



UNIVERSIDADE CATÓLICA PORTUGUESA

Global IQP Index

Ranking Innovation, Quality and Productivity
(IQP) performance at global level

Trabalho Final na modalidade de Projeto
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por

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And to my beloved parents, who have taught me to walk and stand in life, always unconditionally present.

Resumo

Pretende-se com este trabalho definir e desenvolver um novo modelo de avaliação de desempenho de inovação, qualidade e produtividade ao nível macro-económico (países), que permita a observação do desempenho e desenvolvimento relativos dos diferentes países, com destaque para Portugal.

O modelo proposto parte da observação e análise de modelos existentes e orientações oficiais em metodologias de medição de inovação, qualidade e produtividade. As principais referências são o *Innovation Union Scoreboard*, o *Global Innovation Index*, o *Global Competitiveness Report*, o *OECD Oslo Manual on Guidelines for Collecting and Interpreting Innovation Data* o Barómetro de Inovação COTEC e o *OECD Manual on Measuring Productivity*.

Pretende-se que o modelo forneça informação visual clara dos indicadores relevantes, permitindo análise, interpretação contextual e obter conclusões. Pretende-se igualmente que represente uma ferramenta útil de tomada de decisão política, encorajando esforços a nível de desenvolvimento interno e estimulando a competitividade entre pares, enquanto contributo para a consciencialização da importância na medição de desempenho e estabelecer bases para desenvolvimento futuro.

Palavras-chave: Gestão de desempenho, Avaliação de desempenho; Produtividade; Qualidade; Inovação; Barómetros.

Abstract

The aim of this work is to conceptualize and develop a new scoreboard of innovation, quality and productivity performance at macro-economic (country) level, permitting observation of relative performance and development positioning for different countries, highlighting Portugal.

The proposed Scoreboard is based on an analysis of existing scoreboards and institutional guidance and methodologies on measuring Innovation, Quality and Productivity. It's references are the *Innovation Union Scoreboard*, the *Global Innovation Index*, the *Global Competitiveness Report*, the *OECD Oslo Manual on Guidelines for Collecting and Interpreting Innovation Data*, the *COTEC Innovation Digest*, and the *OECD Manual on Measuring Productivity*.

This Scoreboard is intended to provide clear and graphical information of relevant indicators, permitting analysis, contextual interpretation and benchmarking and conclusions. It is also meant to be a useful political decision-making tool, encouraging efforts on internal improvements and stimulating peer performance competition whilst increasing awareness to the importance of performance measurement, whilst setting the basis for future development.

Keywords: Performance management; Performance measurement; Productivity; Quality; Innovation; Scoreboards.

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Introduction

As society develops deeper into global automation, communication and standardization, economic activities are graced with new capacities, forms and origins for sourcing, evaluating, supplying and exchanging goods and knowledge. This evolution is only made possible through innovation and technological advances. These advances represent the leveraging factor of productivity, allowing for an unprecedented increase of capacity feeding the demand macro-economic trends. On the boundaries of such development, quality, in its multiple dimensions, takes central role by defining the governing principles of conformance to the specified objectives.

Feeding this development, information flow processing takes a central role, providing an abundance of data resources and tools for every possible activity, expanding continuously possibilities and bringing a new challenge: how to usefully harness such amount of acquired information power?

Surveys, scoreboards, monitoring systems, quality management and real-time information abound. Top-tens, shortlists and ranks exist for nearly any information of social and economic relevance: economic development levels of countries, unemployment rates, quality of living for cities, best companies to work, university employability, salary surveys, waiting times, transport punctuality and service quality levels, to name but a few. All are mere examples

of a myriad of digested and presented compilation of indicators and data.

Rankings are the competitive and most visible tool for transversal analysis on a given subject group, hierarchically organizing peer performance as per intended indicator. This relative positioning of peers has helped (in)forming public opinion and supporting policy makers or any decision-maker, for whom strategic performance evaluations represent a strong decision support factor for continuity and predictability. Benchmarking has become a very useful tool for qualitative and quantitative analysis on performance, allowing quick observation of relative positioning of a specific agent in relation to its peers. Companies have also recognized this external driver as strategically important in providing a fundamental management support tool (Neely, 1999, p. 211).

Innovation, Quality and Productivity are key performance fields on the development of any economic activity, and are, as such, the subject of analysis in this research. To better understand the state of the art in these key performance fields, this research identifies, collects and evaluates existing literature and measuring models, analyzing the respective methodologies, inputs and outputs, seeking to understand and identify main advantages and shortcomings. The resulting conclusions and identified opportunities serve the supporting basis for the development and proposal of a new model.

Sets of criteria were used for establishing the relevance of existing scoreboards and sources of information. These criteria were:

- a) to be relevant and institutionally recognized;
- b) to be based on robust, high quality and openly available data sources;
- c) to have a wide scope of relevant countries
- d) to permit time range analysis

Each model and source of information is evaluated and analyzed, extracting relevant methodologies and indicator guidelines, to establish the path to the development of the proposed tool. This analysis sets the justification for the development of a conceptual framework that is the governing basis of the proposed scoreboard. The framework is then applied to real data, aggregated, organized and computed into a set of visual outputs, dashboards and benchmarks, establishing what defines the proposed model.

Chapter 1

Conceptual Background

This chapter introduces to the subject, presenting current definitions, reviewing current frameworks and analyses the recognized sources of information.

1.1 Performance measurement: definition

Neely (1995) defines performance measurement as “the process of quantifying action, where measurement is the process of quantification and action leads to performance” (Neely, 1995, p. 80). The author analyses performance measurement systems at individual performance measure level, arguing that performance measures need to be positioned in a strategic context, as they influence what people do. It is observed that quality, time, cost and flexibility represent the key dimensions for performance measurement. With regards to quality, the author notes the shift in the literature from specification conformity to customer satisfaction, noting a shift from process performance towards output performance.

At micro-economic level, Kaplan and Norton (1992) developed the performance measurement tool “Balanced Scorecard” (BSC), focused on strategy and vision of the business instead of extensive controlling measurement, usually ineffective and vulnerable to bias. The proposed framework (see figure 1) values business innovation and productivity and is

based on a four dimensional strategy: Financial, Customer, Internal Business and Innovation and Learning perspectives. For each dimension a defined set of goals is matched by a defined set of measures/indicators that are directly correlated to the goal. By setting these “strategic goals” in a clear, concise

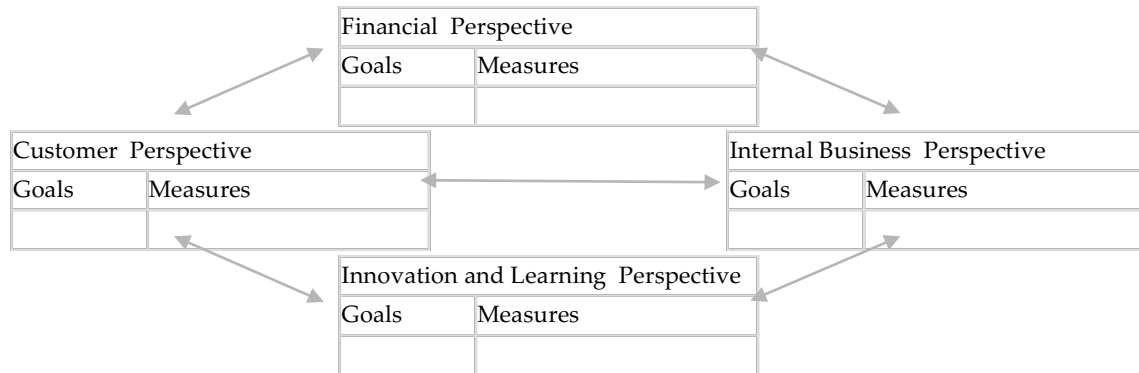


Figure 1: Balanced Scorecard Links Performance Measures (Kaplan *et al*, 1992, p. 72)

manner, supported by measurable indicators, the framework is easily defined and controlled at managerial level, and easily implemented at operational level.

Antonsen (2010) analyzed the BSC methodology applied as a strategic management tool for top-down processes in a financial organization and its effect on line managers and employees. Although recognizing positive financial contribution from the application of BSC, the researcher identifies an adverse impact on employee commitment in the organization, which is widely recognized as beneficial for the organization. BSC application is found to strengthen organization formality, increasing top-down formal management control whilst reducing critical employee feedback. The author argues that BSC application is considered as “inappropriate for measuring complex work tasks” (Antonsen, 2010 p. 49) as considered in the case-study presented. Findings support the need for employee involvement on work process specification and measurement for such complex environments. The BSC methodology is also found to be vulnerable to input errors, resulting in distorted results, which in turn have a further negative effect on employee confidence on organization’s performance control measures.

1.2 Innovation

Innovation is best defined as *“the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations”* (OECD/EUROSTAT, 2005, p. 46). Innovation is also recognized as *“the dominant factor in national economic growth”* (OECD/EUROSTAT/EU, 1997, p. 15) and the *main economic driver of economic growth in the EU*” (European Union, 2013, p. 3).

Four main types of innovation are identified by the OECD-EUROSTAT (2005, p. 16). These are: product/service, process, marketing and organizational innovation.

1.3 Quality

Neely (1995) defines quality as having *“been traditionally defined in terms of conformance to specification”* (Neely, 1995, p.85) and argues that is now shifting from a notion of *“conformance to specification”*, and thus towards customer satisfaction. The author also identifies quality’s multiple dimensions: (1) performance; (2) features; (3) reliability; (4) conformance; (5) technical durability; (6) serviceability; (7) aesthetics; (8) perceived quality; (9) humanity; (10) value. (Neely, 1995, p. 84).

1.4 Productivity

Productivity is *“commonly defined as a ratio of volume measure of output to a volume measure of input use”* (OECD, 2001, p.11). This definition represents the general consensual conception and is adopted by general literature. OECD also recognises difficulties on the correct application and measurement of

productivity, depending on the indicators used, with advantages and limitations. If productivity can be easily defined, its measurement represents challenges as diverse as its applications. It is, therefore, important to clearly define the objective of the measurement in order to correctly conceptualise its applicability. OECD identifies the main objectives of productivity as being Technology, Efficiency, Real cost savings, Benchmarking production processes, and Living Standards (OECD, 2001, p.11-12).

Grassano (2014) argues that a paradigmatic change was introduced by the Information and Communication Technology (ICT) revolution, with special productivity effects on services. Services typically involve customers in the production process and ICT has contributed dramatically to opening activities to co-production. This has resulted in timesavings for both producers and consumers, with consequential reduction in labour costs and increase in productivity.

1.5 Existing tools

Following the purpose of this research it is important to identify, analyze and review existing measurement tools, looking in detail at the conceptual frameworks and input/output indicators. The identified frameworks are presented and detailed down to indicator level and the methodologies reviewed. Due to the extension of some of the existing frameworks it has been chosen to only expand the data that is considered relevant to the proposed model, opting to present without great detail indicators that are not regarded as relevant for the proposed model.

1.5.1 Measuring Innovation

The OSLO Manual (OECD-EUROSTAT 2005), co-developed by the OECD and the EUROSTAT defines a set of guidelines for collection and interpretation of Innovation, based on the following characteristics: (a) Innovation in the firm; (b) Linkages with other firms and public research institutions; (c) The institutional framework in which firms operate; and (d) the role of demand. The framework is presented in the following figure (figure 2).

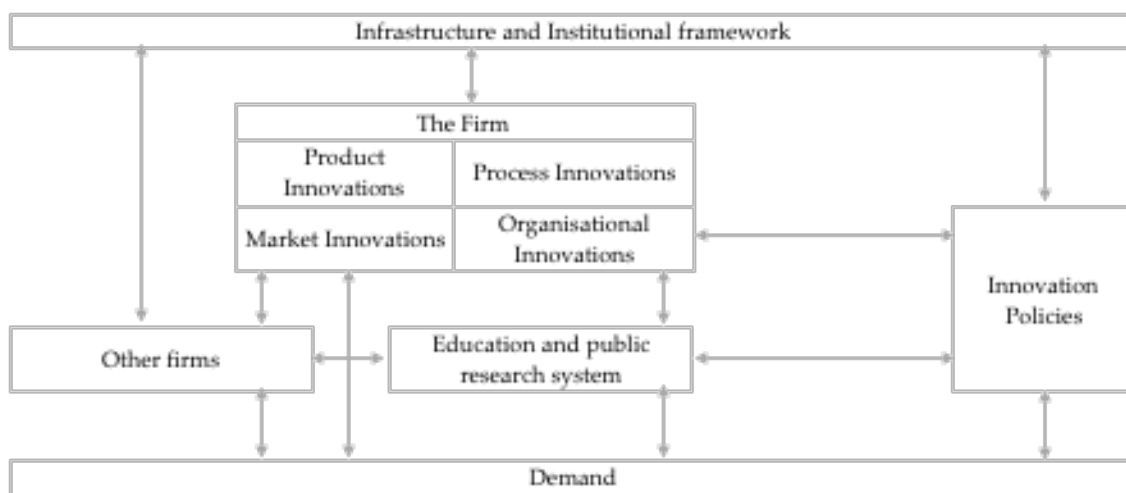


Figure 2: The innovation measurement framework (OECD/EUROSTAT, 2005, p.34)

The essential innovation factors identified at the firm level, are the following: (a) Research and Development; and (b) Innovative activity that indirectly promotes innovation development or adoption. In terms of context, the Manual defines the following factors: (a) basic educational system of population; (b) Higher education system; (c) Technical training system; (d) Science and Research base; (e) shared codified knowledge; (f) innovation policies; (g) legislative and macroeconomic settings; (h) infrastructure (transport and telecommunication); (i) Financial ‘ease of access’; (j) Market accessibility; and (k) Industry Structure and competitive environment.

1.5.1.1 Global Innovation Index (GII)

The Global Innovation Index is an annual publication, developed co-jointly by the Cornell University, INSEAD, and the World Intellectual Property Organization (WIPO) and uses 79 indicators and ranking of 141 world economies. To rank the countries, an overall score is computed as the simple average of the input and output sub-index scores. Each sub-index is a simple average of the corresponding pillar scores (five for input and two for output). The five input pillars focus on contextual environment, considered as enabler pillars, *“conductive to innovation within an economy”* (Cornel/Insead/WIPO 2015. p. 77). These pillars focus on Institutional environment (at Political, regulatory and business level), Human capital and research environment (in terms of expenditure and attainment levels), Infrastructure environment (in terms of ICT, general infrastructure and environmental development) and level of sophistication at Market level (in terms of Credit, investment and competitive environment) and at Business level (in terms of knowledge workers, innovation linkages and knowledge absorption capacity). The two output pillars focus on the results from innovative activities, specifically on Knowledge and Technology outputs (in terms of creation, impact and absorption) and Creative outputs (intangibles, creative goods and services and online creativity).

The index represents a composite value calculated as the weighted average of its subordinated pillars which themselves represent a weighted average of its subordinated sub-pillars, down to each individual indicator. It also presents an Innovation Efficiency Ratio, obtained from the division of the output sub-index score over the input sub-index score. This allows for a secondary ranking/observation in terms of innovation potential. Indicators are normalized using either GDP or population numerators. To allow comparability between economies independently of stage, GDP at purchasing power parity is used. With regards to missing values, a minimum threshold of data availability is set

per country, discarding countries with poor data availability. Following that selection, any missing data are not considered in score calculations. Outliers are identified and not considered for in the score formula to prevent distortions.

All indicators are normalized (following the minimum - maximum method) into a 0-100 range as per the following formulas:

$$\text{Goods: } \frac{\text{economy value} - \text{min}}{\text{max} - \text{min}} \times 100 \qquad \text{Bads: } \frac{\text{max} - \text{economy value}}{\text{max} - \text{min}} \times 100$$

The Global Innovation Index 2015 framework is structured as follows (Cornel/Insead/WIPO 2015. p. 307)

Innovation Efficiency Ratio

- **Innovation Input**

- *Institutions*

- Political Environment

- Political Stability, index (perception of the likelihood for governmental disruption, World Bank – World Governance Indicators)

- Government effectiveness, index (perception of degree of Independence of public services, World Bank – World Governance Indicators)

- Regulatory Environment

- Regulatory Quality, index (perception of government ability to permit and promote private-sector development, World Bank – World Governance Indicators)

- Rule of Law, index (perception of agents confidence in and abide by the rules of society, World Bank – World Governance Indicators)

- Cost of redundancy dismissal, in salary weeks (World Bank, Ease of Doing Business)

- Business Environment

- Ease of starting a business, distance to frontier(World Bank, Ease of Doing Business)

- Ease of resolving insolvency, distance to frontier(World Bank, Ease of Doing Business)

- Ease of paying taxes, distance to frontier(World Bank, Ease of Doing Business)

- *Human Capital and Research*

- Education

- Expenditure on education, % GDP

- Gov. expenditure p. pupil, secondary, % GDP p. cap.

- School life expectancy, years

- Assessment in reading, mathematics and science, PISA average scales (OECD)
- Pupil-teacher ratio, at secondary level of education
- Tertiary Education
 - % of population enrolled in tertiary education of all population at tertiary attainment age
 - Graduates in science and engineering, % of total tertiary
 - Tertiary inbound mobility, ratio % (students from abroad)
- Research & Development
 - Researchers, (Full Time Equivalent)/million pop.
 - Gross expenditure on R&D, %GDP
 - QS university ranking, average score top 3 (QS World University Ranking)
- *Infrastructure*
 - Information and Communication Technologies
 - ICT access, composite index (International Telecommunication Union)
 - ICT use, composite index (International Telecommunication Union)
 - Government's online service, index, survey (UNPAN)
 - online e-participation, index, survey (UNPAN)
 - General Infrastructure
 - Electricity output, kWh/cap.
 - logistics performance, index (World Bank and Turku School of Economics)
 - Gross capital formation, %GDP
 - Ecological Sustainability
 - GDP/unit of energy use, 2005 PPP\$/kg oil eq.
 - Environmental performance index (rank, Yale University and Columbia University)
 - ISO 14001 environmental certificates/bn. PPP\$ GDP
- *Market Sophistication*
 - Credit
 - Ease of getting credit, distance to frontier (World Bank, Ease of Doing Business)
 - Domestic credit to private sector, % GDP
 - Microfinance institutions: gross loans portfolio, % GDP
 - Investment
 - Ease of protecting investors (distance to frontier) (World Bank, Ease of Doing Business)
 - Market capitalisation of listed companies, % GDP
 - Stocks traded, total value %GDP
 - Venture capital per investment location, deals/tr. PPP\$ GDP
 - Trade & Competition

- Tariff rate, applied, weighted mean, all products, %
- Intensity of local competition, survey (World Economic Forum)
- *Business Sophistication*
 - Knowledge Workers
 - knowledge-intensive employment, % workforce
 - firms offering formal training, % firms, survey (International Finance Corporation and World Bank)
 - GERD performed by business enterprise, % GDP
 - GERD financed by business enterprise, % GERD
 - Females employed with advanced degrees, % total employed
 - Innovation Linkages
 - University/Industry research collaboration, survey (World Economic Forum)
 - State of cluster development, survey (World Economic Forum)
 - GERD financed by abroad, % GERD
 - JV-strategic alliance deals/tr. PPP\$ GDP
 - Patent families filed in 3+ offices/bn. PPP\$ GDP
 - Knowledge Absorption
 - Royalty and license fees payments, % total trade
 - High-tech net imports, % total trade
 - Comm., computer and info. services imp., % total trade
 - FDI net inflows, % GDP
- **Innovation Output**
 - *Knowledge and Technology Outputs*
 - Knowledge Creation
 - Domestic resident patent app./bn. PPP\$ GDP
 - PCT resident patent app./bn. PPP\$ GDP
 - Domestic res. utility model app./bn. PPP\$ GDP
 - Scientific and technical articles/bn. PPP\$ GDP
 - Citable documents H index (Economy's number of published articles that have been cited, SCImago)
 - Knowledge Impact
 - Growth rate of GDP PPP\$/worker, %
 - New business density, registrations/th. pop. 15-64
 - Total Computer software spending, % GDP
 - ISO 9001 quality certificates issued /bn PPP\$ GDP
 - High and medium-high-tech manufactures, % total manufacture output
 - Knowledge Diffusion
 - Royalty and license fees receipts, % total trade
 - High-tech net exports, % total trade

- Comm., computer and info.services exports, % total trade
- FDI, net outflows %GDP
- *Creative Outputs*
 - Intangible Assets
 - Domestic resident trademark app./bn PPP\$ GDP
 - Madrid trademark app. issued/bn PPP\$ GDP
 - ICTs and business model creation, survey (World Economic Forum)
 - ICTs and organisational model creation, survey (World Economic Forum)
 - Creative Goods and Services
 - Cultural and creative services exports, % total trade
 - National feature films/mn. pop. 15-69
 - Global entertainment and media output/th. pop. 15-69
 - Printing and publishing output manufactures, % of manufactures output
 - Creative goods exports, % total trade
 - Online Creativity
 - Generic top-level domains (TLDs)/th. pop. 15-69
 - Country-code TLDs/th. pop. 15-69
 - Wikipedia edits/ mn. pop. 15-69
 - Video uploads on Youtube/pop. 15-69

Focusing on the output indicators it is observed that overall, the most relevant measurable innovation outputs are related with Intellectual property and publications, and trade flows and productive outputs of traditionally innovative sectors. For the purpose of this thesis and the construction and development of a proposed model, we'll be focusing on output measures of performance, as they will be relevant for the development of the proposed model.

1.5.1.2 Innovation Union Scoreboard 2015 (IUS)

The Innovation Union Scoreboard is published annually by the European Union and focuses on measuring innovation performance of the EU member states and Iceland, Norway, Switzerland, the Former Yugoslav Republic of Macedonia, Serbia and Turkey. The IUS framework establishes three main classes of innovation indicators: (1) enablers, (2) firm activities and (3) outputs.

The enablers pillar focuses on Human resources (in terms of education attainment levels), on the research systems (in terms of publications and doctorate student composition), and on Finance and support (in terms of public R&D expenditure and venture capital access). With regards to firm activities, this pillar focuses on firm investments (in R&D and innovation expenditure), linkages and entrepreneurship (in terms of SME's innovation, collaboration and public-private co-publications), and intellectual property activities (looking at applications for patents, trademarks and design). The outputs pillar is focused on innovators (in terms of innovative SME's and employment in fast growers of innovative sectors) and the economic effects (on knowledge-intensive activity employment, and trade, and Intellectual Property revenue).

The index represents a composite value calculated as the un-weighted average of its subordinated scores to each individual indicator. An outlier identification is first made to country scores higher than 2 times the standard deviation. The outliers are disregarded in terms of score calculation, being replaced by the non-outlier maximum or minimum. Indicators are normalized using either GDP or population numerators. With regards to missing values, the next and previous available year data are used. If no data are available, the indicator is not used to contribute to the calculation of the Index.

The index score is calculated for each year as an un-weighted average of re-scaled scores (corrected for outliers and data skewing), for all indicators at the same weight. Each country score follows the following formula:

$$\text{Score} = \frac{\text{value} - \text{min}}{\text{max} - \text{min}}$$

The Innovation Union Scoreboard 2015 framework is structured as follows (European Union, 2015. p. 9):

- *Summary Innovation Index (SII)*
 - **Enablers**
 - *Human Resources*
 - New Doctorate Graduates per 1000 population aged 25-34

- % Population aged 25-64 having completed tertiary education
- % Youth aged 20-24 having attained at least upper secondary level education
- *Open, excellent research systems*
 - International Scientific co-publications per million population
 - Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country
 - Non-EU doctorate Students as percentage of all doctorate students
- *Finance and Support*
 - R&D Expenditure in the public sector % GDP
 - Venture capital investments % GDP
- **Firm Activities**
 - *Firm Investments*
 - R&D expenditure in the business sector % GDP
 - Non-R&D innovation expenditure % turnover, survey
 - *Linkages & Entrepreneurship*
 - SME's innovating in-house as % SMEs
 - Innovative SME's collaborating with others as % SMEs, survey
 - Public-private co-publications per million population
 - *Intellectual assets*
 - PCT patent applications per billion GDP (PPSE)
 - PCT patent applications in societal challenges (environment-related technologies; health) per billion GDP (PPSE)
 - Community trademarks per billion GDP (PPSE)
 - Community designs per billion GDP (PPSE)
- **Outputs**
 - *Innovators*
 - SMEs with product or process innovations as %SMEs, survey
 - SMEs with marketing or organisational innovations as %SMEs, survey
 - Employment fast-growing firms of innovative sectors
 - *Economic effects*
 - Employment in knowledge-intensive activities as % total employment
 - Medium & high-tech product exports as % total product exports
 - Knowledge-intensive services exports as % total service exports
 - Sales of new to market and new to firm innovations as % turnover, survey
 - Licence and patent revenues from abroad as % GDP

By focusing on the output indicators it is observed that overall, the most relevant measurable innovation outputs are related with SME's innovative

activities, intellectual property revenue, and trade flows and productive outputs of traditionally innovative sectors.

1.5.1.3. Global Competitiveness Report (GCR)

The Global Competitiveness Report is published annually by the World Economic Forum and assesses the country performance in terms of competitiveness by evaluating the key factors that determine economic growth and prosperity. It measures 140 economies and is composed by 114 indicators, organized in three sub-indices which follow the considered three main stages of economic development: basic requirements (key for factor-driven economies and comprising institutions, infrastructure, macroeconomic environment and health and primary education), efficiency enhancers (key for efficiency-driven economies and comprising higher education and training, goods market efficiency, labour market efficiency, financial market development, technological readiness, and market size), and innovation and sophistication factors (key for innovation-driven economies, comprising business sophistication, and innovation). Depending on the stage of development of the subject economy, the sub-index is given different weight in the calculation of the overall index.

Relying heavily on survey data, the GCR has necessarily a different methodology than the other models. It is not the objective of this research to explore survey indicator usage in the construction of the proposed model, and for this reason, the methodology will not be explored in detail. The rank is obtained by calculating every indicator measurement into a 1 to 7 scale, by applying the following formulas:

$$Score_{positive} = 6 \times \left(\frac{country\ score - sample\ minimum}{sample\ maximum - sample\ minimum} \right) + 1$$

$$Score_{negative} = -6 \times \left(\frac{country\ score - sample\ minimum}{sample\ maximum - sample\ minimum} \right) + 7$$

The indicators are then aggregated according to each pillar and an arithmetic mean is calculated. Each aggregation level is weighted to calculate the next level score, as per defined weight, up to the top level, into a final aggregated overall country score. The countries are finally ranked according to the respective overall individual scores.

The Global Competitiveness Report 2015 framework is structured as follows (World Economic Forum, 2015. p. 39 - 40):

- **Global Competitiveness Report**
- **Basic Requirements, (variable weight: 20 - 60%)**
 - **Institutions, (weight 25%)** (WEFORUM Executive Opinion Survey)
 - *Public Institutions, (75%)*
 - *Property rights, (20%)*
 - (Protection of) Property rights (Survey)
 - Intellectual Property protection rights (Survey)
 - Ethics and Corruption, (20%)
 - (Illegal) Diversion of public funds (Survey)
 - Public trust in politicians (Survey)
 - Irregular payments and bribes (Survey)
 - Undue influence, 20%
 - Judicial independence (Survey)
 - Favouritism in decisions of government officials (Survey)
 - Public-sector performance, 20%
 - Wastefulness of government (Survey)
 - Burden of government (Survey)
 - Efficiency of legal framework in settling disputes (Survey)
 - Efficiency of legal framework in challenging regulations (Survey)
 - Transparency of government policymaking (Survey)
 - *Security, 20%*
 - Business costs of terrorism (Survey)
 - Business costs of crime and violence (Survey)
 - Organised crime (Survey)
 - Reliability of police services (Survey)
 - *Private Institutions, 25%*
 - *Corporate ethics, 50%*
 - Ethical behaviour of firms (Survey)
 - *Accountability, 50%*
 - Strength of auditing and reporting standards (Survey)
 - Efficacy of corporate boards (Survey)
 - Protection of minority shareholders' interests (Survey)

- Strength of investor protection (Survey)
- **Infrastructure, (weight: 25%)**
 - *Transport infrastructure, (50%)*
 - Quality of overall infrastructure (Survey)
 - Quality of roads (Survey)
 - Quality of railroad infrastructure (Survey)
 - Quality of port infrastructure (Survey)
 - Quality of air transport infrastructure (Survey)
 - Available airline seat kilometres (International Air Transport Association)
 - *Electricity and telephony infrastructure, 50%*
 - Quality of electricity supply (Survey)
 - Mobile telephone subscriptions (International Telecommunication Union)
 - Fixed telephone lines (International Telecommunication Union)
- **Macroeconomic environment, 25%**
 - *Government budget balance as % of GDP*
 - *Gross national savings as % of GDP*
 - *Inflation (annual % change in Consumer Price Index)*
 - *Government debt as % of GDP*
 - *Country credit rating (Institutional Investor's "Country Credit Ratings")*
- **Health and primary education, 25%**
 - *Health, 50%*
 - Business impact of malaria (Survey)
 - Malaria incidence (Nr of cases per 100 000 population)
 - Business impact of tuberculosis (Survey)
 - Tuberculosis incidence (Nr of cases per 100 000 population)
 - Business impact of HIV/AIDS (Survey)
 - HIV prevalence (as % of 15 – 49 yr old population)
 - Infant mortality (0-12 months, per 1000 live births)
 - Life expectancy (years, World Bank)
 - *Primary education, 50%*
 - Quality of primary education (Survey)
 - Net Primary education enrolment rate (UNESCO)
- **Efficiency Enhancers, 35 - 50%**
 - **Higher education and training, 17%**
 - *Quantity of education, 33%*
 - Secondary education enrolment rate (gross)
 - Tertiary education enrolment rate (gross)
 - *Quality of education, 33%*
 - Quality of the educational system (Survey)
 - Quality of math and science education (Survey)

- Quality of management schools (Survey)
- Internet access in schools (Survey)
- *On-the-job training, 33%*
 - Local availability of specialised research and training services (Survey)
 - Extent of staff training (Survey)
- **Goods market efficiency, 17%**
 - *Competition, 67%*
 - Domestic competition, variable %
 - Intensity of local competition (Survey)
 - Extent of market dominance (Survey)
 - Effectiveness of anti-monopoly policy (Survey)
 - Effect of taxation on incentives to invest (Survey)
 - Total tax rate (profit tax as % of profits, labour tax as % of profits and other taxes as % of profits)
 - Number of procedures required to start a business (World Bank Ease of Doing Business)
 - Time required to start a business (Ease of doing Business, World Bank)
 - Agricultural policy costs (Survey)
 - Foreign competition, variable %
 - Prevalence of trade barriers (Survey)
 - Trade tariffs (trade-weighted average tariff rate)
 - Prevalence of foreign ownership (Survey)
 - Business impact of rules on FDI (Survey)
 - Burden of customs procedures (Survey)
 - Imports as a percentage of GDP
 - *Quality of demand conditions, 33%*
 - Degree of customer orientation (Survey)
 - Buyer sophistication (Survey)
- **Labour market efficiency, 17%**
 - *Flexibility, 50%*
 - Cooperation in labour-employer relations (Survey)
 - Flexibility of wage determination (Survey)
 - Hiring and firing practices (Survey)
 - Redundancy costs (World Bank, Doing Business, WEFORUM)
 - Effect of taxation on incentives to work (Survey)
 - *Efficient use of talent, 50%*
 - Pay and productivity (Survey)
 - Reliance on professional management (Survey)
 - Country capacity to retain talent (Survey)
 - Country capacity to attract talent (Survey)

- Female participation in labour force (Ratio of woman to men in the labour force)
- **Financial market development, 17%**
 - *Efficiency, 50%*
 - Availability of financial services (Survey)
 - Affordability of financial services (Survey)
 - Financing through local equity market (Survey)
 - Ease of access to loans (Survey)
 - Venture capital availability (Survey)
 - *Trustworthiness and confidence, 50%*
 - Soundness of banks (Survey)
 - Regulation of securities exchanges (Survey)
 - Legal rights index (degree of legal protection of borrowers and lenders rights, World Bank, Doing Business)
- **Technological readiness, 17%**
 - *Technological adoption, 50%*
 - Availability of latest technologies (Survey)
 - Firm-level technology absorption (Survey)
 - FDI and technology transfer (Survey)
 - *ICT use, 50%*
 - % of Internet users
 - Broadband Internet subscriptions (per 100 population)
 - Internet bandwidth (kb/s per internet user, International Telecommunication Union)
 - Mobile broadband subscriptions (active, per 100 population)
- **Market size, 17%**
 - *Domestic market size, 75%*
 - Domestic market size index (Sum of GDP plus value of imports minus value of exports, normalised, WEFORUM)
 - *Foreign market size, 25%*
 - Foreign market size index (value of exports, normalised)
 - GDP (Purchasing Power Parity)
 - Exports as % of GDP
- **Innovation and sophistication factors, 5 - 30%**
 - **Business sophistication, 50%**
 - Local supplier quantity (Survey)
 - Local supplier quality (Survey)
 - State of cluster development (Survey)
 - Nature of competitive advantage (Survey)
 - Value chain breadth (Survey)
 - Control of international distribution (Survey)
 - Production process sophistication (Survey)
 - Extent of marketing (Survey)

- Willingness to delegate authority (Survey)
- **R&D Innovation, 50%**
 - Capacity for innovation (Survey)
 - Quality of scientific research institutions (Survey)
 - Company spending on R&D (Survey)
 - University-industry collaboration in R&D (Survey)
 - Government procurement of advanced technology products (Survey)
 - Availability of scientists and engineers (Survey)
 - PCT patent applications (number of applications under the PCT, per million population)

Though broadly focused on contextual inputs, the GCR is clear to recognize Intellectual property activity as direct Innovation output indicator. This model relies heavily on survey data, obtained through its proprietary Executive Opinion Survey, carried out in 144 economies and covering the opinions of over 14000 business leaders.

1.5.1.4. COTEC Innovation Digest (COTEC ID)

The COTEC Innovation Digest is an annual publication launched in 2010, developed by COTEC Portugal - Business Association for Innovation and Everis, making use of 67 indicators organized in 10 pillars divided by 4 dimensions. The information regarding available data and the model is limited. We tried to seek further clarification from the coordinator of this project, but regrettably we had no reply, which hinders a thorough analysis of the only reference national innovation-measuring tool. The author will present the available information within the stated limitations.

The model uses 67 indicators and ranks 52 world economies. No information was found on the methodology used to calculate individual country scoring. The four dimensions focus on conditions (in terms of institutional environment and ICT level and usage), Resources (in terms of human capital, finance access and investment), Processes (in terms of Networking and entrepreneurship,

knowledge application, Technology incorporation), and results (in terms of economic impacts and innovation impacts).

The COTEC Innovation Digest 2015 framework is structured as follows (COTEC Portugal - Everis, 2015. p. 12):

- **Innovation index**
 - **Conditions**
 - *ICT infrastructure and usage*
 - *Institutional environment*
 - **Resources**
 - *Human Capital*
 - *Finance access*
 - *Investment*
 - **Processes**
 - *Networking and entrepreneurship*
 - *Knowledge application*
 - *Technological adoption*
 - **Results**
 - *Innovation effects*
 - *Economic effects*

Given the limitations on the available information, it is not possible to understand and identify the used indicators, and consequently better illustrate the model's conceptual framework. However, it suggests that most relevant measurable innovation outputs are related with the pillars processes and results.

1.5.2. Measuring Quality

With regards to measuring quality, research reveals a wide gap between macro and micro-economic level. If it's possible to identify tools for measuring quality of service, quality standards for products, or quality performance monitors for specific sectors or economic activities (education, health-care, etc.), at macro-economic level, no relevant measurement frameworks are identified, denoting a large gap and creating an opportunity to explore.

As an example, for micro-economic, sectorial level, Martínez (2010) reviews relevant models for measuring perceived service quality. Respective shortcomings are identified and a cross analysis towards identifying overlaps is produced. The author argues the need for “more creative service quality models” and suggests three alternative quantitative models, created from a formative, reflective and combined perspective, aimed at minimising the identified limitations of existing models. These alternative models are presented as overcoming problems with the empirical application of conceptual models, integrating causes and consequences of perceived quality. Also regarding service quality, the SERVQUAL model (Parasuraman et al., 1988) proposes five essential dimensions for measuring service quality: Reliability, Assurance, Tangibles, Empathy and Responsiveness.

No scoreboard or rank has been identified that evaluates and measures quality at country level, thus further justifying the need and opportunity represented by the present research.

1.5.3. Measuring Productivity

Productivity performance is traditionally well documented and of generalized knowledge at country level. It is also commonly used as the primary reference statistical data of a country’s overall performance with direct political implications and societal expected condition improvements.

Relevant for this research is the guidance the provided *Manual on Measuring Productivity* (OECD 2001), presenting “*the theoretical foundations to productivity measurement*” for measuring aggregate and industry-level productivity growth and the *Compendium of Productivity Indicators* (OECD 2015) presenting a “*broad overview of recent and longer term trends in productivity levels and growth in OECD countries*”, analysing in detail the role of productivity as “*the main driver of economic growth and convergence*”.

The main types of input measure defined by OECD are Labour Productivity, Capital Productivity and Capital, Labour and Intermediate inputs (KLEMS – Capital, Labour, Energy, Materials and Services). All these types of outputs are recommended to be measured at two different measurement levels: Gross output and Value added (table 1).

Type of output measure	Type of input measure			
	Labour	Capital	Capital and Labour	Capital, labour and intermediate inputs (energy, materials, services)
Gross output	Labour productivity (based on gross output)	Capital productivity (based on gross output)	Capital-labour Multi-Factor Productivity (based on gross output)	KLEMS multifactor productivity
Value added	Labour productivity (based on value added)	Capital productivity (based on value added)	Capital-labour MFP (based on value added)	-
	Single factor productivity measures		Multifactor productivity (MFP) measures	

Table 1: Main Productivity measures (OECD/EUROSTAT, 2001, p.13)

For the purposes of the proposed model, we'll be focusing on Labour productivity, for convenience, as data is widely available as opposed to the other types of input measures. No scoreboard or rank has been identified dedicated to productivity performance at country level, thus further justifying the need and opportunity represented by the present research.

Chapter 2

Defining a new model: Global Innovation, Quality and Productivity Index (IQP)

This chapter presents the proposed measurement tool, presenting the underlying framework and methodology.

2.1 Overview

The objective of the Global Innovation, Quality and Productivity Index (IQP) that we developed in this thesis, is to conceive a performance measurement tool that permits evaluating and monitoring the performance of selected world leading economies in terms of the impact of three recognized fundamental dimensions for economic activity: Innovation, Quality and Productivity (figure 3). By aggregating and co-relating the performance between these three fundamental dimensions, the IQP model aims at presenting a richer and wider overview of an economies' fundamental performance by presenting all in a single contextualized tool. The tool is designed for and encourages further exploration in terms of indicators used and scope and level of application.

The model allows comparison between economies and the relative performances in terms of the different dimensions. Portugal will be highlighted and we will be analyzing its relative performance in comparison to its peer countries, fellow members of European Union and Eurozone. Further to this,

we will also seek to breakdown analysis into contextual groups, to seek a better understanding of context effects in performance.

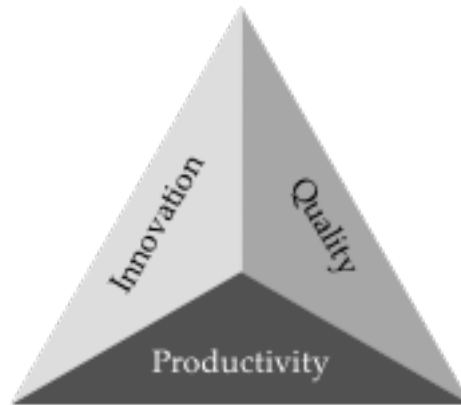


Figure 3: The IQP 3 Dimensional model.

2.2. Conceptual measurement framework

The model is applied to 43 economies, representing about 80% of the world's GDP (in current US\$). Different measures are calculated: The Global IQP Index, the IQP Sub-indices and the IQP Growth, building in a total of 11 output indicators. For the purpose of this thesis, we'll only be focusing on the impact of performance, and thus the model will be calculated based on output indicators. The Global IQP Index is the simple average calculation of all Sub-index scores, measuring the overall contextual performance of any given economy within the selected peers. The index is focused on output measurement, by looking at the impacts introduced by Innovation, Quality and Productivity performance.

The Innovation output sub-index measures the nation's contextual performance score in terms of innovation output effects in the economy and society. The Quality output sub-index measures the nation's contextual performance score in terms of output effects in the economic activities. The Productivity output sub-index measures the nation's contextual performance score in terms of output effects in economy and in society.

The IQP-Growth is the ratio of the score for the last 10 years. It measures the

nations' individual progress performance for the given dimension.

IQP Sub-indexes measure the nation's score in terms of Innovation, Quality and Productivity performance, based on a lower breakdown of output pillars for each dimension (figure 4).

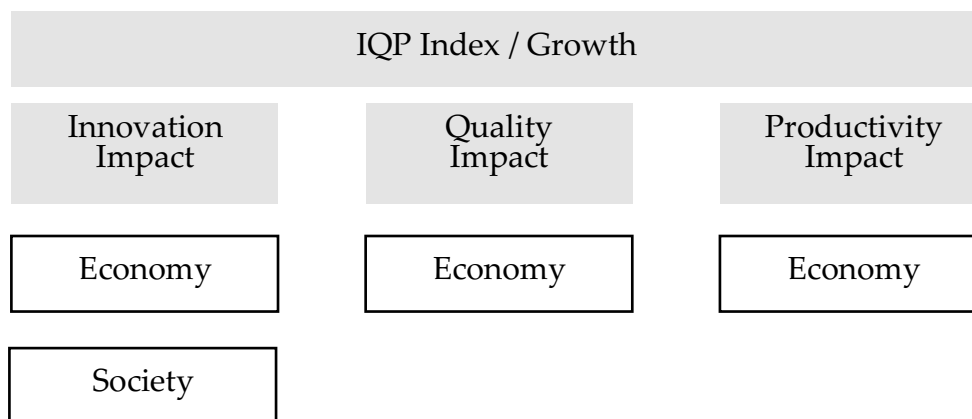


Figure 4: The IQP Index/Growth Framework

Innovation Impact sub-index observes two main pillars of innovation output: Economic and Social. These have been identified by research (from the reviewed existent models) as the most relevant aspects of Innovation output. The indicators used are based on the methodology used by existing measuring tools, having been adjusted to this model. New businesses are considered a clear indication of active business environments (appendix, table 11), capturing and leveraging innovation. High-technology (appendix, table 12) and ICT exports (appendix, table 13) are also a quantifiable output of highly innovative activities, considered directly related to the level of innovation performance of the economy.

Scientific publications are the immediate academic product of innovative environments and a strong indicator of innovative culture (appendix, table 8). Patents (Appendix, table 9) and Industrial Design (Appendix, table 10) applications are also associated with active and innovative business environments, thus its relevance and choice to use.

The Quality Impact sub-index only focuses on economic output. Following the research carried out which revealed existing limitations in terms of quality measurement at macro-level, the author decided to use the only available and applicable known data that could inform of a country's performance in this matter, the International Standard Organization's (ISO) Certificates. Following the definition of conformance to specification, the ISO provides the best, globally used and recognized institution, thus providing a reliable source of data at macro-economic level. It was chosen to use the number of ISO9001 (Quality Management Systems) certifications for being the most recognizable and widely adopted standard for quality management and thus considered to contain a direct relation to a given economy's commitment to quality (Appendix, table 14). ISO9001 is considered the reference standard in terms of quality and for this reason is considered individually. However, additional data on ISO certifications is available and it has been decided to include as a composite indicator for the aggregated number of remaining certifications (not ISO9001 – Appendix, tables 15 to 19), to allow for score robustness. It is a recognized limitation of the current model and additional indicators are encouraged for use in future developments of the IQPi. The common economic denominator used for quality establishes an economic co-relation to the indicator.

The Productivity sub-index observes only Economic impact of productivity, recognized as most relevant for the purposes of this model. To enrich the analysis and better illustrate the wider impact of productivity, the numerator varies to measure different aspects of productivity ratios that accommodate social aspects: population (Appendix, Table 20), labour force (appendix, table 21) and actual work hours (appendix, table 22). As a result, our Global IQP index disaggregates in the following indicators and sub-indicators

- *Global Innovation Quality and Productivity Index*

- **Innovation Impact (33%)**
 - *Economy (50%)*
 - New businesses per billion \$ PPP GDP (33%)
 - High technology exports per billion \$ PPP GDP (33%)
 - ICT goods exports per billion \$ PPP GDP (33%)
 - *Society (50%)*
 - Scientific publications per billion \$ PPP GDP (33%)
 - Patent applications (total) per billion \$ PPP GDP (33%)
 - Design Utility applications (total) per billion \$ PPP GDP (33%)
- **Quality Impact (33%)**
 - *Economy*
 - ISO9001 certificates per billion \$ PPP GDP (50%)
 - Other ISO certificates per billion \$ PPP GDP (50%)
- **Productivity Impact (33%)**
 - *Economy*
 - GDP, PPP current US\$ per Capita (33%)
 - GDP, PPP current US\$ per Labour force (33%)
 - GDP, PPP current US\$ per actual Work hours Labour force (33%)

2.2.1 Data Sources

The model makes use of internationally recognized sources of information, namely the World Intellectual Property Organization (WIPO), International Labour Organization (ILO) and the International Standards Organization (ISO). For global data, the data is combined as necessary from the United Nations (UNSTAT), Organization for Economic Cooperation and Development (OECD), World Bank (WB) and European Statistics (Eurostat). Table 2 presents the detailed information on the sources of data for each indicator.

IQP – Data Sources			
Indicator	Numerator	Denominator	Year
1.1.1	World Bank	World Bank	2004, 2009, 2014
1.1.2	UNCOMTRADE	UNCOMTRADE	2004, 2009, 2014
1.1.3	UNCTAD	UNCTAD	2004, 2009, 2014
1.2.1	SCIMAGO	World Bank	2004, 2009, 2014
1.2.2	WIPO	World Bank	2004, 2009, 2014
1.2.3	WIPO	World Bank	2004, 2009, 2014
2.1	ISO	World Bank	2004, 2009, 2014

2.2	ISO	World Bank	2004, 2009, 2014
3.1	World Bank	UNSTAT	2004, 2009, 2014
3.2	World Bank	ILO	2004, 2009, 2014
3.3	World Bank	ILO	2004, 2009, 2014

Table 2: Data sources

2.2.2 Data Scope

The range of countries considered was dictated by data availability and practicality, and for this reason, a selection of 43 countries was made as base set, representing circa 80% of the worlds' economy. This was considered to be sufficiently representative for the purpose of this research, though application to a wider range of countries is expected and supported. It was observed by researchers that the availability of statistical data reduces significantly for non-OECD members. For this reason it was decided to limit the country scope to OECD member countries and European members. Due to the global relevance of China and generally good data availability it has also been included. The following table 3 lists all the selected countries.

IQP – Countries			
	OECD	European Union	Euro Zone
Austria	O	EU	€
Belgium	O	EU	€
Cyprus		EU	€
Estonia	O	EU	€
Finland	O	EU	€
France	O	EU	€
Germany	O	EU	€
Greece	O	EU	€
Ireland	O	EU	€
Italy	O	EU	€
Lithuania		EU	€
Luxembourg	O	EU	€
Malta		EU	€
Netherlands	O	EU	€
Portugal	O	EU	€
Slovakia	O	EU	€

Slovenia	O	EU	€
Spain	O	EU	€
Bulgaria		EU	
Croatia		EU	
Czech Republic	O	EU	
Denmark	O	EU	
Hungary	O	EU	
Poland	O	EU	
Romania		EU	
Sweden	O	EU	
United Kingdom	O	EU	
Australia	O		
Canada	O		
Chile	O		
Iceland	O		
Israel	O		
Japan	O		
Republic of Korea	O		
Mexico	O		
New Zealand	O		
Norway	O		
Switzerland	O		
Turkey	O		
Russia	O		
China			

Table 3: Selected Economies

The index will be applied to a 10-year time frame, allowing trend observation and overall evolution. The chosen reference years are 2004, 2009 and 2014. 2014 was chosen as the last year due to convenience related to data availability, as most data have not yet been published for 2015. The 5-year gap between measurements is considered for this model as sufficient timeframe to illustrate performance evolution at macro-level.

2.2.3. Methodology

The IQP-index represents an overall composite indicator, obtained from the mean value of scores of the subsequent score.

For each indicator, outlier identification is carried out. The outlier identification process consists of testing the value against its distance to the mean value of the sample. If the distance to the mean is greater than 2 standard deviations, then the measure is considered an outlier. Outlier identification is important to prevent data distortions to average performers and also to identify outstanding results.

For data that is found to have very volatile values, showing low performance for most countries and very high levels for a few others, a square root transformation is applied for normalization.

The next step is to determine the maximum measurement within the sample. For maximum definition, the outliers are not considered, and thus the maximum will attain a relative score of 1. This will give an outlier a >1 score, however it will prevent every other performers to be inadequately positioned.

To compute each indicator score, the following formula is applied:

$$S_{indicator} = \frac{value}{\max value}$$

To obtain the sub-indicator overall score, the un-weighted average score is calculated of all the indicator scores composing the sub-indicator.

Any missing value does not contribute to the calculation of the average score, and thus it is not accounted for. This is a recognized limitation of the model and has been controlled through careful data selection, only happening in Design Applications for Belgium, Luxembourg and Netherlands, and New Business registrations for United States and China, where no data were available. Being only one indicator out of 6, it was considered acceptable for the purpose of this work.

The IQP Growth ratio measures the average annual growth rate of the IQP Index, permitting observation of the country's individual performance progress, denoting the impact of its efforts.

To compute each indicator growth ratio, the following formula is applied:

$$g_{indicator} = \frac{\Delta S_i}{S_1}$$

Benchmarking is obtained by simple ranking of the obtained sub-index scores.

Lastly, to seek a better understanding of what factors influence performance we'll be segmenting the economies in terms of global index and growth score performance, classifying them in two classes:

Outperformers: High Performance & High Growth

Underperformers: Low Performance & Low Growth

Highs are scores above mean values, whilst lows are scores below mean values.

Chapter 3

Model application: IQP Index 2014

This chapter presents the proposed measurement tool applied to real world data.

3.1 Overview

The IQP Index ranks the individual performance of the selected economies. The performance represents a composite indicator calculated from 11 individual indicators that support the three main dimensions: Innovation, Quality and Productivity. The IQP Growth ratio complements the Index by evaluating individual performance growth, allowing a second level of observation by identifying which economies reveal a higher degree of evolution and attributing a quality dimension to the performance. The model will be applied to three time periods: 2004, 2009 and 2014. For 2014 Index score calculation, only data from 2014 is used. For the IQP 2014 growth ratio, it is important to understand in relation to the overall score, what level of improvement has the economy demonstrated for the last 10 years, so ratio is obtained by calculation of all scores of 2014 in relation to 2004.

The following figure (5) presents the IQP Index score results of all economies, with the IQP growth ratio juxtaposed. Full Index scores for all years can be observed on appendix (tables 5, 6 and 7).

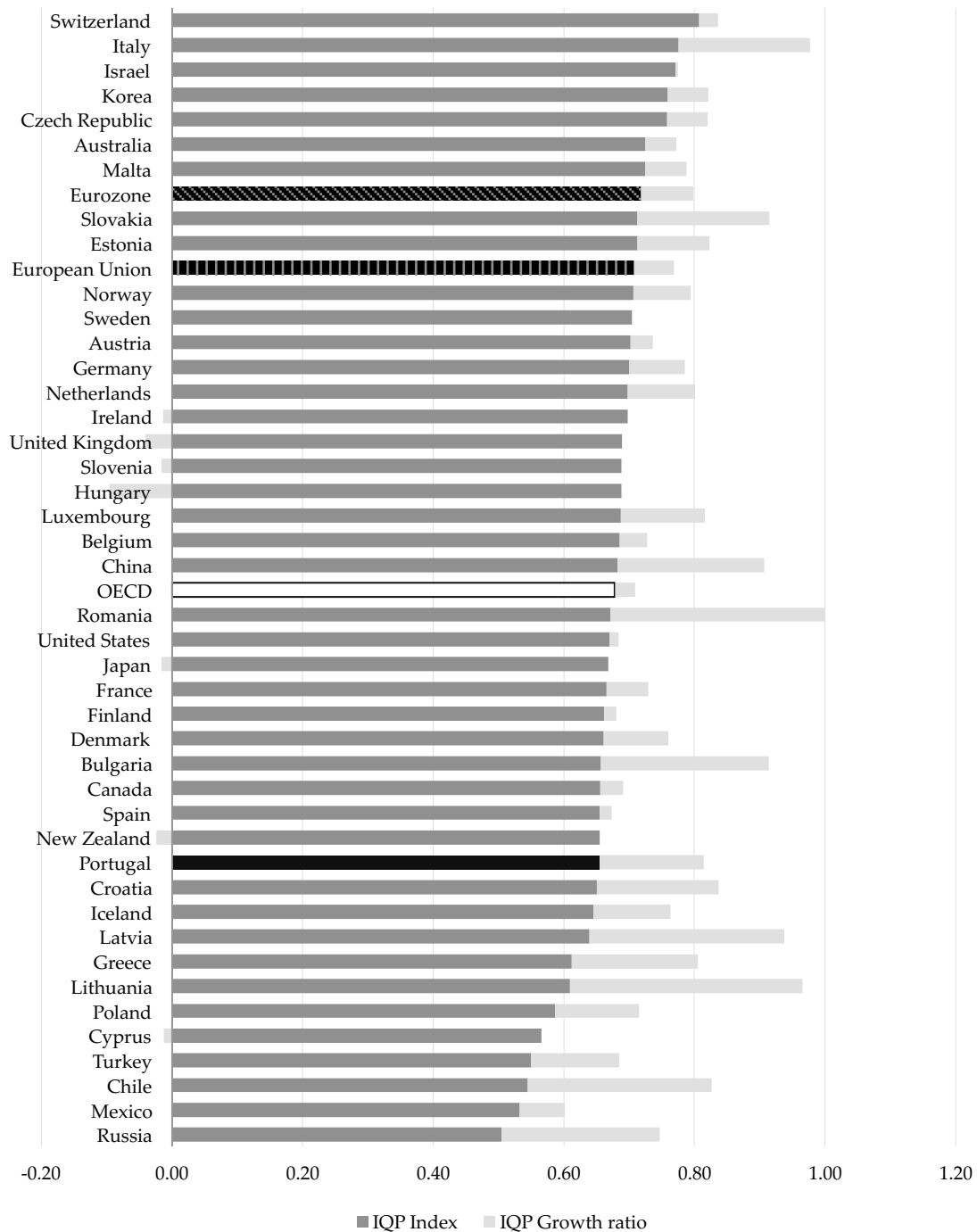


Figure 5: The IQP 2014 Index & Growth rank

The index ranking is clearly led by Switzerland, which is consistent with scores obtained on the previously reviewed measuring tools (see chapter one). Italy, Israel, Korea and Czech Republic follow, all scored above 0,75. Russia presents the weaker score, followed by Mexico, Chile, Turkey, Cyprus and Poland, all scoring bellow 0,60. The Eurozone and European Union are

positively positioned above mean value. Portugal falls slightly below average in terms of Index, with a higher than average Growth performance, revealing recent improvements and suggesting positive outlook on performance growth.

It is also of note that the top 10 weaker index performers present a mean Growth rate that is 100% greater than the mean Growth rate of the top 10 index performers, indicating greater progress potential for the weaker index performers and a slower growth for the top index performers, suggesting a plateauing performance.

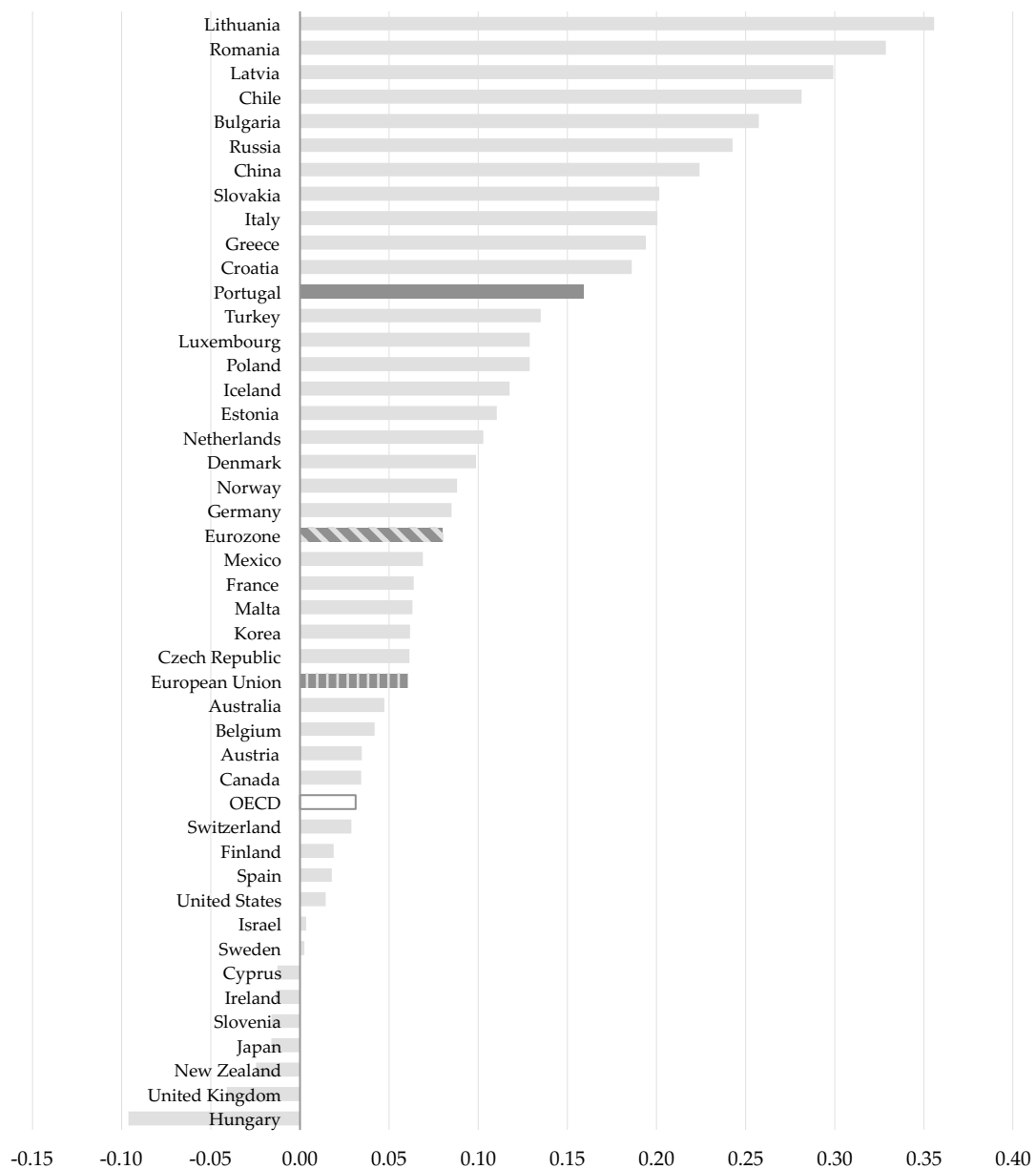


Figure 6: The IQP 2014 Growth Rank

In terms of IPQ Growth ratio (figure 6), Lithuania presents the higher score, representing a 36% rate, far from the average 10% rate for the sample, suggesting a strong outlook on future improvement. European Union, Eurozone and OECD present weaker Growth scores, suggesting some maturity in terms of performance evolution. Seven economies present negative scores for Growth: Cyprus, Ireland, Slovenia, Japan, New Zealand, United Kingdom and Hungary, with Hungary presenting the weakest score of -0,10 which reveal their internal performance is being outperformed by their peers.

(Please see annexed tables for full calculation tables and results)

3.2 Dimensional Performance

In terms of Innovation (Figure 6), Korea (0,94) and China (0,89) are clear leaders with distant scores over 10 points from the next performer, Israel (0,72) However, only China presents a positive growth rate, contrary to the average growth of -0,08. OECD is performing above average level while EU and the Eurozone are aligned with the mean value for performance. From the top 10 overall index performers, Switzerland, Israel, Korea and Czech Republic are among the most 10 innovative economies. Portugal takes 10th position in the 10 weaker economies in terms of innovation outputs, with a score below average. Its null growth rate does not suggest any trend, revealing some resistance to the tendency, or internal improvement being annulled by global factors. Luxembourg is the country that presents the smaller innovation score, believed to relate with data problems.

From all countries, Latvia presents the stronger positive growth rate (0,19) and Malta the stronger negative growth rate (-0,29). Significantly negative strong Growth ratio score is also identified for Hungary (-0,23), Finland (-0,23), Ireland (-0,22) and Japan (-0,19). The average Growth ratio negative score of -0,8 reveals a macro trend of decrease in Innovation output by the represented

economies. This trend suggests a possible alteration in the effectiveness of innovation inputs at macro-economic level Individual Innovation indicator scores for all years can be observed on appendix (tables 8, 9, 10, 11, 12 and 13).

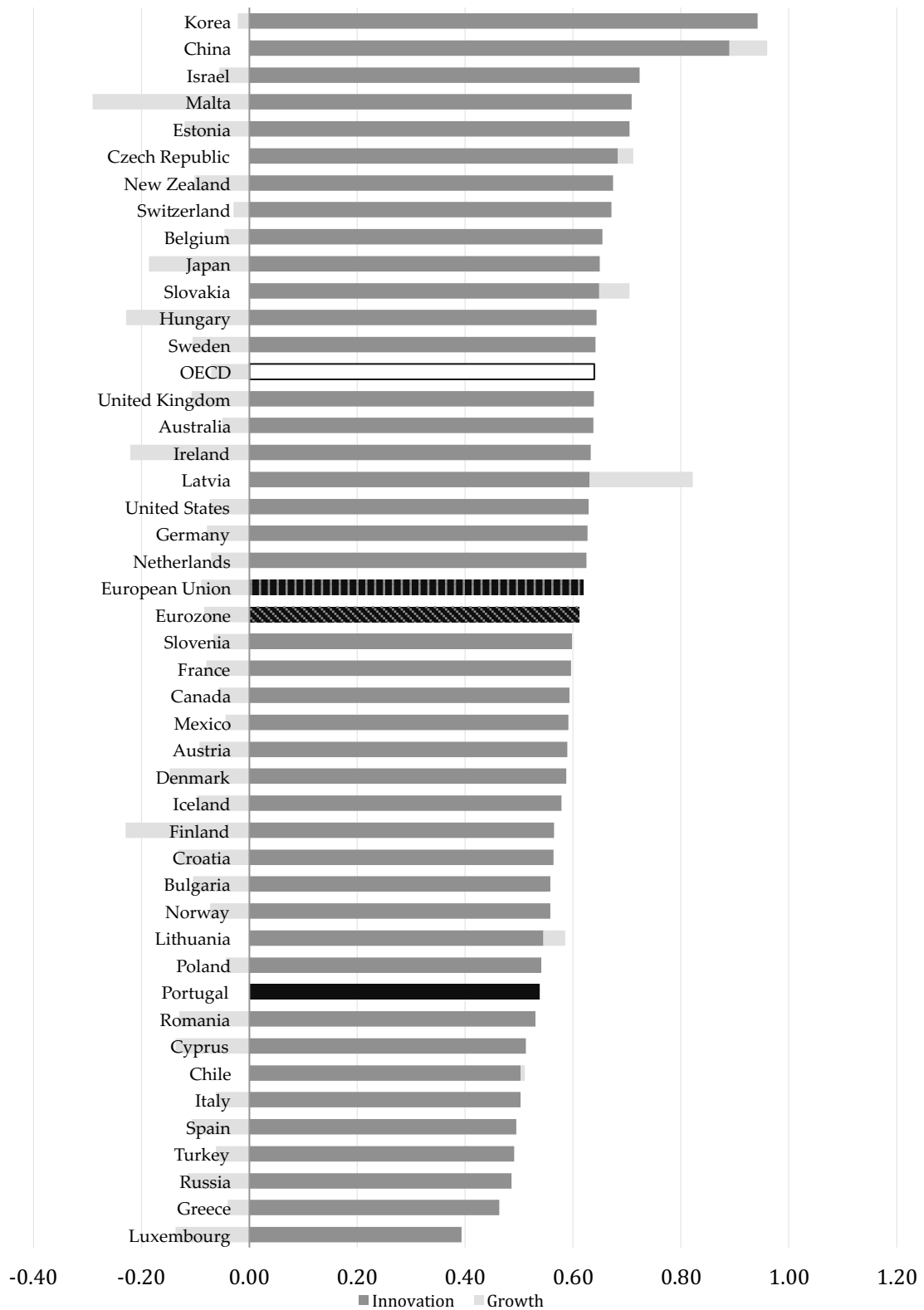


Figure 7: The IQP 2014 Innovation Index & Growth Rank

Quality (figure 8) is lead by Italy (an outlier), with an outstanding score of 1,041 and a very strong growth ratio score, suggesting evolution continuity.

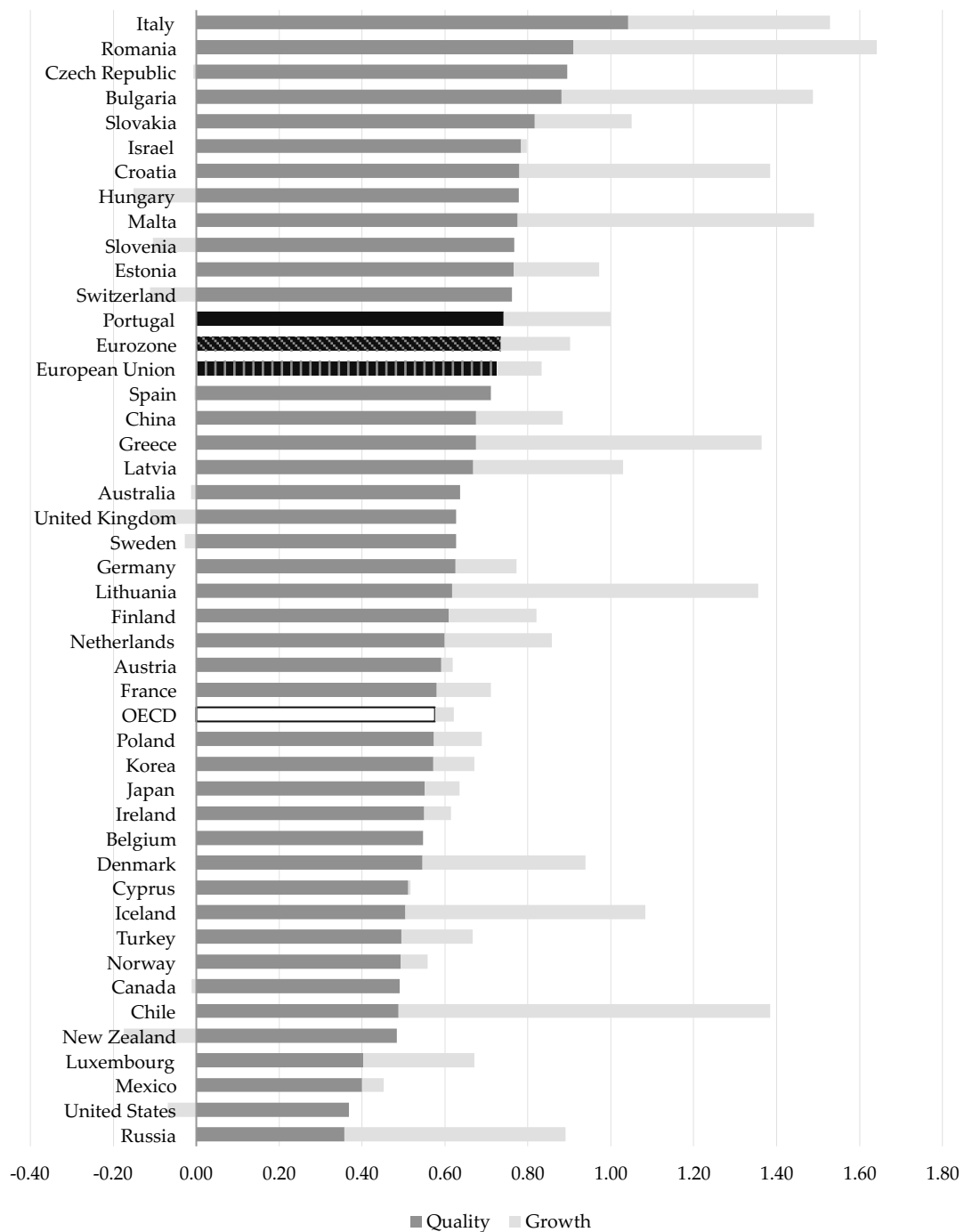


Figure 8: The IQP 2014 Quality Index & Growth rank

Secondly positioned, Romania, with 0,91 presents an even stronger ratio score, suggesting strong growth outlook. Italy is also, on par with Czech

Republic, Israel, Malta and Slovakia, part of the group of countries classified as top 10 performers on the overall index.

From the top 10 quality performers, Hungary, Slovenia and Switzerland present negative growth rates, limiting their growth expectations.

Portugal appears well positioned, 10 points above average score (0,74), in line with EU and Eurozone score (0,73) and with a positive growth rate, suggesting continued improvement.

From the 10 weaker performers in quality, Russia takes the last position, though a strong growth rate suggests improvement, followed by United States. The US presents together with New Zealand negative growth rates, representing a negative outlook for both economies. Out of this group, Chile, Russia and Iceland present strong outlook scores, suggesting future improvement of this pillar. Individual Quality indicator scores for all years can be observed on appendix (tables 14, 15, 16, 17, 18 and 19).

Productivity (figure 9) is lead by three consistently outlying score economies: Luxembourg, Norway and United States, followed shortly by Switzerland. Switzerland, Norway and Australia are also the only economies from the top 10 global index performers to be in the top 10 productivity performers, and these 3 countries also present strong growth rates.

From the 10 weaker productivity performers, China presents the lower productivity, albeit presenting the strongest growth rate for productivity (0,70). The second economy to reveal a strong score and growth outlook is Russia with 0,54. In terms of growth ratio outlook, the weaker performers present a mean growth ratio score of 0,34, the double of the top 10 performers, with 0,16, denoting a strong growth outlook by the lowest performers.

Portugal scores slightly bellow average, with an average growth ratio score.

Individual Productivity indicator scores for all years can be observed on appendix (tables 20, 21 and 22).

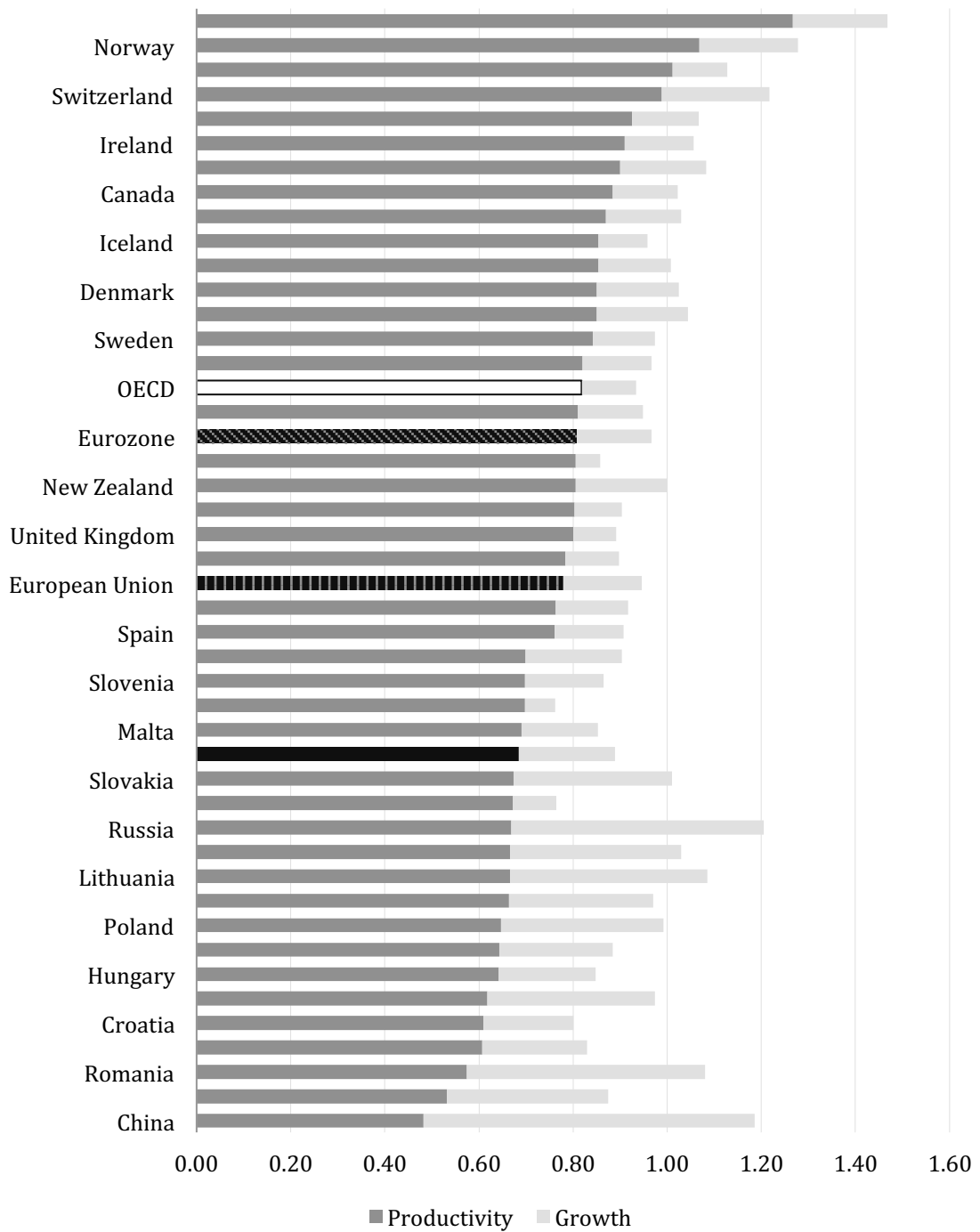


Figure 9: The IQP 2014 Productivity Index & Growth rank

3.3 Performer Classification and analysis

Performers were classified in terms of IQP Index and Growth, considering the group of outperformers (those with High Index and High Growth), and

underperformers (those with Low Index, Low Growth). Other groups include those countries with High Index and Low Growth, and those with Low Index and High Growth. This will enable us to analyse in detail each classes' detailed performance, seeking a better understanding of what variables are noticed to contribute for the results (table 4).

IQP Performers
Outperformers: High Performance & High Growth
Romania, China, Luxembourg, Netherlands, Estonia, Slovakia and Italy
Underperformers: Low Performance & Low Growth
Mexico, Cyprus, New Zealand, Spain, Canada, Finland, France, Japan and United States

Table 4: Economy classification as per IQP scores

By observing figure 10 it's visible that outperformers present the sharpest index evolution of the series, whilst underperformers present a very poor evolution, with actual score decreases in the post-2009 period. It is also visible a clear increase by Portugal, signalling a positive outlook in terms of evolution, closing the gap to OECD and European Union. Though positive, OECD presents a sluggish evolution when compared to the other series.

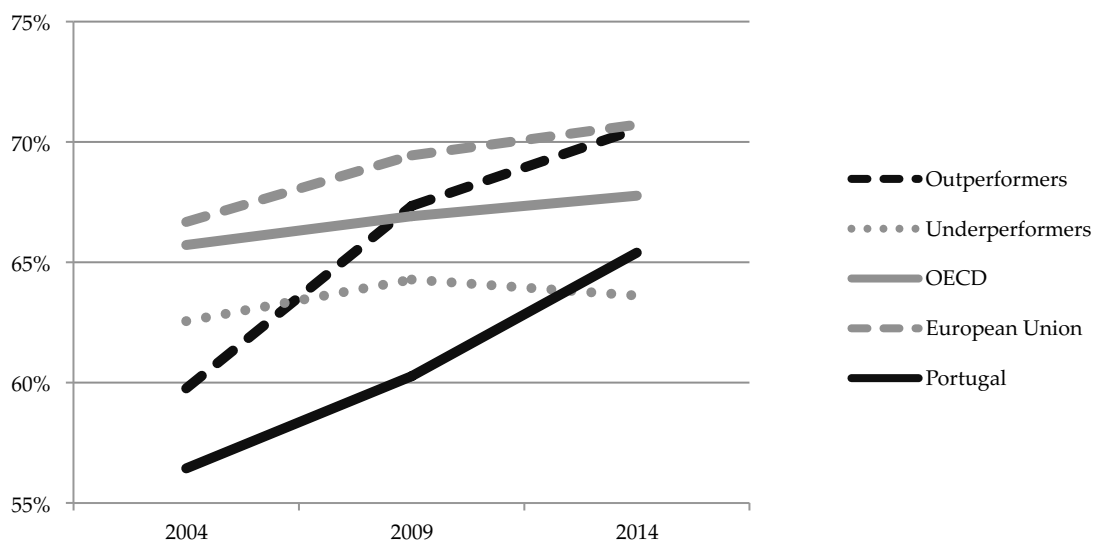


Figure 10: The IQP 2014 Evolution

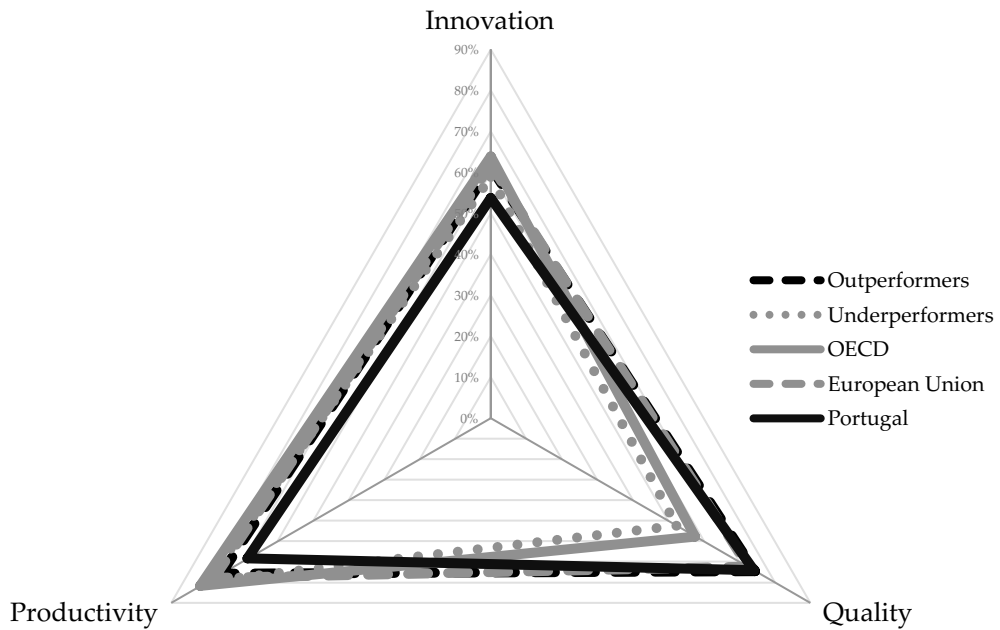


Figure 11: The IQP 2014 3-Dimensional Performance

By observing figure 11, the outperformers' display strong balanced scores for all three dimensions, with slight predominance for Productivity and is coincident with European Union's dimensional relation.

OECD presents a much stronger score on Productivity than on innovation, and a fairly poorer quality score. Both OECD and Underperformers present significant weaker scores on Quality. European Union is well aligned in terms of all dimensions with the Outperformers.

Portugal aligns its quality performance with the outperformers, however it's productivity and innovation scores are lower, even below the underperformers.

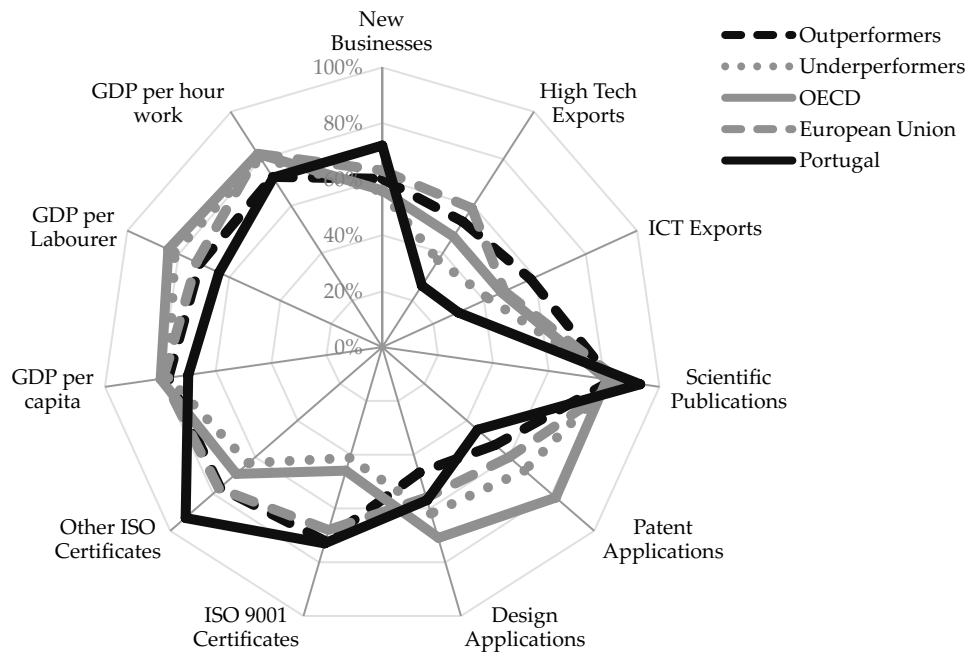


Figure 12: The IQP 2014 Output Indicators

Looking at detail in terms of the components of the 3 dimensions (IQP) we represented in Figure 12 all sub-indicators and the performance of Portugal and along with the outperformers, underperformers, and European Union and OECD averages. The outperformers present fairly balanced results overall, with a good distribution of strong scores.

By comparing both outperformers with underperformers, there are two main divergences noted: outperformers' score higher on high-tech and ICT exports, and in ISO certifications. However, it loses slightly to underperformers on labour productivity and significantly lower for Design and Patent Applications, which is an observation of importance for future research.

All economies present close scores on Scientific Publications and on GDP per capita (exception for Portugal on GDP per capita, scoring lower).

OECD is divergent from the outperformers with regards to ISO9001 certifications, scoring lower, and for Design and Patent Applications, scoring higher.

Portugal outperforms all economies on other ISO certifications, new Businesses and Scientific Publications, underperforming all on Patent applications, High-tech and ICT exports and GDP's per capita and per labourer. This indicates that Portugal's output performance for the moment has stronger results on Quality, and that this strength has not been accompanied by significant Productivity nor Innovation results.

3.4. Drivers of performance

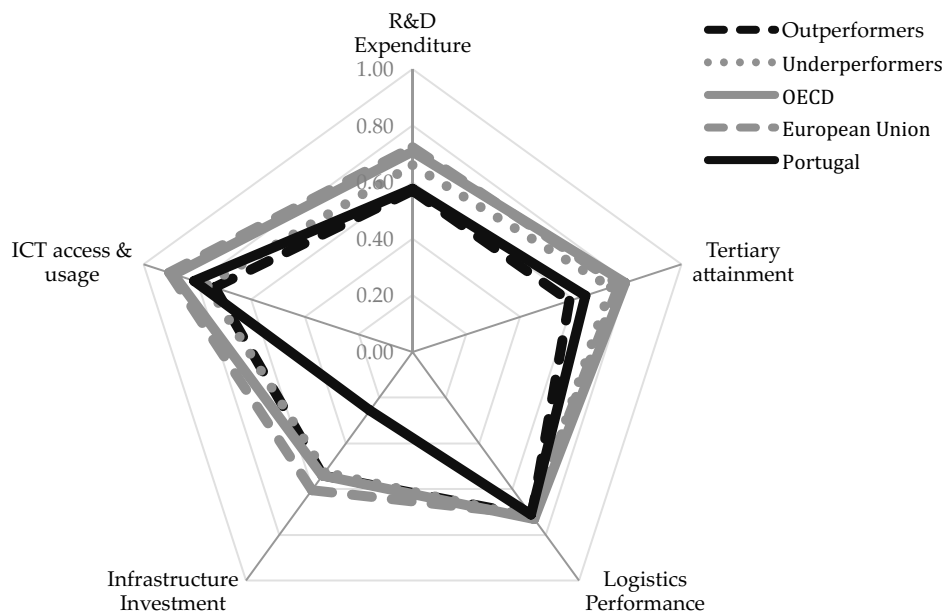


Figure 13: The IQP 2014 - Input Indicators

Input's are also an important aspect of performance. A selection of input indicators was calculated for the selected economies, hoping to better understand the differences and possible clues to different output performances (figure 13). These inputs were selected based on the review of existing models, by considering the indicators that represented consensual measures of

performance between models, that where available and that could fit the models' calculation methodology.

The chosen Input indicators have been ICT access & Usage (in terms of % of population – appendix, table 27) considered a relevant tool as potentiating innovative activities, Infrastructure Investment (in terms of % of GDP, appendix, table 23) and Logistics Performance (in terms of classification in a 1-5 score, World Bank, normalized – Appendix, table 25), both important infrastructure conditions, essential to development, R&D Expenditure (in % of GDP – appendix, table 24), measuring the economies' commitment to innovation, and tertiary attainment level (in terms of % of population of attainable age – appendix, table 26) as measure of the economies knowledge and education investment, as fundamental input measure for innovation, quality and productivity.

It is noticeable a generalised smaller input score by outperformers on each dimension (figure 13). The immediate possible conclusion is of a higher efficiency in terms of capturing the results from the smaller input level. It is also noticeable that Portugal presents a very low score on Infrastructure Investment, considerably far from any other peer economy.

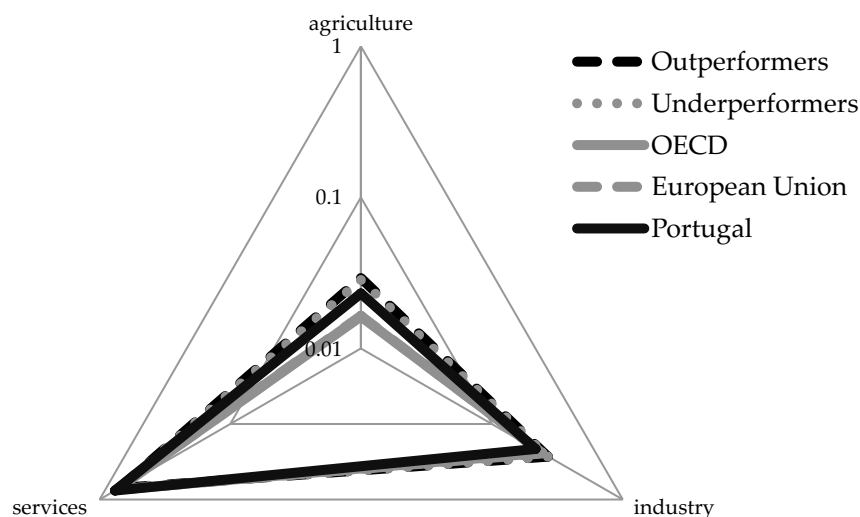


Figure 14: The IQP 2014 – Sectorial Performance

By looking in detail at the sectorial composition of each economy group, presenting a breakdown of GDP in terms of % of value added by agriculture, services and industry, figure 14 shows that there is no significant difference between outperformers and underperformers. However, Portugal does have a slight lesser composition of Industry and Agriculture. OECD average presents the lower weight in terms of agriculture.

Lastly, we'll be looking if culture may influence performance by means of affecting an economies' disposition towards an objective, here being the performance of the three dimensions, Innovation, Quality and Productivity. For this comparison, we'll be using Hofstede's cultural dimensions and country scores (table 28). Professor Geert Hofstede was responsible for conducting a study on cultural influence in workplace. The research developed a six dimensional model (Power Distance, Individualism, Masculinity, Uncertainty Avoidance, Long Term Orientation, Indulgence) where each nation is described culturally in terms of its national cultural values towards each dimension. This allows for country cultural value comparisons and also sheds some light into a

country's disposition towards certain objectives, which may influence or justify the levels of commitment, of perceived importance.

Power distance represents the acceptance of unequally distribution of power. Individualism culture value individuals and independence in detriment of collectivism. A Masculine culture represents competitiveness, achievement and success pursuit, whilst feminine represents cooperation, modesty and care and quality of life. Uncertainty Avoidance expresses how important to the society is to plan it's future. Long term orientated societies display pragmatic approaches, encouraging education and evolution, whilst short term prefer to maintain traditions and see changes with suspicion. Lastly, an Indulgent culture promotes enjoyment of life and leisure while a restraint prefers stricter norms and regulations.

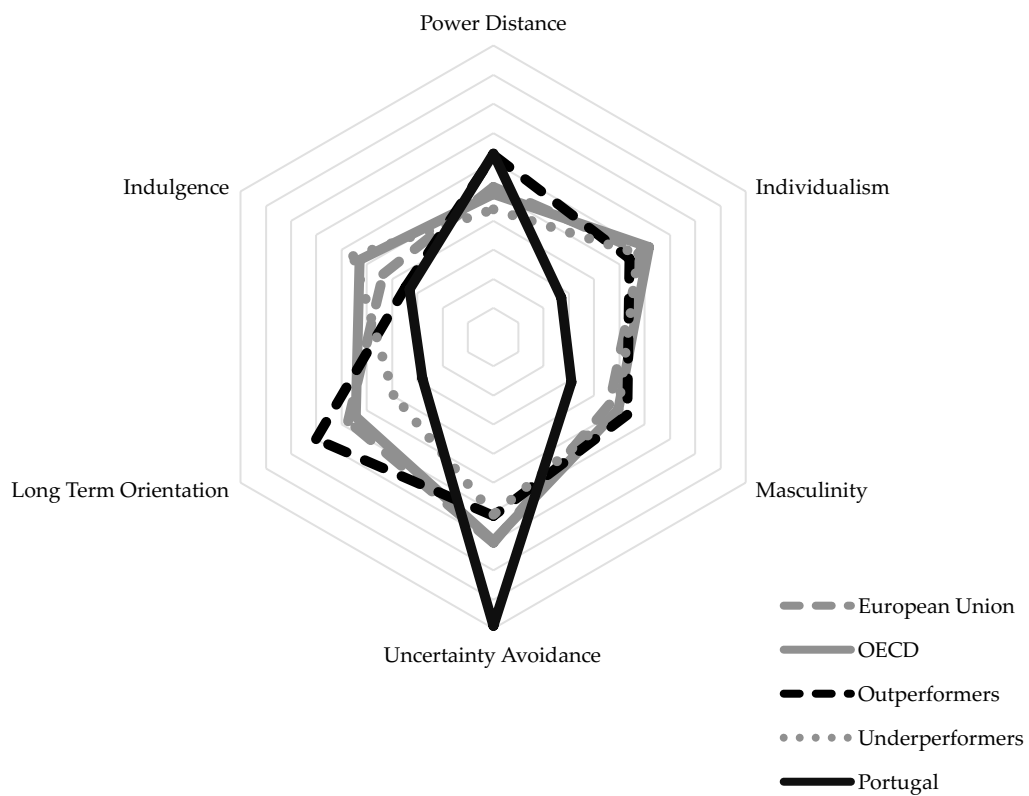


Figure 15: The IQP 2014 - Cultural Dimensions

By observation of figure 15, by comparing outperformers with underperformers, it is possible to verify that Outperformers demonstrate on average a much higher level of Long-term orientation and power distance, and a much lower level of Indulgence. The peak divergence in terms of Long term orientation suggests a pragmatic approach, strongly supportive of innovations as means of preparing the future, and thus a favourable cultural dimension supportive for Innovation. High performers also score lower on Indulgence, denoting societies that favour stricter norms, which could be considered a favourable cultural dimension supportive of Quality. Power Distance is also higher for Outperformers, suggesting a higher acceptance for hierarchical order, which could be positively contributing for it's higher performance scores.

Portugal presents strong uncertainty avoidance culture and high power distance acceptance, which could be both considered favourable cultural dimensions supportive for conformance and Quality. At the same time, short term orientation, more feminine and collective environment may represent cultural dimensions that are not so supportive of innovation and productivity.

Chapter 4

Conclusions

With this work it was intended to conceptualize and develop a new scoreboard of innovation, quality and productivity performance at macro-economic (country) level. The developed model built based its framework and methodology on the conclusions obtained from analysis of existing models by reference institutions, the *Innovation Union Scoreboard*, the *Global Innovation Index*, the *Global Competitiveness Report*, the *OECD Oslo Manual*, the *COTEC Innovation Digest*, and the *OECD Manual on Measuring Productivity*. The model was developed and applied at a selection of 43 global economies, selected by relevance and convenience for the purposes of this thesis.

The main results reveal that from the observed sample 15% of the economies are very strong performers, registering high Index scores and high Growth, 40% are good performers, with high Index scores, but with lower (than average) growth, 25% are average performers, with low Index scores but with higher Growth ratios suggesting future improvement and 20% are poor performers, with low Index scores and with lower and inclusively negative growth ratios, suggesting a very poor future performance and evolution. It was noticeable a higher growth rate on the overall weaker Index performers, suggesting recovery potential, opposed by a predominance of poor growth rates on average on the higher Index scored economies, suggesting a plateauing performance.

Looking at individual dimensions, results show Innovation with a generalized negative Growth ratio, suggesting a negative trend possibly due to alterations in the effectiveness of innovation inputs at macro-economic level. With regards to Quality, positive Index scores are accompanied by strong Growth ratios, which suggests a positive increase in the importance of Quality, with the majority of economies reaching strong improvements. Productivity also presents strong results and generalized positive growth, with the weaker index performer registering the stronger Growth ratios, which also denotes a strong improvement tendency of the weaker performers.

The sample was also segmented in terms of outperformers and underperformers for further analysis and observation of index performance over time revealed sharp evolution of outperformers versus a regressive inflexion by the underperformers. Outperformers presented stronger results overall in terms of Quality and Innovation, being surpassed by underperformers on Productivity. Looking at input, Outperformers presented lower scores overall, revealing a higher efficiency in obtaining the objectives.

Looking specifically at Portugal, it is an average performer, with low performance index score and high growth ratio. Noticeably distant from average in terms of overall index performance, it presents a strong score on the Growth Ratio (also visible in the time evolution analysis), denoting recent efforts and success in the measured dimensions. If it presents a poor Innovation and Productivity score, it's with Quality that Portugal outstands the average, with a strong performance index and growth ratio. In terms of outputs, Portugal is distant from all economies in terms of High Tech and ICT exports, while surpassing all with other ISO Certifications.

The methodology broadly illustrates the state of the art in terms of performance of these economies for these three dimensions. It is recognized that limitations with data availability may introduce data bias and is recommended

the increase of number indicators used to measure each dimension.

It was intended to develop a versatile model that could be adapted and applied to different scopes. It is suggested the application of the model for sectorial breakdown and different aggregation levels, in particular for the services sector.

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Appendix

IQP Index 2004 rank				
Country	Innovation	Quality	Productivity	Global
Austria	0,649	0,575	0,810	0,678
Belgium	0,686	0,547	0,740	0,658
Cyprus	0,593	0,508	0,616	0,572
Estonia	0,800	0,634	0,489	0,641
Finland	0,733	0,503	0,712	0,649
France	0,647	0,514	0,715	0,625
Germany	0,680	0,544	0,712	0,645
Greece	0,482	0,399	0,655	0,512
Ireland	0,811	0,517	0,792	0,707
Italy	0,535	0,700	0,702	0,646
Latvia	0,529	0,490	0,455	0,491
Lithuania	0,524	0,355	0,469	0,449
Luxembourg	0,455	0,317	1,054	0,608
Malta	0,998	0,452	0,593	0,681
Netherlands	0,672	0,477	0,749	0,633
Portugal	0,536	0,589	0,568	0,564
Slovakia	0,614	0,661	0,504	0,593
Slovenia	0,641	0,857	0,598	0,699
Spain	0,553	0,713	0,663	0,643
Bulgaria	0,622	0,548	0,396	0,522
Croatia	0,649	0,485	0,511	0,548
Czech Republic	0,663	0,900	0,579	0,714
Denmark	0,689	0,391	0,724	0,601
Hungary	0,833	0,916	0,532	0,761
Poland	0,565	0,514	0,480	0,520
Romania	0,608	0,526	0,381	0,505
Sweden	0,716	0,644	0,744	0,701
United Kingdom	0,714	0,705	0,733	0,718
Australia	0,671	0,644	0,761	0,692
Canada	0,629	0,496	0,777	0,634
Chile	0,499	0,257	0,519	0,425
Iceland	0,639	0,319	0,774	0,577
Israel	0,765	0,772	0,766	0,768
Japan	0,797	0,509	0,729	0,678
Korea	0,962	0,520	0,662	0,715
Mexico	0,619	0,379	0,496	0,498
New Zealand	0,751	0,587	0,675	0,671
Norway	0,601	0,462	0,883	0,649
Switzerland	0,692	0,856	0,804	0,784
Turkey	0,523	0,423	0,507	0,484
United States	0,678	0,396	0,905	0,660
Russia	0,548	0,232	0,435	0,405
China	0,830	0,558	0,283	0,557
Eurozone	0,667	0,629	0,696	0,664
European Union	0,680	0,654	0,667	0,667
OECD	0,688	0,551	0,733	0,657

Table 5: IQP Index 2004 - rank

IQP Index 2009 rank				
Country	Innovation	Quality	Productivity	Global
Austria	0,582	0,568	0,856	0,669
Belgium	0,668	0,554	0,792	0,671
Cyprus	0,591	0,697	0,701	0,663
Estonia	0,646	0,731	0,569	0,649
Finland	0,663	0,589	0,774	0,675
France	0,612	0,550	0,774	0,645
Germany	0,636	0,634	0,763	0,678
Greece	0,458	0,602	0,712	0,591
Ireland	0,709	0,575	0,827	0,704
Italy	0,503	0,919	0,760	0,727
Latvia	0,604	0,639	0,525	0,589
Lithuania	0,529	0,622	0,547	0,566
Luxembourg	0,427	0,441	1,143	0,670
Malta	0,780	0,684	0,659	0,707
Netherlands	0,614	0,613	0,825	0,684
Portugal	0,535	0,630	0,643	0,603
Slovakia	0,635	0,771	0,607	0,671
Slovenia	0,620	0,779	0,653	0,684
Spain	0,493	0,786	0,736	0,672
Bulgaria	0,575	0,844	0,487	0,635
Croatia	0,595	0,749	0,571	0,639
Czech Republic	0,673	0,917	0,647	0,746
Denmark	0,627	0,562	0,784	0,658
Hungary	0,768	0,799	0,597	0,721
Poland	0,561	0,647	0,561	0,590
Romania	0,585	0,904	0,496	0,662
Sweden	0,660	0,664	0,789	0,705
United Kingdom	0,626	0,637	0,762	0,675
Australia	0,629	0,483	0,840	0,651
Canada	0,614	0,485	0,820	0,640
Chile	0,483	0,522	0,566	0,524
Iceland	0,633	0,309	0,820	0,587
Israel	0,797	0,795	0,760	0,784
Japan	0,726	0,608	0,751	0,695
Korea	0,931	0,661	0,718	0,770
Mexico	0,613	0,376	0,546	0,512
New Zealand	0,707	0,489	0,731	0,642
Norway	0,567	0,478	0,983	0,676
Switzerland	0,685	0,794	0,906	0,795
Turkey	0,500	0,598	0,597	0,565
United States	0,641	0,356	0,928	0,642
Russia	0,481	0,532	0,585	0,533
China	0,878	0,691	0,382	0,650
Eurozone	0,624	0,722	0,756	0,701
European Union	0,634	0,724	0,726	0,695
OECD	0,654	0,597	0,756	0,669

Table 6: IQP Index 2009 - rank

IQP Index 2014 rank				
Country	Innovation	Quality	Productivity	Global
Austria	0,589	0,591	0,924	0,701
Belgium	0,654	0,547	0,854	0,685
Cyprus	0,512	0,511	0,672	0,565
Estonia	0,704	0,765	0,666	0,712
Finland	0,565	0,609	0,810	0,661
France	0,596	0,580	0,819	0,665
Germany	0,626	0,624	0,849	0,700
Greece	0,462	0,674	0,697	0,611
Ireland	0,632	0,550	0,909	0,697
Italy	0,502	1,041	0,783	0,775
Latvia	0,631	0,667	0,617	0,638
Lithuania	0,545	0,617	0,666	0,609
Luxembourg	0,393	0,402	1,266	0,687
Malta	0,708	0,775	0,690	0,724
Netherlands	0,624	0,600	0,869	0,697
Portugal	0,538	0,741	0,684	0,654
Slovakia	0,648	0,816	0,673	0,712
Slovenia	0,598	0,767	0,698	0,687
Spain	0,494	0,710	0,760	0,655
Bulgaria	0,557	0,881	0,531	0,656
Croatia	0,563	0,778	0,609	0,650
Czech Republic	0,682	0,894	0,698	0,758
Denmark	0,587	0,545	0,850	0,660
Hungary	0,643	0,778	0,642	0,687
Poland	0,540	0,573	0,646	0,586
Romania	0,529	0,910	0,574	0,671
Sweden	0,641	0,626	0,842	0,703
United Kingdom	0,638	0,627	0,800	0,688
Australia	0,637	0,636	0,900	0,724
Canada	0,592	0,490	0,884	0,655
Chile	0,503	0,487	0,643	0,544
Iceland	0,578	0,504	0,854	0,645
Israel	0,723	0,783	0,805	0,770
Japan	0,649	0,551	0,802	0,667
Korea	0,942	0,572	0,763	0,759
Mexico	0,591	0,399	0,607	0,532
New Zealand	0,674	0,484	0,805	0,654
Norway	0,557	0,493	1,067	0,706
Switzerland	0,671	0,761	0,987	0,806
Turkey	0,490	0,495	0,663	0,550
United States	0,628	0,369	1,011	0,669
Russia	0,485	0,357	0,669	0,504
China	0,889	0,674	0,482	0,682
Eurozone	0,611	0,734	0,807	0,717
European Union	0,619	0,725	0,778	0,707
OECD	0,639	0,576	0,818	0,678

Table 7: IQP Index 2014 - rank

Innovation: Scientific Publications per 1 000 000 000 GDP, PPP (current US\$) - rank			
Country	2004	2009	2014
Austria	0,862	0,894	0,873
Belgium	0,892	0,924	0,901
Cyprus	0,732	0,862	0,933
Estonia	0,865	0,943	0,943
Finland	0,964	0,974	0,966
France	0,839	0,853	0,820
Germany	0,843	0,858	0,818
Greece	0,819	0,882	0,899
Ireland	0,818	0,904	0,867
Italy	0,799	0,829	0,835
Latvia	0,660	0,736	0,762
Lithuania	0,767	0,868	0,797
Luxembourg	0,564	0,704	0,770
Malta	0,627	0,731	0,825
Netherlands	0,903	0,930	0,914
Portugal	0,797	0,876	0,933
Slovakia	0,834	0,807	0,844
Slovenia	0,917	0,999	0,990
Spain	0,816	0,849	0,865
Bulgaria	0,812	0,794	0,757
Croatia	0,877	0,931	0,916
Czech Republic	0,844	0,886	0,911
Denmark	0,945	0,978	0,989
Hungary	0,832	0,837	0,808
Poland	0,843	0,827	0,806
Romania	0,685	0,798	0,777
Sweden	0,967	0,975	0,965
United Kingdom	0,914	0,953	0,918
Australia	0,925	0,956	0,954
Canada	0,901	0,935	0,889
Chile	0,688	0,730	0,724
Iceland	0,900	0,997	1,000
Israel	1,000	0,991	0,919
Japan	0,769	0,773	0,726
Korea	0,767	0,820	0,829
Mexico	0,554	0,573	0,555
New Zealand	0,967	1,000	0,959
Norway	0,853	0,896	0,876
Switzerland	1,000	0,999	0,968
Turkey	0,753	0,764	0,721
United States	0,810	0,819	0,778
Russia	0,740	0,636	0,627
China	0,692	0,751	0,722
Eurozone	0,838	0,864	0,849
European Union	0,855	0,880	0,862
OECD	0,823	0,836	0,807

Table 8: IQP Index: Innovation – Scientific Publications

Innovation: Patent Applications per 1 000 000 000 GDP, PPP (current US\$) - rank			
Country	2004	2009	2014
Austria	0,627	0,598	0,560
Belgium	0,424	0,430	0,435
Cyprus	0,541	0,293	0,226
Estonia	0,570	0,496	0,389
Finland	0,694	0,636	0,586
France	0,634	0,587	0,573
Germany	0,794	0,760	0,739
Greece	0,397	0,435	0,444
Ireland	0,551	0,542	0,393
Italy	0,555	0,535	0,522
Latvia	0,549	0,580	0,444
Lithuania	0,456	0,421	0,431
Luxembourg	0,390	0,435	0,510
Malta	1,000	0,464	0,365
Netherlands	0,533	0,507	0,482
Portugal	0,350	0,441	0,453
Slovakia	0,556	0,425	0,401
Slovenia	0,616	0,619	0,601
Spain	0,467	0,454	0,431
Bulgaria	0,554	0,449	0,423
Croatia	0,752	0,501	0,439
Czech Republic	0,562	0,480	0,474
Denmark	0,661	0,598	0,567
Hungary	0,722	0,503	0,454
Poland	0,717	0,520	0,519
Romania	0,564	0,490	0,456
Sweden	0,650	0,591	0,553
United Kingdom	0,712	0,641	0,623
Australia	0,886	0,824	0,800
Canada	0,880	0,836	0,783
Chile	0,711	0,572	0,605
Iceland	0,969	0,582	0,524
Israel	0,892	0,864	0,788
Japan	1,176	1,098	1,045
Korea	1,212	1,188	1,207
Mexico	0,656	0,621	0,596
New Zealand	1,020	0,951	0,937
Norway	0,828	0,689	0,530
Switzerland	0,603	0,550	0,517
Turkey	0,388	0,459	0,490
United States	0,838	0,856	0,868
Russia	0,768	0,698	0,657
China	0,788	0,834	0,966
Eurozone	0,652	0,618	0,606
European Union	0,664	0,611	0,597
OECD	0,868	0,829	0,817

Table 9: IQP Index: Innovation – Patent Applications

Innovation: Industrial Design applications per 1 000 000 000 GDP, PPP (current US\$) - rank			
Country	2004	2009	2014
Austria	0,824	0,625	0,622
Belgium			
Cyprus	0,428	0,515	0,356
Estonia	1,077	0,747	0,624
Finland	0,550	0,532	0,501
France	0,694	0,621	0,597
Germany	0,676	0,608	0,608
Greece	0,654	0,500	0,457
Ireland	0,492	0,407	0,453
Italy	0,543	0,466	0,464
Latvia	0,608	0,705	0,559
Lithuania	0,561	0,495	0,519
Luxembourg			
Malta	0,737	0,374	0,485
Netherlands			
Portugal	0,500	0,557	0,569
Slovakia	0,658	0,478	0,462
Slovenia	0,997	0,623	0,545
Spain	0,639	0,522	0,535
Bulgaria	1,000	0,673	0,605
Croatia	0,863	0,862	0,699
Czech Republic	0,663	0,570	0,515
Denmark	0,629	0,510	0,368
Hungary	0,728	0,544	0,506
Poland	0,746	0,651	0,541
Romania	0,845	0,591	0,508
Sweden	0,668	0,597	0,512
United Kingdom	0,618	0,573	0,607
Australia	0,888	0,799	0,807
Canada	0,717	0,690	0,707
Chile	0,591	0,563	0,535
Iceland	0,743	0,894	0,813
Israel	0,864	0,876	0,767
Japan	0,931	0,851	0,816
Korea	1,268	1,302	1,277
Mexico	0,612	0,594	0,600
New Zealand	0,926	0,898	0,851
Norway	0,692	0,622	0,707
Switzerland	0,739	0,799	0,789
Turkey	0,838	0,828	0,829
United States	0,607	0,593	0,613
Russia	0,635	0,553	0,559
China	1,076	1,219	1,213
Eurozone	0,642	0,556	0,551
European Union	0,656	0,569	0,557
OECD	0,749	0,714	0,708

Table 10: IQP Index: Innovation – Industrial Design Applications

Innovation: New Business registrations per 1 000 000 000 GDP, PPP (current US\$) - rank			
Country	2004	2009	2014
Austria	0,414	0,393	0,399
Belgium	0,590	0,574	0,524
Cyprus	1,113	1,096	1,017
Estonia	0,907	0,901	0,981
Finland	0,585	0,623	0,604
France	0,626	0,613	0,548
Germany	0,496	0,495	0,461
Greece	0,470	0,463	0,470
Ireland	0,704	0,644	0,661
Italy	0,585	0,565	0,570
Latvia	0,897	0,836	0,926
Lithuania	0,675	0,693	0,713
Luxembourg	0,606	0,618	0,581
Malta	0,935	0,882	1,000
Netherlands	0,650	0,636	0,650
Portugal	0,732	0,705	0,716
Slovakia	0,756	0,748	0,663
Slovenia	0,639	0,712	0,704
Spain	0,720	0,589	0,617
Bulgaria	0,953	0,944	0,959
Croatia	0,719	0,687	0,770
Czech Republic	0,640	0,660	0,654
Denmark	0,676	0,641	0,623
Hungary	0,769	0,839	0,703
Poland	0,504	0,470	0,449
Romania	1,038	0,812	0,765
Sweden	0,627	0,635	0,697
United Kingdom	0,835	0,775	0,768
Australia	0,831	0,803	0,854
Canada	0,456	0,442	0,467
Chile	0,761	0,770	0,887
Iceland	0,917	0,845	0,771
Israel	0,669	0,653	0,612
Japan	0,496	0,477	0,282
Korea	0,580	0,562	0,594
Mexico	0,517	0,550	0,543
New Zealand	1,103	0,975	0,919
Norway	0,637	0,587	0,660
Switzerland	0,557	0,529	0,505
Turkey	0,615	0,562	0,536
United States			
Russia	0,863	0,774	0,732
China			
Eurozone	0,613	0,584	0,569
European Union	0,680	0,639	0,626
OECD	0,594	0,571	0,561

Table 11: IQP Index: Innovation – New Business Registrations

Innovation: High Technology Exports per GDP, PPP (current US\$) - rank			
Country	2004	2009	2014
Austria	0,715	0,589	0,674
Belgium	0,777	0,835	0,927
Cyprus	0,103	0,190	0,104
Estonia	0,567	0,363	0,587
Finland	0,792	0,568	0,414
France	0,590	0,593	0,650
Germany	0,717	0,665	0,714
Greece	0,192	0,184	0,199
Ireland	1,371	1,108	0,946
Italy	0,376	0,345	0,370
Latvia	0,211	0,298	0,478
Lithuania	0,233	0,388	0,474
Luxembourg	0,583	0,462	0,335
Malta	1,286	0,952	0,807
Netherlands	1,000	0,815	0,910
Portugal	0,349	0,219	0,259
Slovakia	0,394	0,460	0,694
Slovenia	0,417	0,465	0,476
Spain	0,294	0,253	0,307
Bulgaria	0,184	0,248	0,289
Croatia	0,334	0,276	0,277
Czech Republic	0,592	0,696	0,821
Denmark	0,731	0,676	0,601
Hungary	0,906	0,881	0,707
Poland	0,196	0,295	0,380
Romania	0,190	0,295	0,285
Sweden	0,734	0,577	0,601
United Kingdom	0,565	0,449	0,511
Australia	0,217	0,189	0,204
Canada	0,437	0,413	0,435
Chile	0,116	0,118	0,127
Iceland	0,253	0,431	0,281
Israel	0,551	0,606	0,596
Japan	0,568	0,473	0,456
Korea	0,814	0,799	0,872
Mexico	0,503	0,429	0,467
New Zealand	0,230	0,185	0,191
Norway	0,361	0,367	0,385
Switzerland	0,957	0,988	1,049
Turkey	0,119	0,112	0,122
United States	0,371	0,297	0,293
Russia	0,185	0,125	0,161
China	0,522	0,519	0,544
Eurozone	0,624	0,567	0,623
European Union	0,606	0,545	0,594
OECD	0,511	0,449	0,473

Table 12: IQP Index: Innovation – High-Technology Exports

Innovation: ICT Goods Exports per GDP, PPP (current US\$) - rank			
Country	2004	2009	2014
Austria	0,453	0,393	0,406
Belgium	0,401	0,310	0,260
Cyprus	0,643	0,588	0,438
Estonia	0,814	0,427	0,700
Finland	0,811	0,642	0,318
France	0,500	0,405	0,386
Germany	0,553	0,432	0,417
Greece	0,359	0,284	0,305
Ireland	0,931	0,649	0,471
Italy	0,353	0,279	0,254
Latvia	0,252	0,466	0,615
Lithuania	0,452	0,309	0,337
Luxembourg	0,521	0,351	0,277
Malta	1,402	1,276	0,765
Netherlands	0,805	0,690	0,646
Portugal	0,491	0,412	0,297
Slovakia	0,484	0,895	0,824
Slovenia	0,258	0,299	0,269
Spain	0,384	0,290	0,209
Bulgaria	0,229	0,341	0,311
Croatia	0,346	0,316	0,279
Czech Republic	0,680	0,745	0,719
Denmark	0,490	0,362	0,373
Hungary	1,043	1,000	0,679
Poland	0,383	0,600	0,546
Romania	0,328	0,525	0,384
Sweden	0,652	0,588	0,517
United Kingdom	0,644	0,363	0,401
Australia	0,276	0,203	0,204
Canada	0,379	0,365	0,273
Chile	0,128	0,145	0,139
Iceland	0,053	0,051	0,077
Israel	0,616	0,794	0,657
Japan	0,842	0,682	0,568
Korea	1,132	0,917	0,873
Mexico	0,870	0,913	0,786
New Zealand	0,258	0,232	0,184
Norway	0,233	0,244	0,185
Switzerland	0,293	0,247	0,198
Turkey	0,423	0,277	0,242
United States	0,764	0,642	0,588
Russia	0,098	0,103	0,175
China	1,073	1,068	1,000
Eurozone	0,633	0,553	0,469
European Union	0,618	0,561	0,476
OECD	0,581	0,524	0,470

Table 13: IQP Index: Innovation – ICT Goods Exports

Quality: ISO 9001 Certifications per 1 000 000 000 GDP, PPP (current US\$)- rank			
Country	2004	2009	2014
Austria	0,481	0,498	0,451
Belgium	0,513	0,437	0,384
Cyprus	0,777	0,695	0,458
Estonia	0,656	0,737	0,739
Finland	0,464	0,469	0,484
France	0,485	0,449	0,469
Germany	0,455	0,552	0,538
Greece	0,426	0,539	0,605
Ireland	0,461	0,470	0,422
Italy	1,000	1,125	1,242
Latvia	0,579	0,617	0,647
Lithuania	0,462	0,614	0,543
Luxembourg	0,266	0,348	0,232
Malta	0,751	0,880	0,856
Netherlands	0,467	0,573	0,502
Portugal	0,661	0,599	0,725
Slovakia	0,700	0,740	0,768
Slovenia	0,886	0,769	0,724
Spain	0,842	0,877	0,673
Bulgaria	0,682	0,972	0,952
Croatia	0,540	0,766	0,775
Czech Republic	0,995	0,989	0,890
Denmark	0,339	0,389	0,358
Hungary	1,098	0,818	0,742
Poland	0,476	0,585	0,443
Romania	0,730	0,984	0,959
Sweden	0,547	0,534	0,473
United Kingdom	0,710	0,598	0,551
Australia	0,736	0,454	0,600
Canada	0,411	0,347	0,344
Chile	0,308	0,576	0,475
Iceland	0,232	0,184	0,305
Israel	0,912	0,854	0,793
Japan	0,506	0,574	0,440
Korea	0,470	0,574	0,371
Mexico	0,234	0,246	0,267
New Zealand	0,710	0,410	0,386
Norway	0,368	0,368	0,372
Switzerland	0,902	0,767	0,672
Turkey	0,378	0,508	0,342
United States	0,244	0,199	0,193
Russia	0,226	0,614	0,246
China	0,675	0,676	0,610
Eurozone	0,654	0,714	0,705
European Union	0,666	0,703	0,679
OECD	0,496	0,524	0,465

Table 14: IQP Index: Quality – ISO 9001 certifications

Quality: ISO 13485 Certifications per 1 000 000 000 GDP, PPP (current US\$) - rank			
Country	2004	2009	2014
Austria	0,733	0,737	0,834
Belgium	0,510	0,625	0,724
Cyprus	0,000	0,462	0,394
Estonia	0,645	0,514	0,697
Finland	0,503	0,720	0,680
France	0,609	0,684	0,710
Germany	0,590	0,888	0,833
Greece	0,420	0,548	0,661
Ireland	0,679	0,794	0,774
Italy	0,000	0,766	0,941
Latvia	0,497	0,608	0,532
Lithuania	0,000	0,322	0,573
Luxembourg	0,000	0,354	0,632
Malta	0,000	0,000	0,622
Netherlands	0,461	0,647	0,645
Portugal	0,300	0,443	0,607
Slovakia	0,504	0,758	0,712
Slovenia	0,582	0,546	0,740
Spain	0,198	0,423	0,603
Bulgaria	0,470	0,487	0,701
Croatia	0,404	0,555	0,636
Czech Republic	0,618	0,734	0,844
Denmark	0,558	0,754	0,775
Hungary	0,629	0,606	0,702
Poland	0,520	0,593	0,586
Romania	0,000	0,483	0,560
Sweden	0,784	0,833	0,815
United Kingdom	0,832	0,778	0,821
Australia	0,324	0,468	0,549
Canada	0,550	0,683	0,730
Chile	0,000	0,260	0,313
Iceland	0,763	0,666	0,850
Israel	0,859	1,000	1,088
Japan	0,314	0,513	0,617
Korea	0,458	0,626	0,812
Mexico	0,426	0,435	0,435
New Zealand	0,429	0,488	0,533
Norway	0,569	0,517	0,537
Switzerland	1,000	1,078	1,137
Turkey	0,417	0,472	0,501
United States	0,574	0,592	0,657
Russia	0,220	0,382	0,365
China	0,255	0,540	0,545
Eurozone	0,532	0,747	0,789
European Union	0,620	0,742	0,783
OECD	0,575	0,660	0,711

Table 15: IQP Index: Quality – ISO 13485 Certifications

Quality: ISO 14001 Certifications per 1 000 000 000 GDP, PPP (current US\$) - rank			
Country	2004	2009	2014
Austria	0,648	0,661	0,671
Belgium	0,643	0,610	0,648
Cyprus	0,718	0,734	0,623
Estonia	0,786	0,911	0,984
Finland	0,833	0,790	0,832
France	0,616	0,619	0,689
Germany	0,623	0,607	0,617
Greece	0,484	0,554	0,685
Ireland	0,640	0,665	0,674
Italy	0,711	0,845	0,972
Latvia	0,703	0,724	0,842
Lithuania	0,744	0,893	0,885
Luxembourg	0,583	0,561	0,548
Malta	0,459	0,507	0,642
Netherlands	0,648	0,598	0,676
Portugal	0,640	0,634	0,747
Slovakia	0,671	0,806	0,955
Slovenia	0,902	0,837	0,832
Spain	0,843	0,936	0,890
Bulgaria	0,424	0,775	1,000
Croatia	0,582	0,788	0,925
Czech Republic	0,855	1,041	1,058
Denmark	0,770	0,743	0,702
Hungary	0,828	0,865	0,893
Poland	0,596	0,617	0,635
Romania	0,640	1,107	1,128
Sweden	1,000	0,947	0,895
United Kingdom	0,727	0,764	0,821
Australia	0,719	0,583	0,782
Canada	0,591	0,507	0,552
Chile	0,617	0,621	0,646
Iceland	0,456	0,497	0,678
Israel	0,597	0,646	0,676
Japan	0,825	0,910	0,775
Korea	0,600	0,794	0,678
Mexico	0,435	0,441	0,466
New Zealand	0,640	0,565	0,591
Norway	0,666	0,670	0,712
Switzerland	0,809	0,807	0,809
Turkey	0,457	0,630	0,573
United States	0,430	0,400	0,405
Russia	0,290	0,442	0,395
China	0,608	0,771	0,823
Eurozone	0,686	0,740	0,781
European Union	0,709	0,771	0,809
OECD	0,644	0,683	0,674

Table 16: IQP Index: Quality – ISO 14001 Certifications

Quality: ISO 16949 Certifications per 1 000 000 000 GDP, PPP (current US\$) - rank			
Country	2004	2009	2014
Austria	0,625	0,714	0,701
Belgium	0,590	0,634	0,582
Cyprus	0,000	0,000	0,000
Estonia	0,407	0,648	0,627
Finland	0,286	0,516	0,466
France	0,404	0,693	0,655
Germany	0,689	0,841	0,807
Greece	0,210	0,254	0,239
Ireland	0,396	0,490	0,473
Italy	0,488	0,708	0,723
Latvia	0,000	0,549	0,516
Lithuania	0,000	0,396	0,479
Luxembourg	0,519	0,615	0,601
Malta	0,000	0,650	0,691
Netherlands	0,351	0,535	0,530
Portugal	0,610	0,702	0,724
Slovakia	0,693	0,935	0,966
Slovenia	1,000	0,964	0,949
Spain	0,709	0,727	0,730
Bulgaria	0,352	0,554	0,658
Croatia	0,303	0,537	0,581
Czech Republic	0,941	0,985	1,000
Denmark	0,000	0,462	0,471
Hungary	0,747	0,899	0,907
Poland	0,539	0,734	0,731
Romania	0,327	0,731	0,758
Sweden	0,439	0,738	0,712
United Kingdom	0,544	0,596	0,574
Australia	0,613	0,551	0,464
Canada	0,601	0,666	0,624
Chile	0,000	0,243	0,264
Iceland	0,000	0,000	0,426
Israel	0,442	0,504	0,476
Japan	0,396	0,611	0,616
Korea	0,652	1,070	1,077
Mexico	0,711	0,733	0,731
New Zealand	0,321	0,322	0,303
Norway	0,435	0,433	0,404
Switzerland	0,623	0,617	0,584
Turkey	0,528	0,724	0,718
United States	0,637	0,598	0,579
Russia	0,207	0,368	0,442
China	0,457	0,849	0,880
Eurozone	0,596	0,737	0,723
European Union	0,595	0,728	0,718
OECD	0,598	0,687	0,677

Table 17: IQP Index: Quality – ISO 16949 Certifications

Quality: ISO 22000 Certifications per 1 000 000 000 GDP, PPP (current US\$) - rank			
Country	2004	2009	2014
Austria		0,193	0,577
Belgium		0,567	0,696
Cyprus		1,443	0,875
Estonia		0,617	0,707
Finland		0,548	0,722
France		0,406	0,586
Germany		0,386	0,478
Greece		1,090	1,226
Ireland		0,551	0,596
Italy		0,415	0,724
Latvia		0,680	0,787
Lithuania		0,664	0,721
Luxembourg		0,437	0,307
Malta		0,550	0,695
Netherlands		0,556	0,725
Portugal		0,651	0,774
Slovakia		0,704	0,847
Slovenia		0,601	0,541
Spain		0,542	0,640
Bulgaria		0,979	0,929
Croatia		0,850	0,845
Czech Republic		0,577	0,676
Denmark		0,735	0,719
Hungary		0,688	0,759
Poland		0,778	0,751
Romania		1,000	1,079
Sweden		0,485	0,506
United Kingdom		0,288	0,374
Australia		0,000	0,616
Canada		0,331	0,387
Chile		0,481	0,558
Iceland		0,000	0,564
Israel		0,540	0,707
Japan		0,401	0,575
Korea		0,432	0,462
Mexico		0,353	0,472
New Zealand		0,468	0,522
Norway		0,424	0,533
Switzerland		0,605	0,748
Turkey		0,853	0,726
United States		0,159	0,299
Russia		0,413	0,503
China		0,620	0,724
Eurozone		0,565	0,674
European Union		0,599	0,681
OECD		0,484	0,561

Table 18: IQP Index: Quality – ISO 22000 Certifications

Quality: ISO 27001 Certifications per 1 000 000 000 GDP, PPP (current US\$) - rank			
Country	2004	2009	2014
Austria		0,890	0,870
Belgium		0,920	0,900
Cyprus		0,860	0,930
Estonia		0,940	0,940
Finland		0,970	0,970
France		0,850	0,820
Germany		0,860	0,820
Greece		0,880	0,900
Ireland		0,900	0,870
Italy		0,830	0,840
Latvia		0,740	0,760
Lithuania		0,870	0,800
Luxembourg		0,700	0,770
Malta		0,730	0,820
Netherlands		0,930	0,910
Portugal		0,880	0,930
Slovakia		0,810	0,840
Slovenia		1,000	0,990
Spain		0,850	0,870
Bulgaria		0,790	0,760
Croatia		0,930	0,920
Czech Republic		0,890	0,910
Denmark		0,980	0,990
Hungary		0,840	0,810
Poland		0,830	0,810
Romania		0,800	0,780
Sweden		0,970	0,970
United Kingdom		0,950	0,920
Australia		0,960	0,950
Canada		0,930	0,890
Chile		0,730	0,720
Iceland		1,000	1,000
Israel		0,990	0,920
Japan		0,770	0,730
Korea		0,820	0,830
Mexico		0,570	0,550
New Zealand		1,000	0,960
Norway		0,900	0,880
Switzerland		1,000	0,970
Turkey		0,760	0,720
United States		0,820	0,780
Russia		0,640	0,630
China		0,750	0,720
Eurozone		0,860	0,850
European Union		0,880	0,860
OECD		0,840	0,810

Table 19: IQP Index: Quality – ISO 27001 Certifications

Productivity: GDP, PPP (current US\$) per capita - rank			
Country	2004	2009	2014
Austria	0,753	0,826	0,895
Belgium	0,733	0,795	0,854
Cyprus	0,555	0,651	0,613
Estonia	0,496	0,583	0,687
Finland	0,723	0,794	0,827
France	0,698	0,765	0,811
Germany	0,718	0,790	0,883
Greece	0,654	0,718	0,671
Ireland	0,800	0,839	0,911
Italy	0,695	0,757	0,771
Latvia	0,458	0,535	0,629
Lithuania	0,472	0,554	0,682
Luxembourg	1,048	1,161	1,286
Malta	0,579	0,659	0,701
Netherlands	0,771	0,863	0,900
Portugal	0,584	0,663	0,695
Slovakia	0,502	0,624	0,690
Slovenia	0,617	0,680	0,715
Spain	0,666	0,742	0,752
Bulgaria	0,392	0,500	0,538
Croatia	0,496	0,571	0,603
Czech Republic	0,594	0,674	0,724
Denmark	0,746	0,816	0,879
Hungary	0,526	0,592	0,649
Poland	0,468	0,567	0,651
Romania	0,387	0,515	0,585
Sweden	0,759	0,816	0,872
United Kingdom	0,745	0,782	0,822
Australia	0,725	0,822	0,878
Canada	0,753	0,807	0,870
Chile	0,449	0,522	0,610
Iceland	0,766	0,819	0,860
Israel	0,651	0,680	0,752
Japan	0,702	0,732	0,784
Korea	0,621	0,691	0,749
Mexico	0,434	0,484	0,540
New Zealand	0,649	0,718	0,796
Norway	0,852	0,971	1,051
Switzerland	0,796	0,916	1,000
Turkey	0,416	0,496	0,571
United States	0,839	0,889	0,956
Russia	0,415	0,571	0,654
China	0,273	0,373	0,472
Eurozone	0,695	0,765	0,812
European Union	0,667	0,737	0,787
OECD	0,672	0,736	0,795

Table 20: IQP Index: Productivity – GDP per capita

Productivity: GDP, PPP (current US\$) per labourer - rank			
Country	2004	2009	2014
Austria	0,903	0,928	1,000
Belgium	0,696	0,735	0,794
Cyprus	0,636	0,703	0,659
Estonia	0,464	0,529	0,633
Finland	0,686	0,731	0,764
France	0,687	0,731	0,771
Germany	0,671	0,715	0,809
Greece	0,610	0,657	0,619
Ireland	0,765	0,775	0,853
Italy	0,653	0,692	0,710
Latvia	0,427	0,483	0,579
Lithuania	0,442	0,501	0,623
Luxembourg	1,000	1,071	1,195
Malta	0,547	0,598	0,636
Netherlands	0,732	0,798	0,829
Portugal	0,548	0,607	0,638
Slovakia	0,469	0,558	0,619
Slovenia	0,567	0,611	0,649
Spain	0,622	0,678	0,691
Bulgaria	0,362	0,446	0,487
Croatia	0,473	0,527	0,550
Czech Republic	0,548	0,602	0,654
Denmark	0,713	0,753	0,808
Hungary	0,494	0,540	0,591
Poland	0,440	0,518	0,601
Romania	0,357	0,452	0,532
Sweden	0,727	0,753	0,807
United Kingdom	0,716	0,727	0,767
Australia	0,840	0,903	0,969
Canada	0,844	0,874	0,946
Chile	0,583	0,614	0,702
Iceland	0,842	0,871	0,908
Israel	0,852	0,847	0,885
Japan	0,800	0,812	0,869
Korea	0,730	0,782	0,824
Mexico	0,562	0,614	0,682
New Zealand	0,743	0,783	0,862
Norway	0,972	1,060	1,151
Switzerland	0,874	0,963	1,047
Turkey	0,595	0,677	0,747
United States	0,971	1,000	1,091
Russia	0,478	0,625	0,721
China	0,294	0,390	0,493
Eurozone	0,661	0,707	0,755
European Union	0,633	0,679	0,730
OECD	0,731	0,776	0,842

Table 21: IQP Index: Productivity – GDP per labourer

Productivity: GDP, PPP (current US\$) per labourer (actual worked hours) - rank			
Country	2004	2009	2014
Austria	0,772	0,814	0,878
Belgium	0,791	0,846	0,914
Cyprus	0,656	0,748	0,744
Estonia	0,507	0,594	0,679
Finland	0,728	0,797	0,841
France	0,759	0,826	0,877
Germany	0,746	0,784	0,856
Greece	0,701	0,763	0,801
Ireland	0,811	0,868	0,963
Italy	0,759	0,832	0,867
Latvia	0,479	0,559	0,643
Lithuania	0,494	0,584	0,692
Luxembourg	1,113	1,197	1,317
Malta	0,653	0,721	0,732
Netherlands	0,744	0,815	0,877
Portugal	0,571	0,659	0,719
Slovakia	0,540	0,641	0,711
Slovenia	0,611	0,667	0,730
Spain	0,700	0,787	0,837
Bulgaria	0,432	0,515	0,570
Croatia	0,565	0,617	0,675
Czech Republic	0,596	0,667	0,717
Denmark	0,713	0,784	0,863
Hungary	0,577	0,659	0,685
Poland	0,532	0,598	0,686
Romania	0,400	0,521	0,605
Sweden	0,746	0,799	0,846
United Kingdom	0,739	0,779	0,812
Australia	0,716	0,793	0,852
Canada	0,733	0,779	0,836
Chile	0,524	0,563	0,618
Iceland	0,713	0,771	0,794
Israel	0,793	0,752	0,778
Japan	0,686	0,711	0,755
Korea	0,633	0,680	0,716
Mexico	0,493	0,542	0,598
New Zealand	0,632	0,691	0,758
Norway	0,824	0,919	1,000
Switzerland	0,741	0,839	0,915
Turkey	0,512	0,618	0,672
United States		0,896	0,986
Russia	0,414	0,558	0,632
China	0,608	0,771	0,823
Eurozone	0,686	0,740	0,781
European Union	0,709	0,771	0,809
OECD	0,644	0,683	0,674

Table 22: IQP Index: Productivity – GDP per actual worked hours

Inputs: Infrastructure Investment per GDP, PPP (current US\$) - rank			
Country	2004	2009	2014
Austria	0,722	0,750	0,590
Belgium	0,519	0,522	0,477
Cyprus			
Estonia	0,515	0,635	0,689
Finland	0,632	0,669	0,747
France	0,761	0,746	0,742
Germany	0,702	0,628	0,564
Greece	0,908	0,680	0,738
Ireland			
Italy	0,831	0,627	0,479
Latvia	0,453	0,610	0,694
Lithuania	0,568	0,789	0,650
Luxembourg	0,753	0,749	0,711
Malta	0,348	0,156	0,464
Netherlands	0,685	0,577	0,562
Portugal	0,892	0,576	0,256
Slovakia	0,536	0,685	0,613
Slovenia	0,924	0,771	0,697
Spain	0,845	0,914	0,571
Bulgaria	0,628	0,308	0,423
Croatia	1,040	0,906	0,681
Czech Republic	0,689	0,830	0,476
Denmark	0,645	0,584	0,780
Hungary	0,815	0,794	0,538
Poland	0,454	0,758	0,591
Romania	0,700	0,909	0,728
Sweden	0,735	0,740	0,696
United Kingdom	0,605	0,632	0,648
Australia	0,835	0,958	1,000
Canada	0,541	0,781	0,784
Chile			
Iceland	0,989	0,814	0,450
Israel	0,489	0,565	0,633
Japan	0,959	0,895	0,860
Korea	0,740	0,632	0,655
Mexico	0,355	0,385	0,404
New Zealand	0,428	0,553	0,625
Norway	0,692	0,856	0,984
Switzerland	1,101	1,031	0,713
Turkey	0,295	0,496	0,535
United States			
Russia	0,574	0,570	0,613
China			
Eurozone (Average)	0,752	0,690	0,590
European Union	0,721	0,694	0,605
OECD (Average)	0,593	0,581	0,542

Table 23: Input Indicators: Infrastructure Investment

Inputs: Gross R&D Expenditure per GDP, PPP (current US\$) - rank			
Country	2004	2009	2014
Austria	0,749	0,821	0,878
Belgium	0,683	0,716	0,798
Cyprus	0,296	0,341	0,349
Estonia	0,469	0,600	0,609
Finland	0,925	0,984	0,905
France	0,734	0,755	0,763
Germany	0,790	0,839	0,860
Greece	0,369	0,402	0,465
Ireland	0,551	0,645	0,626
Italy	0,521	0,561	0,576
Latvia	0,321	0,342	0,422
Lithuania	0,440	0,463	0,512
Luxembourg	0,646	0,664	0,569
Malta	0,370	0,375	0,468
Netherlands	0,683	0,659	0,714
Portugal	0,434	0,638	0,576
Slovakia	0,360	0,350	0,478
Slovenia	0,594	0,685	0,785
Spain	0,518	0,591	0,564
Bulgaria	0,349	0,358	0,453
Croatia	0,516	0,467	0,452
Czech Republic	0,544	0,579	0,718
Denmark	0,790	0,890	0,892
Hungary	0,472	0,542	0,595
Poland	0,379	0,415	0,493
Romania	0,314	0,345	0,315
Sweden	0,935	0,944	0,903
United Kingdom	0,645	0,670	0,662
Australia	0,692	0,787	0,753
Canada	0,721	0,704	0,645
Chile	0,311	0,302	0,313
Iceland	0,840	0,828	0,699
Israel	1,000	1,031	1,030
Japan	0,899	0,931	0,962
Korea	0,808	0,922	1,052
Mexico	0,319	0,334	0,373
New Zealand	0,544	0,571	0,550
Norway	0,631	0,667	0,664
Switzerland	0,831	0,839	0,839
Turkey	0,366	0,468	0,510
United States	0,802	0,853	0,839
Russia	0,545	0,568	0,553
China	0,562	0,658	0,727
Eurozone	0,678	0,716	0,740
European Union	0,674	0,707	0,725
OECD	0,755	0,790	0,708

Table 24: Input Indicators: Gross R&D Expenditure

Inputs: Logistics performance Index - rank			
Country	2004	2009	2014
Austria			0,730
Belgium			0,809
Cyprus			0,600
Estonia			0,669
Finland			0,725
France			0,769
Germany			0,824
Greece			0,640
Ireland			0,774
Italy			0,738
Latvia			0,681
Lithuania			0,636
Luxembourg			0,789
Malta			0,621
Netherlands			0,810
Portugal			0,712
Slovakia			0,651
Slovenia			0,677
Spain			0,744
Bulgaria			0,631
Croatia			0,611
Czech Republic			0,698
Denmark			0,757
Hungary			0,693
Poland			0,699
Romania			0,652
Sweden			0,792
United Kingdom			0,803
Australia			0,762
Canada			0,771
Chile			0,651
Iceland			0,678
Israel			0,652
Japan			0,783
Korea			0,733
Mexico			0,626
New Zealand			0,729
Norway			0,792
Switzerland			0,769
Turkey			0,700
United States			0,784
Russia			0,539
China			0,706
Eurozone			0,716
European Union			0,712
OECD			0,732

Table 25: Input indicators: Logistics Performance Index (rank)

Inputs: Tertiary Attainment (% of attainable population)			
Country	2004	2009	2014
Austria			0,744
Belgium			0,817
Cyprus			
Estonia			0,830
Finland			0,880
France			0,780
Germany			0,708
Greece			0,726
Ireland			0,881
Italy			0,564
Latvia			0,757
Lithuania			0,838
Luxembourg			0,849
Malta			
Netherlands			0,800
Portugal			0,644
Slovakia			0,619
Slovenia			0,740
Spain			0,797
Bulgaria			
Croatia			
Czech Republic			0,634
Denmark			0,820
Hungary			0,663
Poland			0,709
Romania			
Sweden			0,849
United Kingdom			0,888
Australia			0,882
Canada			1,000
Chile			0,618
Iceland			0,839
Israel			0,941
Japan			0,948
Korea			0,908
Mexico			0,543
New Zealand			0,785
Norway			0,880
Switzerland			0,869
Turkey			0,571
United States			0,899
Russia			0,992
China			0,419
Eurozone			0,768
European Union			0,768
OECD			0,791

Table 26: Input indicators: Tertiary Education Attainment

Inputs: ICT Access and Usage (% of households)			
Country	2004	2009	2014
Austria	0,710	0,853	0,907
Belgium	0,735	0,839	0,917
Cyprus			
Estonia	0,630	0,803	0,917
Finland	0,764	0,901	0,955
France	0,664	0,847	0,918
Germany	0,815	0,908	0,953
Greece	0,484	0,630	0,816
Ireland	0,713	0,834	0,913
Italy	0,645	0,747	0,859
Latvia	0,574	0,778	0,863
Lithuania	0,413	0,791	0,818
Luxembourg	0,835	0,954	0,985
Malta			
Netherlands	0,919	0,967	0,986
Portugal	0,582	0,707	0,812
Slovakia	0,498	0,806	0,892
Slovenia	0,721	0,816	0,883
Spain	0,619	0,743	0,869
Bulgaria			
Croatia			
Czech Republic	0,453	0,752	0,890
Denmark	0,899	0,928	0,972
Hungary	0,488	0,746	0,861
Poland	0,573	0,782	0,871
Romania			
Sweden	0,884	0,947	0,954
United Kingdom	0,806	0,894	0,956
Australia	0,804	0,866	0,918
Canada	0,833	0,901	0,923
Chile	0,461	0,559	0,822
Iceland	0,954	0,967	0,990
Israel	0,726	0,831	0,847
Japan	0,784	0,836	0,847
Korea	1,000	1,000	1,000
Mexico	0,312	0,438	0,591
New Zealand	0,837	0,884	0,901
Norway	0,831	0,945	0,972
Switzerland	0,831	0,945	0,959
Turkey	0,287	0,560	0,782
United States	0,816	0,846	0,869
Russia	0,052	0,054	0,090
China	0,568	0,556	0,513
Eurozone	0,678	0,823	0,899
European Union	0,686	0,829	0,904
OECD	0,711	0,819	0,887

Table 27: Input indicators: ICT Access and Usage

Hofstede's Cultural Dimensions (score)						
Country	Power Distance	Individualism	Masculinity	Uncertainty Avoidance	Long Term Orientation	Indulgence
Austria	11	55	79	70	60	63
Belgium	65	75	54	94	82	57
Cyprus						
Estonia	40	60	30	60	82	16
Finland	33	63	26	59	38	57
France	68	71	43	86	63	48
Germany	35	67	66	65	83	40
Greece	60	35	57	100	45	50
Ireland	28	70	68	35	24	65
Italy	50	76	70	75	61	30
Latvia	44	70	9	63	69	13
Lithuania	42	60	19	65	82	16
Luxembourg	40	60	50	70	64	56
Malta	56	59	47	96	47	66
Netherlands	38	80	14	53	67	68
Portugal	63	27	31	99	28	33
Slovakia	100	52	100	51	77	28
Slovenia	71	27	19	88	49	48
Spain	57	51	42	86	48	44
Bulgaria	70	30	40	85	69	16
Croatia	73	33	40	80	58	33
Czech Republic	57	58	57	74	70	29
Denmark	18	74	16	23	35	70
Hungary	46	80	88	82	58	31
Poland	68	60	64	93	38	29
Romania	90	30	42	90	52	20
Sweden	31	71	5	29	53	78
Utd.Kingdom	35	89	66	35	51	69
Australia	36	90	61	51	21	71
Canada	39	80	52	48	36	68
Chile	63	23	28	86	31	68
Iceland	30	60	10	50	28	67
Israel	13	54	47	81	38	52
Japan	54	46	95	92	88	42
Korea	60	18	39	85	100	29
Mexico	81	36	69	82	24	97
New Zealand	22	79	58	49	33	75
Norway	31	69	8	50	35	55
Switzerland	34	68	70	58	74	66
Turkey	66	37	45	85	46	49
United States	40	91	62	46	26	68
Russia	93	39	36	95	81	20
China	80	20	66	30	87	24
Eurozone	50	59	46	73	59	44
European Union	51	59	46	71	58	43
OECD	49	62	50	70	54	53

Table 28: Hofstede's Cultural Dimensions (score)

