difficult task.
Weights are changing annually and data on turnover are collected every first quarter each year for the previous year. The advantages of annual change is that new services are introduced easily and a list of reporting units is constantly updated, which is in line with Eurostat requirements and PPI methodology at CBS. The disadvantage of annual change is higher burden on reporting units, but, on the other hand, these SPPI data are also used by the Structural Business Statistics Department for the SBS compilation data.
Architects and engineers use a fee strategy to calculate their prices for the provision of services for construction projects. Fees for services are established by reference to the chargeable construction cost of the construction, the construction complexity degree and to the table of service fee percentages. Prices are also often based on hours worked.
For architectural and engineering services for building projects in Croatia, the most often pricing methods used are Percentage fee and Time-based methods due to complexity of services and a wide range of unique projects. Also, companies found that these two methods are the easiest for reporting their prices. In case when services are not complex and when they are relatively homogeneous, a Direct use of prices of repeated services is often used. This method is conducted

mostly by rather small companies, as they often provide the same or very similar services to clients every quarter.

The price data used in the compilation of the SPPI for M71.1 are collected using a quarterly survey since it is, for the time being, the best solution, having in mind the difficulties that have to be faced in capturing changes in productivity in this industry and a lack of other data sources.

Various challenges and problems appear in conducting SPPI for M71.1, but the majority of them are manageable for now. Despite all the burden on reporting units and shortcomings, the overall response rate for this survey is rather high – it amounts up to 80% on average.

References

"Act on Physical Planning and Building Tasks and Activities". http://www.mgipu.hr/doc/Propisi/Act_on_tasks_activities.pdf (Acessed August 12, 2017)

Croatian Bureau of Statistics, 2017. "Gross Domestic Product – Notes on Methodology" http://www.dzs.hr/default_e.htm , Statistics in Line

Lea Bregar, 2015, "Methodological Notes on SPPI Production – Architectural and Engineering Services", internal report.

Direktno.hr, 2016." HGK analizirao građevinski sektor EU i Hrvatske - od recesije do oporavka", Zvonimir Savić http://direktno.hr/domovina/hgk-analizirao-gradevinski-sektor-eu-i-hrvatske-od-recesije-do-oporavka-38821/ (Accessed July 20, 2017)

Sanda Colić, Lea Bregar, 2016. "Croatian Experience in Developing SPPIs"

Official Gazette No. 47/98, "Assembly of the Croatian Chamber of Architects and Civil Engineers"

Official Gazette No. 85, 1999. "Official Scale of Fees for Services by Architects and Engineers"

Eurostat/OECD, 2015. " Methodological Guide for Developing Producer Price Indices for Services". http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-04-14-661

NACE Rev. 2, 2008." Statistical Classification of Economic Activities in the European Community". http://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF