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METHODOLOGIES FOR MEASURING INNOVATION PERFORMANCES

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Abstract: *In many industries innovation has become the most important driver of competitive success. Along with the current imperative for innovation comes the necessity for it to be adequately measured in order to boost innovation performances. Innovation is a wide concept that has many dimensions making it hard to have a clear picture on how it could be measured with acknowledgment of all aspects. There is no one-size-fits-all solution. To develop or adopt particular innovation metrics firstly it must be defined what constitutes innovation potential and what is strategic intent of innovation activities as it can vary from organization to organization. Analyzing diversity of innovation measurement methodologies available in academic and industry-oriented literature this paper provides comparative review of best practice found that may help understand how innovation potential and activities can be viewed and measured in different ways.*

Key Words: ***Innovation, Measuring Innovation Innovation metrics***

1. INTRODUCTION

Innovativeness has been identified as a key success factor in todays' increasingly competitive and complex environment in which competitors are working harder now more than ever to compete across an increasing number of channels and market fronts. It is widely accepted and understood that innovation represents a way of changing the game and as such is a driver of economic and business growth. But innovation is risky as well and requires exploration and divergent thinking [1]. Therefore, more than ever, in the current global economic situation, policy makers and business leaders recognize the need to create an enabling environment to support the adoption of innovation and to spread their benefits across all sectors of society. Along with the current imperative for innovation comes the necessity for it to be adequately measured in order to boost innovation performances and to make innovation processes more manageable. To ensure that innovation investments and resources devoted to innovation projects are spent most efficentlly and effectively it is essential that decision-makers obtain the most reliable estimates of the impacts of innovation [2]. Sustainable success requires that the process of innovation itself must evolve, and ways of measuring and refining it must be continually calibrated to ensurethat the business is taken in the right direction, despite the competition [2]. So we are coming to an old management adage by Peter F. Drucker that you can't manage what you don't measure. But measuring innovation is a fuzzy business as innovation is a wide concept that has many dimensions making it hard to have a clear picture on how it could be measured with acknowledgment of all, rather unique, aspects. There isn't a clear consensus on what are innovation dimensions and key performance indicators that should be measured and there is no one-size-fits-all solution. To develop or adopt particular innovation metrics firstly it must be defined what constitutes innovation potential and what is strategic intent of innovation activities as it can vary from organization to organization. In this article we explore how innovation performances are measured on the level of countries and the level of organizations and what are the common metrics for measuring innovation performance based on academic & industry-oriented literature analysis. Analyzing diversity of innovation measurement methodologies and inicators available this paper provides comparative review of practice found that may help understand how innovation performances and activities can be leveraged and measured in different ways.

2. INNOVATION: WHAT IS IT AND WHY IT IS IMPORTANT

Konishi [3] pointed that in recent years, with the advancement of the knowledge economy, the world has witnessed the power of innovation and its various constituents in revolutionizing the business and economic landscape and how it empowers individuals, communities and countries with profound impact on business, politics, and society. Innovation has become the lifeblood of successful companies and a key driver of economic growth. A clear understanding of what an innovation represents is crucial to assess the innovativion performances. In the literature [4][5][6][7][8][9][10] there are countless different definitions of innovation and they are evolving over time as business and technology advances and innovation opportunities continuo to emerge. Some common used definitions are listed in following. In its broadest sense, innovation includes any business change that results in new value being created.

Based on the work by Schumpeter [4], innovation has been defined as the first introduction of a new product, process, method, or system. But innovation is more than the generation of creative ideas. Innovation is defined broadly and can encompass the use of products, services, processes, methods, organization, and relationship or interconnections. The key requirement to be categorized as an innovation is that it requires the use of something completely new or vastly improved to the organization [5]. Innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or a different service. It is capable of being presented as a discipline, capable of being learned, capable of being practiced [7]. Innovation is a process through which the nation creates and transforms new knowledge and technologies into useful products, services and processes for national and global markets – leading to both value creation for stakeholders and higher standards of living [10]. According to Myers and Marquis [6] innovation is not a single action but a total process of interrelated sub processes. It is not just the conception of a new idea, nor the invention of a new device, nor the development of a new market. The process is all these things acting in an integrated fashion.

Many organizations are adopting Open Innovation concept as a way to generate new products or services. Opening up organization's innovation initiatives to outsiders is seen as more effective than relying solely on internal R&D. Chesbrough implied that valuable and innovative ideas might be created from the inside and from the outside of the company [11], and he defined open innovation as "a paradigm that assumes that firms should and can use external ideas as well as internal ideas, and internal and external path to market, as they look to advance their technology"[12].

This new research paradigm is based on the opinion that it is not possible that all intelligent people, from one particular field, work for the same company [12]. It is necessary to find, and explore knowledge and expertise of people outside of company. The real winners in open innovation process are organizations that use both internal and external ideas and resources, in order to create the best idea for their own company, and environment. According to these definitions innovations must be understood in the widest possible sense: as a new product, new production process, new production technologies, improved management methods, enhanced performance, workforce qualifications improvement and so on. Why it is important to innovate? Innovation is the fuel of continuous improvement [13]. Ability to innovate is a precondition of successful usage of new resources, technology and knowledge [14] and the key to unlocking competitive advantage, as much for country competitiveness in the world economy as for organizations' competitiveness in the field. Innovativeness on macro level refers to country's ability to respond to challenges of innovation through factors that enhance innovation readiness including innovation related policies and practices that promote long-term growth and create framework conditions for innovations and to produce and commercialize goods and services by using new knowledge and skills [15] and it is crucial for achieving or maintaining competitive advantage compared to other countries [16]. For organizations innovation has become one of the most important, and we could say mandatory, strategic and operational levers available to managers [17] necessary in order to maintain existing and to develop new competitive advantage in a way that will keep up with the pace of technological change, changing demands and expectations [1].

3. MEASURING INNOVATION

Along with the current imperative for innovation comes the necessity for it to be adequately measured in order to boost innovation performances both on national and organization level. Innovation performances are effected by elements of innovation capability that should be measured including [18]:

- Innovation potential - consists of factors that affect the present state of innovation capability. The factors reflect the potential that organizations have to produce innovations.
- Innovation processes - systems and activities that assist organizations to utilize their innovation potential and therefore enable innovations. They are the way systems and activities are carried out.
- The results of innovation activities - product/service innovations, and process innovations

Is it possible to measure innovation and aforementioned elements of innovation performances? Innovation is complex, nonlinear, multidimensional, and unpredictable. Whereas this new concept of open innovation that become an important part of many companies' innovation strategy, also imply a fairly high level of complexity and uncertainty that innovation teams, within their exclusively internal or even traditional inter-firm cooperation projects, have been never faced before [19].

No single measure is likely to characterize innovation adequately in its totality [14]. So why measure it? A core of management is to defining specific objectives and measure progress in achieving it (management by objective). In order to drive innovation there is a necessity to measure how effectively organization is innovating, which efforts and methods are efficient, and what innovation deliver benefits for the organization in order to be able to manage for improvement. Measuring innovation is possible at the level of the country / region and at the level of the organization. Difference is in criteria taken into account before measuring and consequences and actions after the measurement results obtained. The purpose is almost identical: to provide a higher level of innovation and thus ensure better competitive position. Generally speaking, the main reason for innovation performance measurement initiative is to ultimately increase efficiency and effectiveness of innovation activities [20].

For countries and their policy makers, innovation measurement data are required to better understand innovation and its relation to economic growth, as well as to provide indicators for benchmarking national performance.

For organizations innovation measurement data are an enabler and catalyst for [20]:

1. Diagnosis - Discovering and pinpointing specific weaknesses among a firm's innovation capabilities through an on-going innovation performance audit;
2. Orientation - Focusing staff's attention on the right projects, the right activities and the right behavior from an innovation performance point of view;
3. Motivation - Choosing the right goals and respective incentives to drive employee involvement, ultimately increasing innovation efficiency and effectiveness.
The measures of the innovation performance are linked to the business performance [18].
There are three challenges that organizations face when they try to measure innovation performance and manage innovation as a business process more effectively [21]:
1. Innovation performance is difficult to measure and interpret. Most organizations have some form of key performance indicators (KPI) to show performance and help manage innovation. However, few companies believe their KPIs are the right ones.
2. KPIs can be hard to turn into meaningful improvements. Where KPIs are measured and interpreted, organizations struggle with setting shared priorities for improvement.
3. Incidental improvements rarely mature into a system and culture of continuous improvement. Regularly changing KPIs and priorities often hinder organizations in tracking innovation performance and trends over time, and demonstrating the success of the implemented improvement actions.

Key performance indicators (KPIs) are quantifiable measurements which are used to examine the improvement in performing an innovation implementing activity that is critical to the success of a business [22]. They are generic building blocks for any innovation performance measurement initiative. Innovation measurement methodologies and KPIs are evolving over time as innovation is multidimensional phenomena that cannot be measured directly or with a single indicator, and for assessing innovation today, there exists a large set of innovation KPIs which can be divided into direct and indirect, objective and subjective, financial and non-financial ones and they vary from organization to organization.

3.1 Measuring countires' innovation performances

Countries' innovation performances refers to ability to respond to challenge of innovations through factors that enhance innovation readiness including innovation related policies and practices that promote long-term and by the ability to produce and commercialize goods and services by using new knowledge and skills [15]

How the prevailing understanding is that innovation is multidimensional phenomena, currently, for assessing countires' innovation performances, complex models based on dozens of parameters are used. Using this complex models and on the basis of innovative features world economies are ranked according to their innovativeness through different defined methodologies and adopted measures in several different annual reports [23]. Some of them are listed in following:

Global Innovation Index (GII) [24]. Developed by Confederation of Indian Industry together with INSEAD (Business School for the World) and Canon India. GII report rank world economies' innovation capabilities and results. Using this framework, the world's best-and worst-performing economies are ranked on their innovation capabilities, which provide insights into the strengths and weaknesses of countries in innovation-related policies and practices. The Global Innovation Index GII) relies on two sub-indices, the Innovation Input Sub-Index and the Innovation Output Sub-Index, each built around pillars. Five input pillars capture elements of the national economy that enable innovative activities: (1) Institutions, (2) Human capital and research, (3) Infrastructure, (4) Market sophistication, and (5) Business sophistication. Two output pillars capture actual evidence of innovation outputs: (6) Knowledge and technology outputs and (7) Creative outputs. Each pillar is divided into sub-pillars and each sub-pillar is composed of individual indicators (79 in total).

The Bloomberg Innovation Index [25]. Innovation is measured by seven factors, including R&D intensity, productivity, high-tech density, researcher concentration, manufacturing capability, education levels and patent activity and countries are ranked on a scale of 0 to 100% on seven factors.

Innovation union scoreboard [26]. Developed by European Commission analyses the performance of the EU innovation system. The measurement framework used in the Innovation Union Scoreboard distinguishes between 3 main types of indicators and 8 innovation dimensions, capturing in total 25 different indicators. The enablers capture the main drivers of innovation performance external to the firm and cover 3 innovation dimensions: Human resources, Open, excellent and attractive research systems as well as finance and support. Firm activities capture the innovation efforts at the level of the firm, grouped in 3 innovation dimensions: firm investments, linkages & entrepreneurship and intellectual assets. Outputs cover the effects of firms' innovation activities in 2 innovation dimensions: innovators and economic effects.

OECD Science, Technology and Industry Scoreboard [27]. Over 200 indicators in the OECD Science, Technology and Industry (STI) Scoreboard show how OECD and major non-OECD economies are starting to move beyond the crisis, increasingly investing in the future.

The Eco-Innovation Scoreboard [28]. The Eco-Innovation Scoreboard (Eco-IS) is the first tool to assess and illustrate eco-innovation performance across the EU Member States. The scoreboard aims at capturing the different aspects of eco-innovation by applying 16 indicators grouped into five thematic areas: eco-innovation inputs, eco-innovation activities, eco-innovation outputs, resource efficiency and socio-economic outcomes. It thereby shows how well individual Member States perform in different dimensions of eco-innovation compared to the EU average and presents their strengths and weaknesses.

Innovation Index in American Regions [29]. The Innovation Index compares regional performance to the United States and is calculated from 4 component indexes relying on different sub-indexes: (1) Human Capital (education, population growth rate, occupational

mix), Economic Dynamics (venture capital investment, broadband density, churn, business sizes), Productivity and Employment (High-Tech employment share growth, job growth-to-population growth ratio, patent activity, gross domestic product), Economic Well-Being (average poverty rate, average unemployment rate, net migration, compensation, growth in per capita personal income.

3.1.1. Key performance indicators (KPIs) for measuring countires' innovation performances

The traditional approach of expressing innovativeness is based on an old paradigm of an industrial economy on parameters such as the number of patent, papers published in scientific journals per million residents, workforce size and experience, innovative products and share of research and development activity costs in gross domestic product. More recently there has been significant progress in delineating the multiplicity of resources required for innovation, the non-linearity of the innovation process, the quite different and variegated meaning of innovation in service sectors, and the innovators' connection to and dependence on the global competitive market forces and their immediate socio-economic and institutional environment [10]. Milbergs and Vonortas [10] portrayed evolution of innovation indicators through four generations as it is presented in Table 1.

Table 1. *Evolution of innovation metrics by generation* [10]

1st Generation Input Indicators (1950s-60s)	▪ R&D expenditures ▪ S&T Personnel ▪ Capital ▪ Tech intensity
2nd Generation Output Indicators (1970s-80s)	▪ Patents ▪ Publications ▪ Products ▪ Quality ▪ Change
3rd Generation Innovation Indicators (1990s)	▪ Innovation surveys ▪ Indexing ▪ Benchmarking innovation capacity
4th Generation Process Indicators (2000+emerging focus)	▪ Knowledge ▪ Intangibles ▪ Networks ▪ Demand ▪ Clusters ▪ Management techniques ▪ Risk/Return ▪ System Dynamics

All indicators used within afore mentioned frameworks are used for global rankings and cross-national comparisons of innovative features but the comparability of indicators is serious challenge. Although the indicators themselves are designed to be comparable, the data itself, the procedures used for collecting it, and the interpretation of the data are not identical in all countries, and not identical for all science, technology and research fields. The relative importance of individual factors, the relevance of inputs, the causal link between input and output data for generating innovation remains "speculative"[30].

3.2 Measuring organizations' innovation performances

Organisational innovativeness is defined as an organisation's overall innovative capability of introducing new products to the market, or opening up new markets, through combining strategic orientation with innovative behaviour and process [31]. Innovation process has been conceptualized through different frameworks and models in order to help firms manage their innovation performances using adequate measurement techniques and KPIs. Some of them are listed in following:

The Balanced Scorecard Model [32]. A strategy-based balanced scorecard model identifies the connection between creative capacity, efficient internal product development processes, improved customer and stakeholder value, and financial outcomes as four strategic perspectives, for looking at organizational strategy and performance. The use of perspectives allows the organization to build a model of how the "intangible" factors – creativity, talent, new ideas, collaborative interaction with customers – interact with the more "tangible" factors – well defined processes, funds invested, sales results - to create an innovative, sustainable organization that can adapt resiliently to change.

'*Diamond' model* [33]. This model for successful growth and innovation suggests classifying complex projects according to four dimensions such that the values attributed to each of these dimensions indicate a recommended style of management for increasing the likelihood of the project's success. Its categorization is established on initial characteristics of project and identifies independent dimension comprised in the NTCP acronym. Shenhar and Dvir's project uncertainty model has four dimensions are defined as follows [33]:

- Novelty – How new the product is to the customers and to the market (derivative, platform and breakthrough).
- Technology – The extent of use of new or even non-existing technology at the time of project initiation (low-tech, medium-tech, high-tech and super-high-tech).
- Complexity – Where the project's product is located on the scale from a simple component to an array (assembly, system and array).
- Pace – How urgent the project is at the time of initiation; the criticality of the project's completion time (regular, fast/competitive, time-critical and blitz).

10 Types of Innovation model [34]. This model categorizes the innovation opportunities into three sections: Configuration, Offering, and Experience. Each of these categories include related types of innovation as following: profit model, network, structure, process, product performance, product system, service, channel, costumer engagement. Model shows companies multiple types of innovative methods which can be utilized inside the organization. After years of research, Doblin says that

any organization can achieve success in innovation if it focuses on at least four types of the ten highlighted in the model.

Innovation Radar. Developed by Kellog School of Management, the Innovation Radar is a framework and a tool to look at innovation in a very broad sense. Its authors Sawhney, Arroniz and Wolcott (2006) have defined innovation as "the creation of substantial new value for customers and the firm by creatively changing one or more dimensions of business system. It features 4 major dimensions that serve as business anchors: offerings a company creates (what); customers it serves (who); processes it employees (how) and points of presence it uses to take its offering to market (where). A framework includes 12 dimensions of innovation: offering, platform, solutions, customers, customers experiences, value capture, processes, organizations, supply chain, presence, networking, brand.

Pentathlon Framework. Developed by Goffin and Mitchell [35] claim that as innovation is a multi-dimensional rather a linear process, it is metaphorically like a Pentathlon. The five elements of the innovation Pentathlon Framework are: creating an innovation strategy, generating ideas, prioritizing and selecting from these, implementing the ideas selected and involving people from all areas of the business. Managers must bring together all five elements within their organization if they are to achieve successful innovation. Over-emphasis on one will be at the expense of another, and will result in less satisfactory results or even failure.

The Idea Funnel Model. The funnel illustrates how innovation goals, innovation actions, innovation teams and innovation results interact with each other to create change in any organization. It consists of 9 elements: strategic thinking, portfolio management and metrics, research, ideation, insight, targeting, innovation development, market development, selling [14].

The Value-Added Corporate Innovation Management (v-CIM) framework [36]. This framework is composed of five domains: (1) Business base which covers the firm's overall market understanding, its corporate business goals, its strategic imperatives, the dynamics of its business models, and its innovation strategies; (2) Resources which covers the people within the company, the corporate facilities, infrastructure and tools, the technology platforms on which products and services are built, and the business partnerships and networks for external collaboration for taking full advantage of open-innovation opportunities; (3) Will and Culture which addresses the leadership of the company, its governance, its organization, and its culture; (4) Solutions which captures the "creations" of the company: the processes it uses and the products and services it sells. The managing of innovation is in itself one of the critical corporate processes because it encompasses most aspects of the firm, it is critical to the competitive evolution of the firm, and it requires special management attention; (5) Value which consists of the portfolio of corporate innovation outcomes: its financial outcomes, its customer base, its brand, its territorial position in the market, its social achievements, and its environmental impacts.

Oslo manual. Developed by OECD this manual standardize innovation definitions and indicators and establish analytical frameworks and guidelines for collecting and interpreting innovation data in order to foster the collection of comparable innovation indicators.

In this new era of open innovation companies are innovating with external actors in a very flexible and informal way beyond the traditional notion of technology partnerships or innovation alliances [37]. Because the open innovation approach is so new there is a dearth of guidance on how to measure the success of open innovation activities [19]. Open innovation systems might facilitate the diffusion of knowledge over firms and within firms much better, adding to the chances of recombining mature and emergent knowledge [38].The incorporation of such a large number of diverse insights can be challenging. In this context, measuring open innovation would mean that the contribution of each participating individual and their innovation tools needs to be transparently stated in a firm's performance measurement system in order to accordingly evaluate the quantity and quality of their provided inputs [19].

3.2.1 Key performance indicators (KPIs) for organizations' innovation performances

By examining the innovation measurement methodologies available in academic and industry-oriented literature in Table 2 we summarized the common KPIs employed in the past research to measure innovation.

Table 2 *Common KPIs for organizations' innovation performances*

Financial measures	• Revenue and Profit from new products or services [13] • Ratio of sales of new products to R&D expenditures [39], Innovation Sales Rate" (ISR) [40] • Return on Product Development Expense, or RoPDE [41] • Ratio of sales of new products to total sales [42] • Total R&D spending [43] • Rate of return on Innovation Investment (how sustainable is Innovation) [13] • Percentage of revenue or profit coming from international versus domestic markets[44] • Revenues from products or services sold to new customer segments [44] • Royalty or licensing revenue from intellectual property, lisencing patents [44][13] • Sales from new products & services: sales from existing products & services [45] • Profit from new products & services : profit from existing products & services [45]
Market measures	• New customers from new products or services [13] • Percentage of existing customers that trade up to next-generation products

	or services [44] • New segments and market sector entry from new products and services [44] • Market share growth from new products & services [13] • Market share protected by patents [13] • Customers on the new products: customers on the old products [44]
Products measures	• New products or product improvements [47] • Patent or parent application [48] • Patent citations [49]
Employees	• Number of ideas turned into patents by employees [44] • Number of ideas turned into innovation experiments by employees • Number of teams that submit projects for innovation awards [44] • Percentage of employees trained in the innovation process [44] • Number of employees in R&D [44] • Innovative work behavior [50] • Team Innovativeness [51]
Leadership	• Percent of new innovations that come from external sources like crowdsourcing or open innovation [44] • Percent of funding for game changers versus small tweaks to existing products or services [44] • Percent of senior executive time focused on the future versus on daily operations [44]
Customers	• Number of ideas submitted by customers through "open innovation" programs [44] • Number of new product or service ideas that come from mining social networks [44] • Number of customers that help test and refine new ideas [44]

Observing the Table 2 we can see that KPIs aim to measure the resources that are needed for innovating, the processes that must be implemented in order to turn innovation inputs into innovative outputs and the outputs coming from innovative processes [34].

A clear definition of what are intended results of innovation activities is a pre-condition for determing what to measure. That is why it is important to consider what goes into the innovation process and what should come out of it and to apply different types of measurements including financial and non-financial indicators in a balanced group of metrics. In Table 3 common KPIs are grouped according to relationship between what is aimed with innovation an what to measure to help an organization measure progress toward organizational goals.

Table 3 *Common types of innovation indicators* [21]

	Input	**Process**	**Output**
Financial returns	-Absolute and relative spend	-Productivity -Predictibility Speed	-Revenues and growth -Margins and costs -Innovation success rate -Pipeline value
Competitive advantage	-Clarity on innovation targets	-External collaboration	-Market share per area -Product service performance -Costumer perception -IP positioning
People development	-Skill levels -Headcount per area -Time spend and dedication	-Internal collaboration -Process excellence -Employee satisfaction	-Competency development -Talent attraction
What to aim for	**What to measure**		

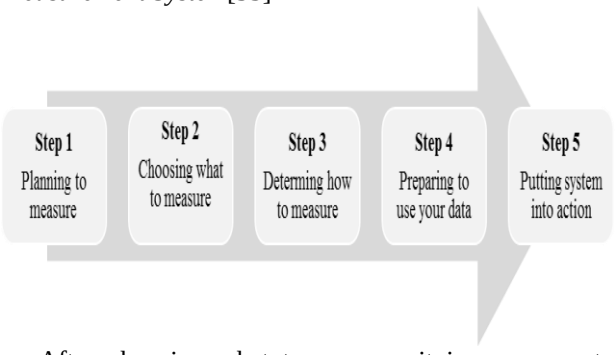
3.3 How to build innovation performance measurement system?

Research done by Boston Consulting Group shows that companies are struggling in terms of measuring innovation; what to measure, how to collect the data, how to use data to make decisions. Key findings of the report are [52]:

- Only 32% of executives are satisfied with their innovation measurement practice.
- Most of the executives (73%) believe that innovation should be tracked as rigorously as other business operations, but only 46% of companies actually do so.
- The majority of companies continue to rely on a handful of matrics to measure the full scope of their innovation activities 52% of respondents said their companies used 5 of fewer metrics.
- A small number of companies (27%) attempt to drive innovation by linking employee incentives to innovation metrics.
- The most widely tracked components of innovation are company profitability (79%), overall customer satisfaction (75%) and incremental revenue from innovation (73%).
- The metrics that most employees pay attention to – the ones that have great impact on their behavior and attitude towards company's innovation efforts – are incremental revenue from innovation and overall customer satisfaction.
- Companies considered them most effective at measuring innovation outputs (revenue growth, shareholder returns, and brand impact).They considered themselfs far less succesufull tracking innovation inputs (dedicated resources such as people, fund invested) and the quality of their innovation procesess.

So the importance of a custom-made innovation performance measurement system is obvious and to create it is a process itself. After defining what is aimed to be achieved with innovation, building measurement system consist of choosing what to be measured and how to measure it. A five-step process to build performance measurement system is presented below.

Figure 1 *The Five-Step Process to Build a Performance Measurement System*[53]



After choosing what to measure it is necessary to identify possible KPIs and that could be challenging. KPIs could be adopted from previous analyses, from competitors, and innovation leaders from other sectors, or research additional indicators that are theoretically important and practically available taking the specific characteristics of the organization into consideration. These characteristics are primarily the purposes and goals pursued with an innovation activity, the innovation strategy, firm size and culture, the industry context and the overall maturity level of the innovation organization[21]. KPIs vary from domain to domain depending on these characteristics. Regarding the selection of KPIs, balance is needed between supplying a rich set of measures that captures all the relevant information and avoiding too many measures that may be too costly to collect, administer, and interpret or that may lead to information overload [20].

There is no fixed menu of indicators that organizations can or should use. Innovation performance measurement system should be built on their own needs and strategy and in general should fulfill quality criteria presented in Table 4.

Table 4 *Quality criteria for innovation performance measurement systems*[20]

Balanced (contain qualitative and quantitative, financial and non-financial metrics)	**Transparent** (users should fully understand the calculation and meaning of metrics)	**Adaptable** (e.g., when the company's strategy changes)
Coherent (display casual and logic links between metrics)	**Reflective** (of demands of both internal and external stakeholders)	**Supportive** (of continuous improvement)

Numerous organizations employ the aforementioned or similar KPIs to control and measure their internal innovation activities. However, only few recognize the need to adapt their measurement tools to the new concepts and challenges of open innovation. Given that open innovation involves innovating with others, the heterogeneity of a network, incentive systems or the design of tools and platforms for cooperation, becomes more critical for successful innovation in an open innovation environment. Thus, appropriate tools and metrics are needed that empower innovation teams to properly measure open innovation in order to be able to promote the best innovation ideas and solutions and in fact to turn new knowledge into successful commercialized products or services [19].Three distinct principles that organizations must consider to successfully set up a metrics-based performance measurement system for their open innovation projects are[19] :

- The usage of unique metrics for each open innovation method (lead user method, ideation contest, broadcast search)
- Considering different types of measures (input KPIs, process KPIs, output KPIs, outcome KPIs)
- Thinking about how to effectively utilize open innovation metrics (instrumental, conceptual, symbolic use)

Organizations that develop and implement practical, and transparent innovation key performance indicators (KPIs) have accessed innovation productivity increases of between 20 and 50 % [21].

4. CONCLUSION

As the necessity to innovate continues to grow, measuring innovation performances is becoming more and more important. A clear definition of what constitutes innovation and innovation processes is a pre-condition for successful measuring of innovation performances and effective innovation management. But innovation, with creativity as its source is rather unpredictable and not easy to defined making it hard to find the right things to be measured and different ways in which it could be measured. That is why there are a number of KPIs of innovation activities and performances that are used within different frameworks and models. However, there is no one-size-fits-all solution as innovation is a multidimensional and complex phenomenon that cannot be measured by only one KPI or metrics since no single performance indicator can capture the full complexity of an innovation performance. There is no standardized framework or measurement tool that meets all the needs since measurement processes depend on a lot of factors. That is why it is important to consider what goes into the innovation process and what should come out of it and to apply different types of measurements including financial and non-financial indicators in a balanced group of metrics around all innovation dimensions in order to evaluate the elements of innovation performances. For decision makers it is of utmost importance to have reliable estimations and date about innovation activities and their effects as innovation offer a possibility of new growth platforms both on countries' level when talking about the economic growth as the biggest national issue and organization level when talking about competitiveness and value creation. Adequate innovation performance measurement has an impact on promoting and boosting innovation

performance on both levels. KPIs help decision makers create the right environment to innovate. Selecting the right KPIs for measuring innovation performances within different frameworks and models is fundamental as applying wrong metrics may lead to decisions and actions that create non-intended orientations with unpredictable consequences. In order to custom-tailor an innovation performance measurement system, design choices should be driven by what are the intended results of innovation-based strategic objective. These means that, on all levels, firstly it is important to know where we want to go with innovation, consider what goes into the innovation process and what should come out of it in order to apply a balanced group of KPIs within Innovation performance measurement system. Innovation performance measurement in organizations cannot be considered independently of external environment characteristics, and that is something that certain methodologies very often neglect. Measuring techniques will differ across domains and there will be many different approaches, but that is a matter to be investigated.

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