Report to the European Commission, DG Regional and Urban Policy

ECOSYSTEMS and FUNCTIONING EDP for S3 2021-207 in CYPRUS

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Introduction: DG Regio assignment

This report presents the outcome of the DG Regio assignment on "Ecosystems and Functioning Entrepreneurial Discovery Process (EDP) for S3 2021-2027 in Cyprus". We describe and discuss the findings of a survey realised between November 2019 and March 2020 and the derived policy recommendations on how to achieve "functioning EDP" for smart specialisation strategies 2021-2027.

The objective of the DG Regio assignment is to advice the European Commission on business and/or innovation ecosystems and their role to RIS3 Entrepreneurial Discovery Processes (EDP). Following the inception report agreed in the DG Regio meeting on 26/9/2019, the following tasks are included in the Section A of the assignment.

Task A1 - Identification of ecosystems: It will focus on the mapping of the Greek and Cypriot innovation ecosystems and the pre-selection of 10 ecosystems per region, which will be further elaborated and investigated throughout the assignment. More specifically, Task A1 will focus on the identification of existing and emerging business ecosystems at regional level. The initial detection of regional ecosystems will be achieved through the use of (1) employment data, and (2) the calculation of the location quotients (LQ) for each region. Hence, a mapping of the regional agglomerations will be outlined, which will lead to the identification of the ten (10) most important 3-digit NACE ecosystems. Moreover, a set of 4 interviews per region with companies and/or stakeholders will follow, targeting on collecting additional information regarding the identification of value chains or platforms corresponding to the 10 identified ecosystems. As a final activity of this task, we will determine the three (3) most important business ecosystems within each region, followed by the outline of corresponding value chains or common platform (in case of platform-based ecosystems).

Task A2 - Profiling of ecosystems: It will focus on further analysing the selected ecosystems of each region (Greece and Cyprus) by elaborating their profile and assessing relevant existing bottlenecks for innovation diffusion within the region. This will be achieved through the use of secondary data. Most important companies participating in each ecosystem will be identified alongside with their demographic characteristics using data coming from official sources (ICAP database). Emphasis will be given on the identification of potential areas of ecosystem diversification, in order to better understand emerging trends and future areas of development.

Task A3 - Research and innovation intensity of ecosystems: It will focus to a further exploration of the R&D and innovation intensity within the three most important ecosystems for each region that have been identified in Task A1. The main secondary sources of data that will be used include:

- EPANEK (GR), Competitiveness and Sustainable Development (CY) which provide essential information for ecosystem companies having received or still receiving funding from IP1b. This will provide information regarding the main areas of R&D financing that the selected ecosystems received from ESPA.
- ICAP which provides information regarding the internal R&D spending for each company. It will be essential for the analysis to identify companies that have a growing trend for R&D spending and identify their main areas of interest.
- CORDIS which provides information referring to H2020 projects. Through CORDIS information, we will better understand the positioning of the ecosystem companies regarding their participation in EU projects and their collaboration status with other international companies.
- Available information from CIS and the National documentation Centre (Metrics) and data on Universities and Research Institutes that might be parts of ecosystems (patents, publications, citations per research/technological area)

All above-mentioned sources of information are essential for better understanding the latent R&D potential within the selected regional ecosystems, in terms of emerging technologies and areas of interest that are significant for those ecosystems, and thus, could be potential areas for future investments.

Task A4 - Recommendations: Presentation of the findings in a meeting with DG Regio recommendations on R&I policy and RIS3 focusing on business ecosystems at a regional level for Greece

and Cyprus, and procedures to improve (a) prioritisation of activities and (b) research and innovation actions in prioritised activities in the next round of RIS3.

The survey we present in this report was developed in two stages. At stage 1 we address the ***prioritisation problem*** (defining areas in the economy and society that have the greatest potential for future development) and the feasibility of an EDP approach without excluding major industrial activities. This means that we don't define priority activities by a theoretical approach excluding some activities, but we assess all major activities considering that all have potential of future diversification and growth. We assess the feasibility of this non-excluding methodology. At stage 2 we address the ***discovery problem***, assessing fields for policy and action at the level of business ecosystems which may be beneficial for all members of an ecosystem.

At each stage, we worked with secondary data from Cyprus of the last four years (2016-2020) as well as primary data from interviews. ***There are some limitations*** in going deeper into the above two problems of EDP prioritisation and EDP discovery in Cyprus due to availability of secondary data:

- Data per NACE industry groups are provided for manufacturing and services only (155 categories). In some categories data is aggregated for two or more groups. For some important industry groups, such as gas manufacturing and trade and water transport, data is missing.
- We cannot calculate Location Quotients for Cyprus to be used as specialisation indexes, because statistics in Cyprus are provided at national level without any break down to smaller regional entities.
- Most important, we did not find any sectoral study for the most important industry groups and should be further studied by field survey of major industry groups.

The above limitations, and mainly the lack of published sectoral studies, reduce the analytical capacity in the sections A2 and A3, as we cannot report growth and innovation challenges per industry group and outline potential platforms for ecosystem building.

We should underline that our work is not to perform EDP, which is a collaborative engagement of stakeholders rather than an expert advice exercise. Our objective is to pave the way and define the terms for a functioning EDP in Cyprus in the programming period 2021-2027.

Problem definition: The challenge of functioning EDP

This assignment of DG Regio is placed in the framework of enabling conditions of good governance of national and regional smart specialisation strategies 2021-2027, defined by the Policy Objective 1 for 'Smarter Europe' through innovation, digitisation, economic transformation and support to small and medium-sized businesses. The good governance is assessed by seven (7) fulfilment criteria:

1. Analysis of challenges including bottlenecks for innovation diffusion
2. Existence of competent regional / national institution or body, responsible for the management of the smart specialisation strategy
3. Monitoring and evaluation tools to measure performance towards the objectives of the strategy
4. Functioning of stakeholder co-operation ("entrepreneurial discovery process")
5. Actions necessary to improve national or regional research and innovation systems, where relevant
6. Where relevant, Actions to manage support industrial transition
7. Measures for internationalisation

The present assignment ***focuses on the criterion 4***, a "functioning of stakeholder co-operation in entrepreneurial discovery process". Functioning EDP is working EDP. EDP doing what it's supposed to do, namely addressing two challenges (1) the prioritisation challenge and (2) the discovery challenge. EDP must ***identify and prioritize*** innovative business activities in a variety of technological areas and sectors, that have the potential for diversification and transformation towards higher added value activities. Moreover, EDP must ***outline policy actions*** and public support measures for the benefit of entire industry sectors or ecosystems than the benefit of specific organisations and enterprises. Both are critical for a successful smart specialisation strategy.

Under Europe's 2020 strategy for smart, sustainable and inclusive growth, the research and innovation strategies for smart specialisation (RIS3) were introduced as a precondition for receiving financial support from European Structural and Investment Funds (ESIF). The preparation for these strategies started in 2011 and in May 2012 the *Guide of RIS3* was published by Foray, Goddard, Beldarrain, Landabaso, McCann, Morgan, Nauwelaers, and Ortega-Argilés, as a "methodological guidance for policy-makers and implementing bodies on how to prepare for and how to design, draft and implement a national/regional research and innovation strategy for smart specialisation (RIS3)" (Foray et al., 2012).

The basic principle of smart specialisation is that European regions should aim to explore and exploit key capabilities for global niche markets, with the intention of creating long term competitive advantages (Foray, 2014; Reid and Maroulis, 2017; Komninos et al., 2018). Thus, the overall objective of RIS3 is to create innovative, but place specific and evidence-based capabilities, which take advantage of available resources and competences within a process of diversification and transformation. In particular, diversification and industrial transformational strategies should foster cross-sectoral links and/or cross-border cooperation (Gianelle et al., 2014; Landabaso, 2014). These capabilities have to be identified and revealed through an Entrepreneurial Discovery Process.

Thus, the Entrepreneurial Discovery Process (EDP) ***is the cornerstone of smart specialisation*** (Kyriakou et al., 2016) a feature that distinguishes the S3 from innovation strategies of the past (Rodriguez-Pose and Wilkie, 2017). During the EDP, different entrepreneurial actors are brought together in ***a government-led participatory process*** generating a collective debate, integrating the divided and dispersed knowledge belonging to different actors, and setting common priorities for S3 interventions.

Guidance on Entrepreneurial Discovery Process (EDP) is provided by the RIS3 Guide (Foray et al., 2012) and other official documents on aims, contribution to prioritisation, and methods of implementation.

- EDP "aims to build a systematic understanding of the areas in the economy and society that have the greatest potential for future development" (p.20) & "mobilise talent by matching RTD + I capacities and business needs through an entrepreneurial discovery process" (p.17).
- "Smart Specialisation should address the difficult problem of prioritisation and resource allocation based on the involvement of all stakeholders in a process of entrepreneurial discovery, which should secure a regionally and business-driven, inclusive and open prioritisation process" (p.52).
- "There are different methodologies for organising such processes, e.g. surveys, seminars with participatory leadership methods, crowdsourcing, etc. Such an open, participatory process, together with reliance on robust evidence based on regional assets, are the best guarantees to avoid both the risk of capture by interest groups and the risk of lock-in into traditional activities" (p.52). "An effective appreciation of dynamic EDP can only be performed if entrepreneurial actors and management and governance bodies responsible of RIS3 engage in direct discussion" (p.20).

Despite the guidance provided, serious gaps and open questions still remain in the theory and methodology for EDP.

The specifications of S3 make clear that the objective is diversification and industrial transformation toward higher added value activities. Diversification may be ***intra-industry***, when research and innovation change and improve products and processes of an industry or ***inter-industry***, when innovation leads to branching of an industry towards other sectors. Inter-industry diversification may be "***related***" to existing skills and know-how or "***unrelated***" towards new skills and know-how. Empirical evidence suggests that knowledge spillovers within a region, or smaller country, occur primarily among related sectors, and only to a limited extent among unrelated sectors. It is the related variety in a region that feeds branching out new activities from technologically related activities, not regional diversity nor regional specialisation per se (Boschma and Frenken 2011, p.67). The meaning of this finding is that related variety can guide the selection of priority activities for inter-industry related diversification. Unfortunately, ***we don't dispose any theoretical guidance about the diversification of industries in the other three trajectories,*** either in the case of intra-industry change or inter-industry unrelated change.

This theory gap is accompanied by a methodology gap regarding the EDP granularity. Granularity allows defining the level of detail in modelling industries or decision-making processes. The greater the granulation, the deeper the level of detail and the better understanding of future trends.

Statistical data on industrial activities are given at four levels of granularity, classifying industries in 21 Sections, 88 Divisions, 272 Groups, 615 Classes as below (see, NACE rev 2).

Section	Division	Group	Class	Description of the class
C	25	25.9	25.91	Manufacture of steel drums and similar containers
	28	28.1	28.11	Manufacture of engines and turbines, except aircraft, vehicle ar
		28.2	28.24	Manufacture of power-driven hand tools
		28.9	28.93	Manufacture of machinery for food, beverages and tobacco pr
			28.95	Manufacture of machinery for paper and paperboard productio
G	46	46.1	46.14	Agents involved in the sale of machinery, industrial equipment
		46.6	46.61	Wholesale of agricultural machinery, equipment and supplies
M	71	71.1	71.12	Engineering activities and related technical consultancy

Figure 1: NACE industry classification in sections, divisions, groups, classes

We don't dispose any methodological guidance about the best granularity level to perform EDP. For instance, is it better to perform EDP at the level of industry sections, industry divisions, industry groups, or industry classes? The JRC application *Eye@RIS3: Innovation Priorities in Europe* which depicts S3 priorities across Europe shows that most member-states and regions have selected priorities (thus performed EDP) at the level of industry section or division. This is rather a low granularity EDP, which obstructs a clear understanding of industrial diversification, because sections and divisions include a mix of industrial activities with very different features and future trajectories.

In RIS3Cy 2014-2020, EDP in Cyprus has been conducted with the technical assistance of an independent study group, operating under the supervision of DG EPCD. The EDP included consultation at all levels of analysis with questionnaires, focus groups, interviews and workshops and with the participation of about 850 enterprises, 50 experts and one focus group in each sector of interest (S3Cy, 2015, p.202).

Many methods were used to identify priority areas for specialisation through EDP (Antoniou, 2014):
Desk research

- Critical review of the literature
- Case studies
- National and international reports on the economy and RTDI sectors
- Evaluation of RTDI programmes
- Evaluation of participation in international programmes
- Statistical data for Cyprus & EU
- Sectoral analyses

Field research

- Quantitative data: questionnaires to enterprises
- Qualitative data: interviews with opinion leaders and focus groups

Public consultation

- Government bodies, universities, enterprises, wider public
- Government board
- Open workshops
- Special thematic workshops
- Publicity

The EDP combined the principles of 'regional basis' and 'relevance'. The regional basis relates to the existence of productive activities that are in harmony with socio-economic conditions and are based on a trained local workforce. Relevance is the diversification of businesses into related sectors, based on evolving innovative techniques or methods (S3CY, 2015, p.42).

There is no doubt the analytical methods used in EDP are adequate and justify the industries selected. However, following the RIS3 implementation there are second thoughts regarding the EDP capacity to reveal detailed investment opportunities and emerging business clusters, which point out the need for more advanced business intelligence by competent consulting organisations.

Also, the granularity used to define priority industry sectors is rather low and priority activities should be defined at higher granularity and interconnectedness (this is stated as intention for 2021-2027) (See the report GOOD GOVERNANCE OF RIS3 CYPRUS, 2021-2027, pp 16-18).

Having the above in mind, we address the problem of ***functioning EDP in Cyprus for period 2021-2027*****,** which includes: (1) the *prioritisation* and selection of activities for specialisation – diversification, and (2) the *discovery* of policy mix or design of policy actions, assuring consistency to priorities and wide impact to beneficiaries.

- Prioritisation refers to identification of priority areas or activities that will be selected as focus of S3 in which most public funding will be channelled.
- Discovery refers to policy design and action plan of the S3 strategy. A key question is how EDP can best drive public funds to maximise a sustainable growth potential? Here an important concern is the policy mix derived from EDP, which must be public policy avoiding lock-in in private or specific interests. Bringing a significant amount of investment in a few actions has the risk to direct public funds to industries with only a few beneficiaries, which contradicts the principles of cohesion policy and inclusive growth.

Our survey on the ***prioritisation challenge*** is presented in the section A1 of this report. We adopt a methodology based on data than theory. We start from the statement that all industries of a country or region have potential for diversification and growth. Our intention is to test the feasibility of this approach. Instead of selecting a few industries and perform EDP in them, we examine the ***most important industries*** per region, in terms of size and investments. We test the feasibility of performing EDP at the level of NACE industry groups

(272 groups) for all important industry groups of Cyprus. Our aim is to assess whether the effort for this detailed EDP without initial exclusion of any important industry group is functional. ***Priority activities for S3 2021-2027 should be selected after the conclusion of EDP in all important industries***.

A complementary survey that deals with the ***discovery*** challenge is presented in sections A2 and A3**.** Having included all important industry groups in the EDP process, our intention is to assess whether EDP can address common challenges and drive the industrial transformation, assuring the public and inclusive character of EDP-derived policy measures and actions. We use the concept of ***platform*** and ***platform-ecosystem*** (fig. 1) to identify actions for the benefit of an entire industry group or ecosystem than the benefit of some companies and organisations. Supporting platform-based ecosystems we assure that EDP shapes policies for public goods that bring companies and organisations under the same challenges and objectives for collaboration and growth.

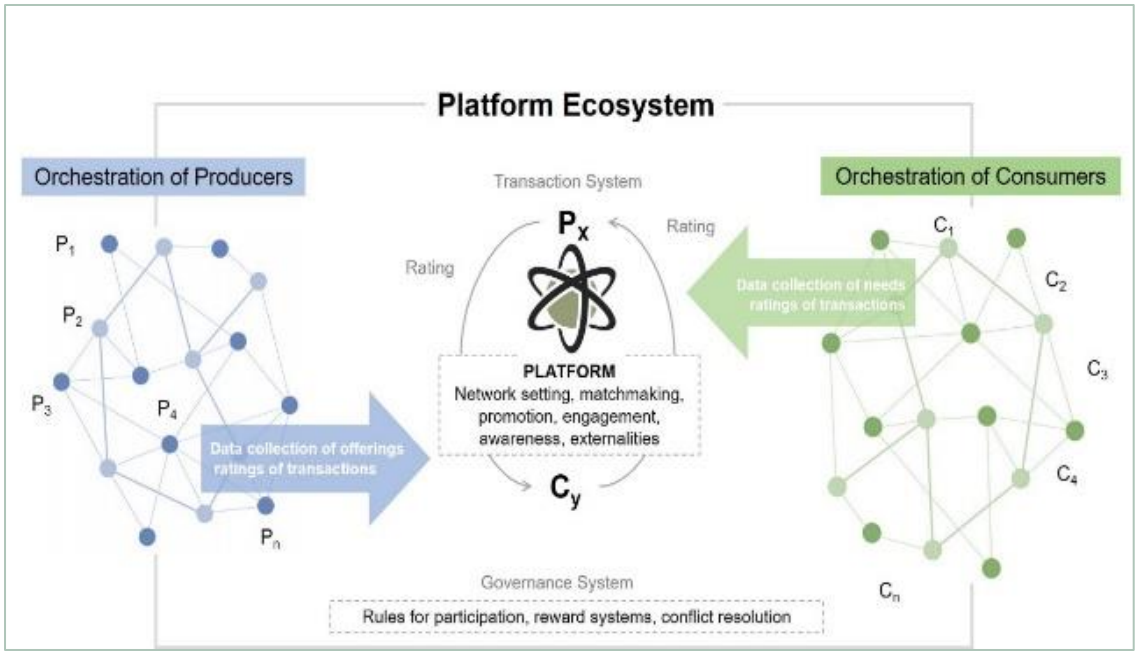

Figure 1: Platform-ecosystems and two-side orchestration

A1. Identification of most important industry groups and business ecosystems in Cyprus

Our aim at this stage of work is to assess whether it is functional to ***perform EDP without excluding any important industry*** in advance, even if theoretical knowledge allows for focusing the EDP investigation in some specific industries. Two reasons justify this orientation of work: (a) the widely accepted S3 principle for place-specific innovation strategy or "one-size-does-not-fit-all", which suggests that the most robust theoretical prediction should be assessed with place-specific data (Tödtling and Trippl, 2005), and (b) the probability of finding innovative solutions in less expected activities, a trend outlined by many aspects of innovation theory, such as the probabilistic and non-deterministic character of innovation, serendipity in innovation, and innovation outcomes by chaotic systemic combinations (Chenga and Van de Ven, 1996; Poutanen et al., 2016). We assess the feasibility of EDP without exclusion at NACE industry group level in four steps (a) starting with the distribution of industrial activity in Cyprus at NACE group level, (b) defining the most important industry groups, (c) defining the top-10 industry groups in Cyprus, (d) and defining emerging industry groups also.

1 Distribution of NACE industry groups

NACE rev 2 classifies industrial activities at 4 levels: in 21 Sections, 88 Divisions, 272 Groups, and 615 Classes. In Cyprus, detailed data are available at the level of Sections, Divisions, Groups and Classes. The industry group level is the level of high granularity and manageable number of categories.

Data on the regional distribution of NACE industry groups in Cyprus is provided by CYSTAT. The latest dataset is for 2017 for manufacturing, 2016 for services and 2019 for energy. These datasets are available at the addresses and the form below:

- ΕΡΕΥΝΑ ΒΙΟΜΗΧΑΝΙΑΣ - ΑΝΑΛΥΤΙΚΑ ΑΠΟΤΕΛΕΣΜΑΤΑ ΚΑΤΑ ΟΙΚΟΝΟΜΙΚΗ ΔΡΑΣΤΗΡΙΟΤΗΤΑ, 2017
  https://www.mof.gov.cy/mof/cystat/statistics.nsf/industry_construction_61main_gr/industry_construction_61main_gr?OpenForm&sub=1&sel=2

- ΕΡΕΥΝΑ ΥΠΗΡΕΣΙΩΝ ΚΑΙ ΜΕΤΑΦΟΡΩΝ – ΑΝΑΛΥΤΙΚΑ ΑΠΟΤΕΛΕΣΜΑΤΑ ΚΑΤΑ ΟΙΚΟΝΟΜΙΚΗ ΔΡΑΣΤΗΡΙΟΤΗΤΑ, 2016
  https://www.mof.gov.cy/mof/cystat/statistics.nsf/services_74main_gr/services_74main_gr?OpenForm&sub=4&sel=2

ΠΙΝΑΚΑΣ 1. ΑΡΙΘΜΟΣ ΕΠΙΧΕΙΡΗΣΕΩΝ, ΑΠΑΣΧΟΛΗΣΗ, ΑΞΙΑ ΠΑΡΑΓΩΓΗΣ, ΠΡΟΣΤΙΘΕΜΕΝΗ ΑΞΙΑ ΚΑΙ ΚΕΦΑΛΑΙΟΥΧΙΚΕΣ ΕΠΕΝΔΥΣΕΙΣ ΚΑΤΑ ΒΙΟΜΗΧΑΝΙΚΗ ΔΡΑΣΤΗΡΙΟΤΗΤΑ, 2017

TABLE 1. NUMBER OF ENTERPRISES, PERSONS ENGAGED, PRODUCTION VALUE, VALUE ADDED AND EXPENDITURE ON FIXED ASSETS BY INDUSTRIAL ACTIVITY, 2017

Κώδικας NACE Αναθ. 2 Code NACE Rev. 2	Αριθμός Επιχειρήσεων Number of Enterprises	Απασχόληση Persons Engaged	Αξία Παραγωγής Production Value (€000's)	Προστιθέμενη Αξία Value Added (€000's)	Κεφαλαιουχικές Επενδύσεις Expenditure on Fixed Assets (€000's)
10.13	35	438	45.219	13.374	2.107
10.2+10.4	**36**	**177**	**33.035**	**5.620**	**249**
10.20+10.41	36	177	33.035	5.620	249
10.3	**40**	**754**	**104.030**	**32.078**	**2.514**

Table 1: CYSTAT industry groups in Cyprus

Five variables are given per NACE group from which we retain (1) the number of enterprises, (2) the employment in persons engaged, (3) the production value, and (4) the expenditure on fixed assets, which reflect the dimensions of size and investments. This dataset is our **basic data matrix. It** comprises **155 NACE industry groups** in manufacturing and services.

2. Ordering industry groups by index

For each one of the above four indexes, we select the most important industry groups by ordering the industry groups from larger to smaller. Four **ordered lists of industry groups are produced** by number of companies, number of employees, production value, and expenditure on fixed assets. These lists sort industry groups per size and investments. We did not use the value-added index, considering that the other two variables (number of companies and number of employment) represent better the size of industry groups.

We fine-tune these ordered lists of industry groups by removing industry groups having low potential for business ecosystems development, such as groups with (a) limited entrepreneurial activity, (b) public companies in utilities, such as electricity and water supply, (c) public services, such as public administration, defence, libraries and museum, etc., and (d) services in which self-employment dominate, such as legal and accounting, veterinary, and

other. Those industry groups that fall in such categories are given in the Table 3 at NACE section / division level.

NACE Section/ Division	Name	NACE groups no business activity
E37	Sewerage	1
H53	Postal and courier activities	2
I56	Food and beverage service activities	3
J58	Publishing activities	2
M69	Legal and accounting activities	2
M71	Architectural and engineering activities; technical testing, analysis	2
M73	Advertising and market research	2
m74	Other professional, scientific and technical activities	4
M75	Veterinary activities	1
N77	Rental and leasing activities	4
N78	Employment activities	3
N80	Security and investigation activities	2
N81	Services to buildings and landscape activities	3
N82	Office administrative, support and other business support activities	4
O85	Education (except higher education – 85.4)	5
Q86	Human health activities (except hospital activities – 86.1)	2
Q87	Residential care activities	4
Q88	Social work activities without accommodation	2
R91	Libraries, archives, museums and other cultural activities	1
R92	Gambling and betting activities	1
S94	Activities of membership organisations	3
S95	Repair of computers and personal and household goods	2
S96	Other service activities	1
T97	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	1
		57

Table 3: Industry groups with low or null entrepreneurial activity

The fine tuning of industry groups shortens the full list **NACE industry groups from 153 to 96,** capturing mainly areas of manufacturing and services having business activity than self-employment or administration services. In fact, the number of industry groups that is not given attention is much lower, because usually industry groups with limited business activity are not at the ten top positions in the ordered lists of industry groups by size.

The ordering and fine-tuning industry groups by size and investment indexes produces a list of **top-40 groups,** in total 40 industry groups for Cyprus. These industry groups are presented in **Table 4,** ordered from larger to smaller.

Number of companies-Top 10			Number of employees-Top 10			Production value-Top 10			Fix capital investments-Top 10		
70.2	Management consultancy activitie	1622	55.1	Hotels and similar accommodatio	18517	52.2	Support activities for transportatic	2223953	55.1	Hotels and similar accommodatio	180191
49.3	Other passenger land transport	1179	52.2	Support activities for transportatic	9927	62.0	Computer programming, consulta	1270220	61.3	Satellite telecommunications activ	79999
86.9	Other human health activities	1125	10.7	Manufacture of bakery and farinac	6031	55.1	Hotels and similar accommodatio	1039771	62.0	Computer programming, consulta	58045
16.2	Manufacture of products of wood,	841	70.2	Management consultancy activitie	4281	70.2	Management consultancy activitie	417945	52.2	Support activities for transportatic	48051
25.1	Manufacture of structural metal p	829	62.0	Computer programming, consulta	3196	10.5	Manufacture of dairy products	366109	61.9	Other telecommunications activiti	44928
62.0	Computer programming, consulta	827	49.3	Other passenger land transport	3114	61.1	Wired telecommunications activiti	336025	21.1+21.2	Manufacture of basic pharmaceuti	21346
49.4	Freight transport by road and rem	798	25.1	Manufacture of structural metal p	2585	10.7	Manufacture of bakery and farinac	292379	10.7	Manufacture of bakery and farinac	17563
52.2	Support activities for transportatic	721	86.1	Hospital activities	2545	10.1	Processing and preserving of meat	280489	23.5+23.9	Manufacture of cement, lime and	15242
93.1	Sports activities	622	85.4	Higher education	2.225	21.1+21.2	Manufacture of basic pharmaceuti	226582	33.1	Repair of fabricated metal produc	13632
90.0	Creative, arts and entertainment a	522	10.5	Manufacture of dairy products	2172	61.9	Other telecommunications activiti	208459	60.2	Television programming and broa	12663

Table 4: Top-40 industry groups in Cyprus (10 per index)

3. Top-10 industry groups in Cyprus

The Table 4 includes four ordered lists and shows the top-10 industry groups by (1) number of companies, (2) employment, (3) production value, and (4) fix capital investments. However, this is not a combined ordering, but four independent ordered lists of industry groups. A combined ordering identifies top industry groups that figure at the top of all ordered lists by size and investment. For a combined identification of top industry groups in all indexes, we select one after the other:

- Industry groups at the top-10 positions in all four lists;
- Industry groups at the top-10 positions in three out of four lists;
- Industry groups at the top-10 positions in one list related to size and one list related to fix capital and investments;
- If the above selection gives less than 10 industry groups, we fill the rest positions by industry groups that figure either in the two lists of size or the two lists related to fix capital.

The Table 5 below shows this logic for identifying top-10 industry groups in Cyprus. We start with the selection of groups that figure in all lists of size, production value and investment and move down to industry groups with size or investments only.

Number of companies-Top 10			Number of employees-Top 10			Production value-Top 10			Fix capital investments-Top 10		
70.2	Management consultancy act	1622	55.1	Hotels and similar accommod	18517	52.2	Support activities for transpor	2223953	55.1	Hotels and similar accommod	####
49.3	Other passenger land transpor	1179	52.2	Support activities for transpor	9927	62.0	Computer programming, cons	1270220	61.3	Satellite telecommunications	####
86.9	Other human health activitie	1125	10.7	Manufacture of bakery and fa	6031	55.1	Hotels and similar accommod	1039771	62.0	Computer programming, cons	58045
16.2	Manufacture of products of wo	841	70.2	Management consultancy act	4281	70.2	Management consultancy act	417945	52.2	Support activities for transpor	48051
25.1	Manufacture of structural me	829	62.0	Computer programming, cons	3196	10.5	Manufacture of dairy product	366109	61.9	Other telecommunications ac	####
62.0	Computer programming, cons	827	49.3	Other passenger land transpor	3114	61.1	Wired telecommunications ac	336025	1.1+21	Manufacture of basic pharma	21346
49.4	Freight transport by road and	798	25.1	Manufacture of structural me	2585	10.7	Manufacture of bakery and fa	292379	10.7	Manufacture of bakery and fa	17563
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90.0	Creative, arts and entertainm	522	10.5	Manufacture of dairy product	2172	61.9	Other telecommunications ac	208459	60.2	Television programming and	12663

NACE	NAME	COMP	EMPOY	PROD	INV
62.0	Computer programming, consultancy and rel	827	3196	1E+06	58045
52.2	Support activities for transportation	721	9927	2E+06	48051
70.2	Management consultancy activities	1622	4281	417945	
55.1	Hotels and similar accommodation		18517	1E+06	2E+05
10.7	Manufacture of bakery and farinac		6031	292379	17563
10.5	Manufacture of dairy products		2172	366109	
49.3	Other passenger land transport	1179	3114		
25.1	Manufacture of structural metal pr	829	2585		
21.1+21	Manufacture of basic pharmaceuti			226582	21346
61.9	Other telecommunications activiti			208459	44928

Table 5: Logic for selection of top-10 industry groups

These Top-10 industry groups in Cyprus are listed in the Table 6.

Code NACE Rev. 2	Name	Number of Enterprises	Persons Engaged	Production Value (€000's)	Expenditure on Fixed Assets (€000')
10.5	Manufacture of dairy products	101	2,172	366,109	8,529
10.7	Manufacture of bakery and farinaceous products	462	6,031	292,379	17,563
21.1+21.2	Manufacture of basic pharmaceutical products	7	1,634	226,582	21,346
25.1	Manufacture of structural metal products	829	2,585	204,333	4,186
49.3	Passenger land transport	1179	3,114	144,032	6,497
52.2	Support activities for transportation	721	9,927	2223953	48,051
55.1	Hotels and similar accommodation	404	18,517	1039,771	180,191
61.9	Telecommunications activities	48	1,082	208,459	44,928
62.0	Computer programming, consultancy and related activities	827	3,196	1270,220	58,045
70.2	Management consultancy activities	1,622	4,281	417,945	-7,450
	Total	6,200	52,539	6,393,783	389,336

Table 6: Top-10 industry groups in Cyprus

We should add two more industry groups in the above list of important industries in Cyprus:

- 50.1 Sea and coastal passenger water transport
- 50.2 Sea and coastal freight water transport

For some reason, data for the above industries are not included into the official statistics on transport services (see Fig. 2).

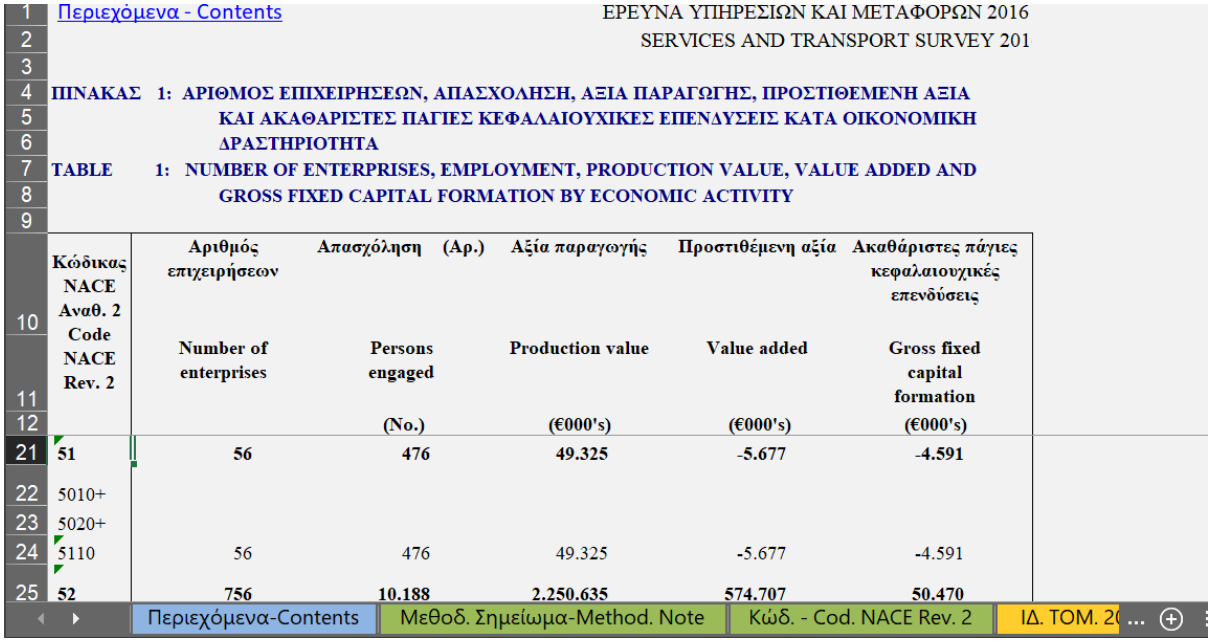

Fig. 2: Services and transport survey 2016
Source: CYSTAT industry groups in Cyprus

The maritime industry is a vibrant sector contributing to foreign direct investment and is now primed for further growth. The Cyprus shipping industry is a global success story. The industry ranks as the third largest merchant fleet in Europe and the 11th largest in the world. Cyprus is also the EU's largest ship management centre and amongst the top five in the world. Major companies are present in Cyprus. For example, two highly respected privately-owned ship management companies are Columbia Shipmanagement and Marlow Navigation, both based in Cyprus, are merged in 2017 to form Columbia Marlow, making one of the world's largest ship and crew-management companies.

Cyprus' merchant fleet exceeds 23 million gross tonnage, the number of companies increased from 168 in 2018 to over 200 in 2019 and the sector employs around 3% of Cyprus' workforce. The industry directly employs 55,000 seafarers from around the world and 9,000 personnel onshore, more than half of whom are Cypriot graduates, attracted to the sector because of its professionalism and high salaries. Cyprus' maritime industry contributes more than €1 billion to the economy annually, which translates to over 7% of GDP, a far higher figure compared to other countries. Ship management alone accounts for 5%. In the second half of 2018, industry revenues from ship management companies reached €528 million, recording an increase of €22 million when compared with the first half of 2018. The main exporting destinations for the services of the ship management industry include Germany, Switzerland, Singapore and Malta.

This industry has flourished without any state investment, although it enjoys continuous and strong state support. Cyprus' two dynamic shipping associations - the Cyprus Shipping Chamber (CSC) and the Cyprus Union of Shipowners (CUS) - work closely with the state. The creation of a new and independent Shipping Deputy Ministry in 2018 made the sector even more efficient. The new Deputy Ministry fully focused on shipping, coupled with the country's competitive tax incentives, has led to the relocation of a number of shipping companies to Limassol, the island's maritime capital.[1]

4. Emerging industry groups

We investigated also another dimension of manufacturing and service activities in Cyprus related to emerging industry groups. We define as emerging those groups that have small number of companies (less than 20) but high investment performance. The Table 7 below shows those two dimensions of industry groups. It allows identifying four groups that fall into the above criteria:

- Manufacturing of pharmaceutical products
- Manufacture of cement, lime and plaster, and non-metallic mineral
- Television programming and broadcasting activities
- Satellite telecommunications activities

	No of companies <20			Top-20 by investments
12.0+19.2	3		55.1	180191
20.2	3	Satellite telecom	61.3	79999
23.2	3	Television programming	60.2	58045
24.2	3		52.2	48051
25.4	3		37.0	46497
23.5+23.9	4	M. cement, lime, plaster	61.9	44928
28.1+28.4	4	M. of pharmaceutical	21.1+21.2	21346
16.1	6		10.7	17563

[1] See, CyprusProfile (2019). Maritime and shipping propelling the economy. https://www.cyprusprofile.com/en/sectors/maritime-and-shipping/

24.4	6	M. cement, lime, plaster	23.5+23.9	15242
28.9	6		33.1	13632
36.0	6		60.2	12663
21.1+21.2	7	M. of pharmaceutical	86.1	9535
22.1	7		10.5	8529
14.3	8		11.0	8307
28.3	8		63.1	8086
25.2	9		23.6	7351
30.1+30.3	9		10.1	6694
32.2+32.4	9		49.3	6497
55.9	9		85.4	6.185
59.2	9		93.1	5132
15.1	10			
20.3	13			
60.2	13	Television programming		
15.2	15			
63.9	15			
20.1+20.5	16			
23.3	17			
38.2+39.0	17			
61.3	18	Satellite telecom		

Table 7: Emerging industry groups in Cyprus

Another emerging industry group is 35.2-manufacture of gas; distribution of gaseous fuels through mains, which includes the manufacture of gas, the distribution of gaseous fuels through mains, and the trade of gas through mains. During the last 10 years, sales from Liquified Petroleum Gases is stable around 53,000-55,000 metric tonnes per year. Also, for this group analytical data is not provided in the energy statistics.

This is expected to change with the natural gas discovery in Cyprus' EEZ. Hydrocarbon Discovery by US firm Noble Energy and Delek Group in the Aphrodite gas-field in the block 12 is estimated at 4.54 trillion cubic feet (tcf) of gas. Following successful appraisal drilling, Aphrodite was declared commercial in 2015. The next discovery was made in 2017 by Total and ENI in block 11 in September 2017. But it was small and non-commercial. This was followed in February 2018 by the discovery of the Calypso gas-field in block 6 by Italian ENI with similar quantities of gas to Aphrodite. The most recent success was the discovery in March 2019 of the Glaucus gas-field in the promising block 10 by ExxonMobil and Qatar Petroleum, estimated at 5 to 8 tcf of gas. ExxonMobil was planning to drill one more exploratory well and an appraisal well at Glafkos in block 10, likely in 2020. However, this plan is postponed for 2021 due to coronavirus crisis and falling of oil demand.

The oil and gas sector is certainly set to become a key driver of economic growth, with Cyprus actively considering options to exploit its natural gas, hoping for high revenues in the future. Production with Noble Energy and its partners over the Aphrodite gas reservoir is expected to bring Cyprus an estimated €93 billion over 18 years. Based on the plan, the first gas is expected between 2024 and 2025 and according to the Energy Ministry would be the biggest infrastructure project ever undertaken in the Republic of Cyprus. The recent discovery of Glaucus in block 10 by ExxonMobil is related to building of a gas liquefaction plant at

Vassilikos for liquefied natural gas(LNG) exports to Europe and Asia. This would require total gas discoveries to approach 12-15 tcf and global gas prices to justify commercial viability.[2]

5. Most important industry groups in Cyprus

In the previous sections we followed a transparent process for identifying the most important industries in Cyprus. The selection is based on five criteria, considered as important industry groups those figuring in tandem at the top-10 positions of (1) size by number of companies, (2) employment, (3) production value, (4) fix capital investments, plus (5) the emerging industry groups. These industry groups figure in the Table 8 below.

Code NACE Rev. 2	Name	Number of Enterprises	Persons Engaged	Production Value (€000's)	Expenditure on Fixed Assets (€000')
10.5	Manufacture of dairy products	101	2172	366,109	8,529
10.7	Manufacture of bakery and farinaceous products	462	6031	292,379	17,563
21.1+ 21.2	Manufacture of basic pharmaceutical products	7	1634	226,582	21,346
23.5+ 23.9	Manufacture of cement, lime and plaster, and non-metallic mineral	4	266	112,790	15,242
25.1	Manufacture of structural metal products	829	2585	204,333	4,186
35.2	Manufacture of gas and distribution of gaseous fuels through mains	NA			
49.3	Passenger land transport	1179	3114	144,032	6,497
50.1	Sea and coastal passenger water transport	NA			
50.2	Sea and coastal freight water transport	NA			
52.2	Support activities for transportation	721	9927	2223,953	48,051
55.1	Hotels and similar accommodation	404	18517	1039,771	180,191
60.2	Television programming and broadcasting activities	13	618	38,688	12,663
61.3	Satellite telecommunications activities	18	105	110,610	79,999
61.9	Telecommunications activities	48	1082	208,459	44,928
62.0	Computer programming, consultancy and related activities	827	3196	1270,220	58,045
70.2	Management consultancy activities	1622	4281	417,945	-7,450

Table 8: Most important established and emerging industry groups in Cyprus

Those 16 industry groups, both mature and emerging, have a lion share in the overall industrial business activity on Cyprus between 43,33% - 50% in number of companies, 57.37%-65% in employment, 66.34%-70% in production value, and 72.73%-85% in fix capital investment (Table 9).

[2] See, CyprusProfile (2019). Energy: Oil and gas exploration race. https://www.cyprusprofile.com/en/sectors/energy-and-environment/

Industry groups	Number of companies	Number of employees	Production value (million €)	Fix capital investment (million €)
13 most important industry groups	6,235	53,528	6,655,871	489,790
All industry groups	14,390	93,304	10345,615	673,473
Share of top-10 to all industry groups	43.33%	57.37%	64.34%	72.73%

Table 9: Share of most important industry groups without water transport and manufacture of gas

6. Sensitivity in identifying most important industry groups

The 16 industry groups selected as most important ones are at the top positions in terms of size, production value, and investments. A question that directly comes up is how sensitive is the selection of most important industries from these initial selection criteria? How the list of top performing industries that figure on Table 8 will change if we add more criteria, such as export performance or growth rates of the specific industries in recent years.

We checked this problem by examining the manufacturing industry groups defined as most important ones, for which we have statistical data on exports (2012-2018) and growth of sales of industrial commodities over the period 2014-2017:

10.5 Manufacture of dairy products
10.7 Manufacture of bakery and farinaceous products
21.1+21.2 Manufacture of basic pharmaceutical products
23.5+23.9 Manufacture of cement, lime and plaster, and non-metallic mineral
25.1 Manufacture of structural metal products
35.2 Manufacture of gas and distribution of gaseous fuels through mains

We cannot make the same assessment for the services group of Table 8 (49.3 to 70.2) because there are not exports in services and growth statistics are given at 2-digit NACE Divisions than 3-digit NACE Groups. Nevertheless, the sensitivity analysis of manufacturing groups may provide some important lessons about the importance of the initial selection criteria.

Looking at export data (shorturl.at/fHKQ8) of 2018, a clear division appears. On one hand, industries such as "10.5 Manufacture of dairy products" and "21.1+21.2 Manufacture of basic pharmaceutical products", are top export industries, and the same we may assume for "35.2 Manufacture of gas and distribution of gaseous fuels" though there is not data available. On the other hand, industries such as "10.7 Manufacture of bakery and farinaceous products", "23.5+23.9 Manufacture of cement, lime and plaster, and non-metallic mineral" and "25.1 Manufacture of structural metal products" operate mainly in the local market, and their export performance is low.

Looking at growth rates of industrial commodities sales (shorturl.at/sEFM7) over the period 2014-2017, it appears that all manufacturing groups have good growth performance, close or above the average growth rate of all manufacturing groups (17.72%). Higher than the average performance have "10.5 Manufacture of dairy products" (20.15%), "23.5+23.9 Manufacture of cement, lime and plaster, and non-metallic mineral" (19.70%) and "25.1 Manufacture of structural metal products" (28.68), while close to average are "10.7 Manufacture of bakery and farinaceous products" (14.43%) and "21.1+21.2 Manufacture of basic pharmaceutical products" (15.93%).

This data shows that replacing some of the initial selection criteria, a few industry groups will not appear at the top positions of performance, and will be replaced by other groups. In other words, there is no single truth about which industries in Cyprus are the more important ones and to some degree this depend on the initial criteria for making the selection.

The significance of this finding is high. Identifying the most important industries should start from defining and agreeing on the selection criteria. This is a decision to be taken by S3 authorities and stakeholders. It is not a technical issue to be decided by experts. Moreover, the number of initial selection criteria should be rather limited to 3 or 4 (e.g. size, investments, growth, or size, investment, exports) because by adding more criteria we reduce the probability of finding top performance in all, thus good performance in more dimensions.

This finding supports also the need to engage stakeholders from the first steps of EDP, before making the selection of important industry groups. Because selection criteria, definition of important industry groups, and EDP exercises to all important groups are components of the same decision-making process.

7. Energy and higher education

Two industries not included in the list of important industrial activities of Cyprus are energy and higher education. Further analysis of those industries should be performed given the significance for the development of Cyprus. Statistics are either missing or show an industry (higher education) which performs well and is within the top-10 in employment and growth rates. Higher education might be part of the most important industry groups of Cyprus. As the previous section on sensitivity analysis shows, this is a question of the initial selection criteria, given that higher education is among the top industries is some fields of activity. About energy and the different forms of power generation more data are needed.

Code NACE Rev. 2	Name	Number of Enterprises	Persons Engaged	Production Value (€000's)	Expenditure on Fixed Assets (€000')	Added value (€000')	Growth rate 2008-2016
35.1	Electric power generation						
35.2	Manufacture of gas; distribution						
35.3	Steam and air conditioning supply						
85.4	Higher education	37	2,225	141,728	6,185	92,225	20.01%

Table 10: Energy and higher education performance

Energy consumption in Cyprus show a dependence on oil and very low use of renewable energy (Table 11). There is much room for energy transition and turn towards renewable energy sources.

Energy product	**Unit**	**Building heating**	**Water heating**	**Air conditioning**	**Cooking**	**Electrical appliances & lighting**	**TOTAL**	**%**
Electricity	KWh	642	382	1.107	554	3.603	**6.288**	
Heating oil	litre	331	24	-	-	-	**355**	
Clean oil	litre	42	2	-	-	-	**44**	
LPG	Kg	50	8	-	67	-	**125**	
Biomass	Kg	231	2	-	11	-	**244**	
Coal	Kg	-	-	-	48	-	**48**	

Electricity	kgoe	55	33	95	48	310	**541**	47.37
Heating oil	kgoe	284	20	-	-	-	**304**	26.62
Clean oil	kgoe	35	2	-	-	-	**37**	3.23
LPG	kgoe	55	9	-	74	-	**138**	12.08
Biomass	kgoe	83	1	-	4	-	**88**	7.70
Coal	kgoe	-	-	-	34	-	**34**	2.97
TOTAL	**kgoe**	**512**	**65**	**95**	**160**	**310**	**1.142**	**100,00**

Table 11: Annual energy spending (2009)

A2. Ecosystems and challenged in most important industry groups

In this section, we look closer into those 16 industry groups identified as most important activities and assess:

- The relationship to current smart specialisation strategy, RIS3Cy 2014-2020.
- Whether there is capacity for platform and ecosystem building to the benefit of all companies of each industry group.
- Weak cases for ecosystem building.
- The capacity for performing EDP in those groups. Should we perform EDP in all cases or some industries don't meet the conditions for a successful outcome?

We should underline ***the limited published data*** we have to assess these questions, mainly due to lack of sectoral studies describing the current status and trends of those 16 industries.

1. Relation of most important industries to priority sectors of CyRIS3 2014-2020

In the ongoing Smart Specialisation Strategy of Cyprus (RIS3Cy 2014-2020) the following industries have been selected as priority activities. It is estimated that they have the greatest potential for future development. In these industries public resources support companies and research organisations through the RIS3 action plan and programmes such as RESTART provide public funding for innovation and development.

- **Tourism**: sustainable tourism, alternative forms of tourism, digital tourism applications, management and promotion of tourism product.
- **Energy**: renewable forms of energy, solar energy, solar-thermal technology, solar photovoltaic, technologies for solar heating and cooling, energy storage and transfer.
- **Agriculture–food industry**: agricultural and livestock production, agriculture, food security and climate change.
- **Construction industry**: sustainable urban development, sustainable construction, existing building stock, innovative and intelligent materials, reuse of building materials, cultural heritage.
- **Transportation**: marine, shipping, Intelligent Transport Systems, road freight.

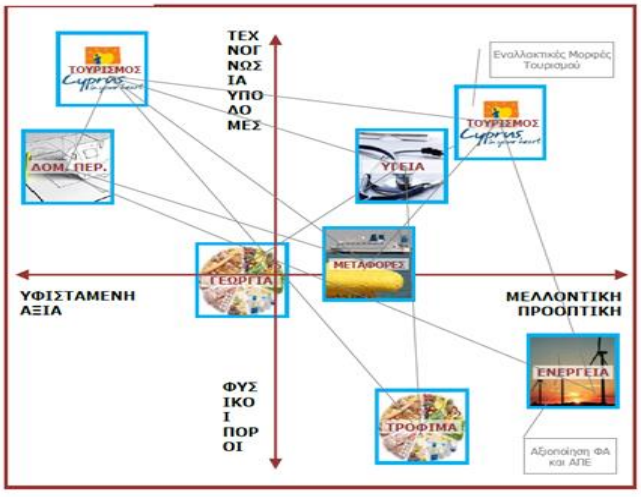

Figure 1: RISCy 2014-2020 priority sectors, Source: S3CY (2015)

- **Health**: e-health, prognosis - prevention and treatment of diseases, health pharmaceutical industry.
- In addition, **Environmen**t related technologies (climate change, pollution, eco systems, eco – innovation, water resources) and **ICT** (applications, future technologies) were defined as important horizontal activities feeding with technology all priority industries.

We have compared the 16 most important industry groups identified in the section A1 with the priorities of RIS3Cy 2014-2020.

Code NACE	Name	Included in RIS3Cy 2014-2020 priorities	Not included in RIS3Cy 2014-2020 priorities
10.5	Manufacture of dairy products	Included in the agrofood industry	
10.7	Manufacture of bakery and farinaceous products	Included in the agrofood industry	
21.1+ 21.2	Manufacture of basic pharmaceutical products	Included in the health sector	
23.5+ 23.9	Manufacture of cement, lime and plaster, and non-metallic mineral	Included in the construction industry	
25.1	Manufacture of structural metal products	Included in the construction industry	
35.2	Manufacture of gas, distribution of gaseous fuels through mains	Included in the energy industry	
49.3	Passenger land transport	Included in transportation	
50.1	Sea and coastal passenger water transport	Included in transportation	
50.2	Sea and coastal freight water transport	Included in transportation	
52.2	Support activities for transportation	Included in transportation	
55.1	Hotels and similar accommodation	Included in tourism	
60.2	Television programming and broadcasting activities		Not included
61.3	Satellite telecommunications activities		Not included
61.9	Telecommunications activities		Not included
62.0	Computer programming, consultancy and related activities	Included in ICT as horizontal technology	
70.2	Management consultancy activities		Not included

Table 12: Important industry groups in Cyprus and relation to RIS3Cy 2014-2020

It becomes clear from the Table 10 that most important industrial activities defined by our survey and the sectoral priorities of RIS3Cy 2014-2020 match very well. Two areas of divergence are, which should be given attention are:

- First, ***emerging services*** such as television programming and broadcasting activities, and satellite telecommunications activities ***are not included in priority domains*** in the current RIS3Cy.
- Second, all top-important industries included into S3 priorities are into wider categories of NACE Sections or Divisions (e.g. construction industry instead of manufacture of structural metal products, agrofood instead manufacture of dairy products). The meaning of this remark is that RIS3Cy 2014-2020 ***has extended***

prioritisation into industry groups that are not justified as important in terms of size, production and investment intensity.

2. Ecosystems in most important industry groups

To assess the dynamic for ecosystem building, we conducted interviews with business stakeholders and experts in Cyprus. Interviews were guided by open questions having the aim to identify business ecosystems into industry groups. We searched groups in which there is potential for ecosystem building, companies that can work together, share common functional elements (physical resources, infrastructures, collaboration platforms, technologies, or share value chains) or other components that determine an interdependent growth. The questionnaire driving the interviews can be found at the addresses below: https://www.surveymonkey.com/r/3B86KQS.

The data we gathered are not sufficient to understands the dynamics of ecosystems in the 16 industry groups. ***A wider field survey is needed to identify potential for ecosystem building.***

We may assume with some confidence that the 16 industry groups identified as important one are cluster-type ecosystems because most of activities take place in the main urban centres of the country (Nicosia, Limassol, Pafos, etc.). Collaboration in cluster-based ecosystems is emerging, due to spatial proximity and interdependencies by knowledge spillovers. However, it is rarely orchestrated effectively by policy interventions. This emerging collaboration is extremely difficult to be replicated by policy measures, and cluster policies – though very popular - in many cases failed both in high-tech and low-tech clusters to overcome 'inertia' or 'path dependency', and the tendency to stick to existing patterns rather than to pace up with innovation (Hospers, 2005). Existing research finds also clear reasons to be pessimistic about the ultimate welfare implications of cluster policy interventions (Ketels, 2013), as not every cluster is also a case of successful collaboration and community (Kasabov, 2010).

A3. Discovery of platforms for ecosystem building

A novel solution to address business and innovation challenges in industry groups is based on orchestration of producers and consumers. It comes from the recent literature on platforms and platform-based ecosystems.

1. Platforms and platform-based ecosystems

Research in this field shows that "industry platforms are technological building blocks (that can be technologies, products, or services) that act as a foundation on top of which an array of firms, organized in a set of interdependent firms (sometimes called an industry "ecosystem"), develop a set of inter-related products, technologies and services" Gawer (2010; 287). Equally, platforms can be understood as collaborative business models based on technology that engender ecosystems. A platform is "a plug-and-play business model that allows multiple participants (producers and consumers) to connect to it, interact with each other and create and exchange value" (Castellani, n.a.).

Platform-based ecosystems are created when an organisation launches a platform that becomes the foundation for products and services of other companies. Gawer and Cusumano (2002) call this relationship "platform leadership", a strategy that enables companies to exert influence over the direction of innovation in an industry, by engaging other firms in a joint effort for complementary products. Industry-wide platforms offer resources that third party organisations can use to develop their own complementary products, technologies, or services. They enable the creation of business ecosystems and has a disruptive network effect in many

industries. They are foundations for setting up ecosystems of organisations that share resources, knowledge or access to markets (Gawer and Cusumano, 2014). Working with an industry-wide platform typically results in a two-part structure: on the one side, there is the specific solution that is hosted on the platform, and on the other side, there is the platform with its infrastructure, hardware, software and data which communicate with the hosted solutions and organise collaboration according to established procedures.

A typology proposed by Srnicek (2017) classifies platforms according to their purpose: *advertising platforms* (e.g. Google, Facebook) which offer an advertisement space; *cloud platforms* (e.g. Salesforce) that offer hardware and software as a service; *industrial platforms* (e.g. GE, Siemens) which offer infrastructures for the digital transformation of manufacturing; *product platforms* which generate revenue by using other platforms to offer goods as a service; and *lean platforms* (e.g. Uber, Airbnb) that provide a business model of minimal asset ownership.
In platform-based ecosystems the orchestration at the producer and consumer sides is achieved by the platform, its services and infrastructures, and the business model for viability. Platforms offer services or infrastructure, they have income from these services, which secure their financial sustainability.

Various types of industry platform connect companies of industry groups towards orchestrated ecosystems. A similar survey in Greece identified platforms:

- Market-driven: providing access, branding, product promotion
- Product-driven: supporting new products, smart products, quality, and product / service certification
- Technology-driven: promoting common research, processing technologies, and supply chain integration
- Infrastructure-driven: providing physical, institutional, equipment, tools
- Materials-driven: on new materials, raw material, waste management and recycling.

A good working example from Greece is MEDITERRA S.A, the research and innovation centre of Mastiha producers in Chios. It was founded in 2002 by Chios Mastiha Growers Association, with objectives to establish a marketing tool for mastiha, promotion and sale of mastiha products worldwide. To date the company has developed a retail outlet network under the brand "mastihashop" which comprises stores in Greece and abroad, has established a food production unit in Chios island where over than 100 different products are produced, has developed a wide distribution network for brands such as natural mastiha, mastiha chewing gum, cosmetic products, parapharmaceutical products (selling line mastiha therapy), and Greek food products (selling line cultura mediterra). MEDITERRA's R&D centre performs R&D on the antibacterial activity of mastiha, non-oxidative action, mastiha in oral hygiene, dermatological and healing properties of mastiha, and new product development using mastiha as natural supplement to functional foods. Own facilities have a covered surface of approximately 10,000 m2 and house the total range of activities, including two production units for mastiha processing & packaging, ELMA products and distillation of mastiha oil.

MEDITERRA works as two-side platform and orchestrator. At the producer side with the dissemination of production practices and methods to increase productivity and yield, as well as product development centre for new creation and development of new products. At the demand side with the creation of a distribution network and commercial stores for the promotion and sales of brands and products based on mastiha, as well as the expansion into new markets of functional foods and para-pharmaceutical products.

Another example for Cyprus may be a digital platform for the pharmaceutical industry based on user data. In the near future the pharmaceutical industry will change dramatically by the move from a mass-market approach to a more targeted, personalized, and data-based approach. A two-side platform may orchestrate both the supply and demand sides of drug production and use.

- At the supply side, the so-called Health 2.0 promotes the proliferation of electronic personal health records. Large IT companies, like Microsoft and Google, have already launched online services for people to create and store their personal health records on the web, but there are also other smaller companies with similar services, including myPHR.com, medicalrecords247.org and ihealthrecord.org. Governments at national and regional level have started focusing on prevention rather than treatment and promote electronic medical records for the entire population. This data, anonymized, may be shared and used by pharmaceutical companies for better drug design and development and this intelligence can support disease prevention and treatment. Information from sensors may also provide real time information about the health level of the population. With the widespread adoption of electronic medical records, a growing number of healthcare payers are measuring the performance of different medicines which enables them to determine best medical practice and pay for treatments based on the outcomes they deliver.
- At the demand side, more and more people are using the Internet to find healthcare information, and numerous blogs and online forums have sprung up to cater for them. Health recommender systems may improve the quality of advice provided to the population, especially if they are grounded on local data and health features of the population that uses a recommender system.

Such a platform, orchestrating the supply and demand sides of drug production and use is for the benefit of the entire industry group than specific enterprises belonging to this industry.

Infrastructures can also be developed from a platform perspective. In Cyprus, to support the increase offshore drilling activities a new support base has been set up in Limassol port to cater to the expanding needs of the international exploration companies, services providers and processing companies. This facility will support the industry group 35.2 manufacture of gas and distribution of gaseous fuels through mains, which includes the manufacture of gas, the distribution of gaseous fuels through mains, and the trade of gas. The Cypriot government has also committed to establish a dedicated industrial port at the energy centre at Vassilikos to become operational by 2023, which will operate as a service centre for the oil and gas industry in Cyprus and the wider region. The investment will be around €250 million, and this facility may be an infrastructure-based platform for Cyprus' drive to become a regional centre providing support companies and services to the Eastern Mediterranean oil and gas industry.

2. Weak cases in emerging ecosystems and international collaboration

From a platform perspective the emerging industry groups identified in the Table 7 are weak cases. These four industry groups have extremely small number of companies: manufacture of basic pharmaceutical products (7 companies), manufacture of cement, lime and plaster, and non-metallic mineral (4 companies), television programming and broadcasting activities (13 companies), and satellite telecommunications activities (18 companies). Thus, the orchestration at the supply side is uncertain, depending on decisions of very few actors. On

the other hand, these industries perform very well at the investment side, and offer products and services in large markets. Thus, orchestration at the demand side would be easier.

A way to address this weakness is by promoting international collaboration among EU regions and setting industry platforms bringing together companies from many countries and regions.

The pharmaceutical industry may be a good example for this type of collaboration between Cyprus and Attica (Table 11).

Pharmaceutical industry	Cyprus	Attica
Number of Enterprises	7	19
Employment	1,634	1,215
Production Value or Turnover (million €)	226.58	646.22
Expenditure on Fixed Assets (million €)	21.346	

Table 13. Pharmaceutical industry in Cyprus and Greece

Both industry groups have similar size features and share the same objectives towards **widening the share of generic drugs** and **the management of health data** for the development of services that could support disease prevention and treatment.

Many other industry groups could profit from developing platforms for ecosystem creation by international collaboration with other EU regions. For instance, six industry groups that are identified as most important in Cyprus also figure in the most important industry groups of Greece (Table 14). Collaboration for the development of joint platforms should be attempted. For market-driven, product-driven, and technology-driven platforms, the distance is not a barrier to collaboration.

Code NACE Rev. 2	Name	Cyprus		Regions of Greece		
		Number of Enterprises	Persons Engaged	Number of Enterprises	Persons Engaged	Region
10.5	Manufacture of dairy products	101	2172	84	2,077	Thessaly
10.7	Manufacture of bakery and farinaceous products	462	6031	680	2.399	Peloponnese
21.1+21.2	Manufacture of basic pharmaceutical products	7	1634	19	1.215	Attica
25.1	Manufacture of structural metal products	829	2585	867	3,664	Central Macedonia
55.1	Hotels and similar accommodation	404	18517	1.077	20.284	Crete
62.0	Computer programming, consultancy and related activities	827	3196	4,868	17,312	Attica

Table 14. Industry groups candidate for interregional platform development between Cyprus and regions of Greece

3. EDP exercises for definition of S3 priorities and policies

In platform-ecosystems, the creation of the ecosystem goes together with the development and deployment of the respective platform. However, platforms and commons should be designed and developed from scratch.

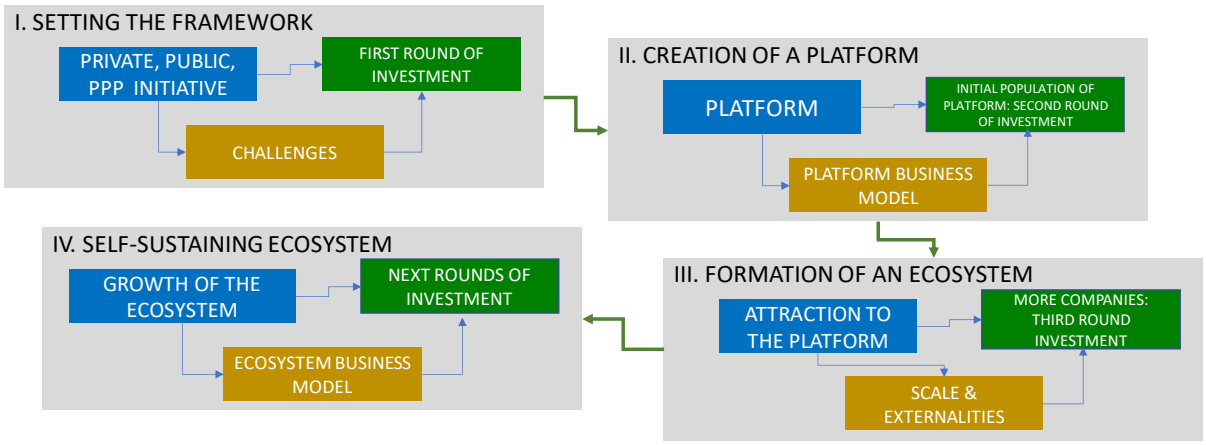

Figure 3: Platforms and the creation of industry ecosystems

The Figure 3 illustrates a succession of four steps towards platform-based ecosystems, from setting the framework for the platform, creation of the platform, formation of an ecosystem of organisations, and growth of a self-sustaining ecosystem. The platform is the enabler and the ecosystem the maker of externalities. Externality is a value from an economic activity freely received by unrelated organisations. It is a value external to market transactions. In platform ecosystems externalities derive from network effect and the large number of complementors on the platform.

The discovery and description of platforms for industry ecosystems is a main task of the ***EDP exercise***. At step 1 of Figure 3, EDP should investigate common challenges in an ecosystem, potential platforms for the orchestration of producers and consumers, and organisations to take the initiative for setting and operating the platform. Thus, EDP can be justified as a collective search for actions to the benefit of all actors belonging to an ecosystem.

Should we perform EDP in all important industry groups and ecosystems?
In principle yes as the cost of an EDP exercise is small compared to the added value in case of successful discovery and description of a platform. However, there are some conditions for setting a platform, which should be taken into consideration, such as:

a) The capacity to describe the platform and mainly the services to be provided.
b) Existence of sufficient number of companies and organisations to populate the platform.
c) The capacity to define a business model for the operation and viability of the platform.

Given the lack of sectoral studies on the 16 industry groups identified as most important industry groups, further survey is needed to assess whether we should perform EDP for platform discovery in all 16 cases.

How many EDP exercises would be needed for all ecosystems in Cyprus?
Since the number of important industry groups and potential ecosystems is only 16, EDP should be attempted in all cases to reveal common challenges and features of platforms for ecosystem building. In these 16 cases, EDP is expected to reveal actions for public policy, promoting collective rather than individual interests. Thus,

- EDP at the level of most important industry groups, mature and emerging, requires 16 cases only.
- This number of EDP cases is at a t detailed level of industry classification.
- EDP in 16 industry groups is quite feasible for a member state as Cyprus having strong business and consulting expertise in the public and private sector and academia.

A4. Policy recommendations

The final section (A4) of the report outlines a series for recommendations to the European Commission DG Regio, as well as to relevant authorities of Cyprus about the management of EDP for 2021-2027.

1. EDP should be performed at the level of NACE industry groups

Statistical data that are necessary to assess areas in the economy and society that have the greatest potential for future development (which is the aim of EDP) are provided at the level of industry sections (21 categories), divisions (88 categories), groups (272 categories), and classes (615 categories). Industry sections and divisions are very heterogeneous, including diverse economic activities with very different growth potential and trajectories. Industry groups on the contrary is the only category with sufficient homogeneity to assess future development. This level of industry granularity is the best possible to reveal the detailed challenges and future prospects of an industry. The only barrier to perform EDP at the level of industry groups is the large number of EDP exercises. However, we have seen that most important industrial activities in Cyprus, in terms of size and specialisation, are gathered in just 16 industry groups, which advocates in favour for EDP at industry group level.

EDP in Cyprus can be implemented at NACE industry group level. This level of industry granularity is the most functional to reveal the detailed challenges and the future prospects of every industry.

It is within the potential of the smart specialisation strategy of Cyprus for 2021-2027 to implement EDP in the most important industry groups of island. We have identified 12 groups that are mature industries with respect to size, production value, and investments, and 4 more groups as emerging ones. Thus, full coverage of all major industry groups in Cyprus for RIS3 2021-2027 would require 16 EDP exercises. This is quite feasible given the experience of the current RIS3, which has covered a much wider industry landscape.

2. Priority domains for RIS3 support should be determined after and with respect to EDP outcomes

All 16 industry groups identified as important industries should not necessarily be selected as RIS3 priority domains, but only those having potential for future development assessed successfully by EDP. An initial task of S3 stakeholders and authorities is to define the selection criteria for the most important industries of Cyprus.

Then, authorities responsible for RIS3 2011-2027 should perform EDP without excluding any important industry in advance. Two reasons justify this orientation of work: (a) the widely accepted S3 principle for place-specific innovation strategy or “one-size-does-not-fit-all”, which suggests that the most robust theoretical prediction should be assessed with place-specific data, and (b) the probability of finding innovative solutions in less expected activities, a trend outlined in many aspects of the innovation theory, such as the probabilistic and non-deterministic character of innovation, serendipity in innovation, and innovation outcomes by chaotic systemic combinations.

However, compared to RIS3Cy 2014-2020, a higher granularity of analysis is needed to focus better on industries that have real potential for innovation and growth.

3. The design of platforms that support innovation should be the main objective of EDP

Industry platforms address common challenges of companies belonging to an industry group and create favourable conditions for setting up business and innovation ecosystems. In every important industry group production, trade, technology and environmental challenges should

be identified. With respect to these challenges, EDP would focus on the design of platforms that drive the formation of business ecosystems. Platforms may be physical, institutional, infrastructure and digital. They can be *market-driven*, providing access to markets, branding, and promotion; *product-driven* for new product design and development, smart products, product quality and certification; *technology-driven* to facilitate research, processing technologies, and supply chain integration / optimisation; *infrastructure-drive*n to provide physical, institutional, and digital infrastructure; and *materials-driven* to better manage new materials, raw materials, waste and recycling.

Platforms must be designed as service providers. Their detailed design must define the model of service provision, the providers, services, and users, as well as the business model, the service operation model, and the quality model of provided services assessment. Failure of defining a sustainable service model is equal to EDP failure and no further policy support to the respective industry group should be provided.

International cooperation should be sought in the design and definition of platforms. Since each platform is a service provider, it is possible to attract the interest of international organizations and companies from other EU regions who have experience in the relevant field and wish to participate in a PPP to organise and run the platform.

4. Towards platform-ecosystems: EDP as public cohesion policy

Platforms providing services for market making (access, branding, promotion), product development (innovation, quality, certification, standardisation) and technology development (materials, processing, value chain optimisation) are mostly needed to address growth and innovation challenges of business ecosystems. They give birth to business ecosystems created around common challenges. Platforms and ecosystems guarantee the public character of policy mix and actions deriving from EDP as they serve common needs of an industry group than individual trajectories and interests of companies.

We have identified 16 industries in which the creation of business and innovation ecosystems should be investigated and documented by EDP. These ecosystems do not exist prior to platforms, which would act as anchors orchestrating complementors. Ecosystems can be created in each and every industry group around a challenge and common assets that deal with the challenge.

The starting point is to recognise some form of externalities (conditions outside the market and inter-firm competition) and how platforms can engage companies of an industry in dealing with the challenges they face. These may be e-commerce platforms, common quality control laboratories or technology centres, common recycling of production waste or by-products. It may be also a service developed by a group of companies, which is needed, without being a field of their competition. More data and field surveys is needed to identify and outline such opportunities, and this is a critical role for functioning EDP.

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