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PROPOSAL OF A MODEL FRAMEWORK FOR MEASURING INNOVATION PERFORMANCE IN HEALTH

Araştırma

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Şeyma Güner, İstanbul Medipol Üniversitesi Yönetim ve Strateji Doktora programında tez aşamasındadır. Aynı üniversitede inovasyon ve yenilikçi düşünce teknikleri dersi vermektedir. Stratejik yönetim, kurumsal yenilik yönetimi, inovasyon performans ölçümü, yenilikçi düşünme teknikleri alanlarında araştırmalar yapmaktadır.

İlker Köse, lisansını 1999'da İÜ Elektronik Mühendisliğinde, yüksek lisans ve doktorasını 2003 ve 2015'te GYTE Bilgisayar Mühendisliğinde tamamladı. 1999-2014 yıllarında belediye, özel ve kamu sektörlerinde, 2014-2022 yıllarında Medipol Üniversitesi'nde akademisyen/TTO yöneticisi olarak çalıştı. Halen Alanya Üniversitesi Bilgisayar Mühendisliğinde akademisyendir.

Not: Bu makale Şeyma Güner'in, tez danışmanı İlker Köse yürütücülüğünde Tübitak tarafından desteklenen 122G080 nolu tez projesinin araştırmalarının bir bölümünden üretilmiştir.

PROPOSAL OF A MODEL FRAMEWORK FOR MEASURING INNOVATION PERFORMANCE IN HEALTH

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Abstract

Purpose: Indicators that will reveal the current situation are the most needed tool in policy and strategy development processes. A national and sectoral measurement model is required to the strengths and weaknesses of innovation policies and practices. Although models various models are developed to measure the innovation performance of the national health system, there is yet to be a widespread and inclusive model that can be adapted to every country. This study aims to develop a model framework that measures the innovation performance of the national health system and can be customized according to the institutions and country's dynamics when necessary.

Method/Design/Methodology/Approach: Three models developed to measure the innovation performance of the national health system were examined by document analysis method and analyzed by content analysis method. Models designed to serve the same purpose were evaluated as holistic and inclusive. The results were subjected to a second analysis with the comparative analysis method.

Findings: A model that will measure the innovation performance of health systems in a country, Financing; Human Resources; working environment; Political and Legal Environment; Intellectual Property Rights (opportunities, facilitators, and intellectual resources); Information technologies; Cooperation Opportunities; R&D Activities; It has been seen that it can be evaluated in 10 dimensions, namely Service Delivery and Innovation Outputs.

Originality: A measurement model that measures the national innovation performance of country health systems and can be adapted to all countries has yet to be found. There needs to be a study in which existing models are evaluated together. It is an original research study that assesses the dimensions and criteria the measurement model will include and creates a framework. This framework can form a basis for measurement tools to be developed in a country-specific manner.

Keywords: Innovation in Health, Digital Transformation in Health, Innovation Management, Innovation Performance Measurement

JEL Classification: I18, I19, L53, O, O30

SAĞLIKTA İNOVASYON PERFORMANSINI ÖLÇMEK İÇIN MODEL ÇERÇEVESI ÖNERISI

Özet

Amaç: Politika ve strateji geliştirme süreçlerinde en çok ihtiyaç duyulan araç, mevcut durumu ortaya çıkaracak göstergelerdir. İnovasyon politikalarının ve uygulamalarının güçlü ve zayıf yönlerini ortaya koymak için ulusal ve sektörel bir ölçüm modeline ihtiyaç vardır. Ulusal sağlık sisteminin inovasyon performansını ölçe amacıyla geliştirilen çeşitli modeller olsa da, her ülkeye uyarlanabilir yaygın ve kapsayıcı bir model bulunmamaktadır. Bu çalışmada, ulusal sağlık sisteminin inovasyon performansını ölçen ve gerektiğinde kurum ve ülke dinamiklerine göre özelleştirilebilen bir model çerçevesi geliştirilmesi amaçlanmaktadır.

Yöntem/Tasarım / Metodoloji / Yaklaşım: Ulusal sağlık sisteminin inovasyon performansını ölçme amacıyla geliştirilen üç model doküman analizi yöntemi ile incelenmiş ve içerik analizi yöntemi ile analiz edilmiştir. Aynı amaca hizmet etmek için geliştirilen modeller bütüncül ve kapsayıcı olarak değerlendirilmiştir. Elde edilen sonuçlar karşılaştırmalı analiz yöntemi ile ikinci bir analize tabi tutulmuştur.

Bulgular: Bir ülkedeki sağlık sistemlerinin inovasyon performansını ölçecek bir modelin, Finansman; İnsan Kaynakları; Çalışma ortamı; Siyasi ve Hukuki Ortam; Fikri Mülkiyet Hakları (fırsatlar, kolaylaştırıcılar ve fikri kaynaklar); Bilgi teknolojileri; İşbirliği Fırsatları; Ar-Ge Faaliyetleri; Hizmet Sunumu ve İnovasyon Çıktıları olmak üzere 10 boyutlu olarak değerlendirilebileceği görülmüştür.

Özgünlük: Ülke sağlık sistemlerinin ulusal inovasyon performansını ölçen ve tüm ülkelere uyarlanabilen bir ölçüm modeli bulunamamıştır. Mevcut modellerin bir arada değerlendirildiği bir çalışma da bulunmamaktadır. Ölçüm modelinin içereceği boyut ve kriterleri değerlendirdiği ve bir çerçeve oluşturduğu için özgün bir araştırma çalışmasıdır. Bu çerçevenin ülkeye özel olarak geliştirilecek ölçüm araçları için bir temel oluşturabileceği düşünülmektedir.

Anahtar Kelimeler: Sağlıkta İnovasyon, Sağlıkta Dijital Dönüşüm, İnovasyon Yönetimi, İnovasyon Performans Ölçümü

JEL Sınıflandırması: I18, I19, L53, O, O30

INTRODUCTION

Innovation performance measurement is one of the most critical needs of innovation management (Karaata, 2012a). The fact that innovation has become a central problem for the growth of countries and institutions has brought with it the need to evaluate innovative performance. To determine whether the resources allocated to innovation are used effectively or not, countries and institutions should regularly assess their innovation performance (Ayçin & Çakın, 2019).

It is known that countries and institutions benefit from various measurement tools and models to establish a successful innovation system and to make improvements by identifying areas open to development. Various measurement tools separately measure the innovation performance of both countries (INSEAD, 2020; WIPO, 2021) and institutions (Daneshmand & Bui, 2012; Innovation 360, 2021; InnovationIQ, 2021). When these measurement tools are examined in detail, it is remarkable that they include privatizations suitable for the specific structures of the sectors. As a matter of fact, basic guidelines such as the Oslo Handbook and many studies in the literature (Akçomak & Kalaycı, 2016; Anderson, 2003; Diederen, van Meijl, & Wolters, 2002; Elverdi, 2019; Karaata, 2012b; Mahroum & Al-Saleh, 2013; NITI Aayog, 2020; Temel et al., 2016) emphasize the necessity of customizing measurement tools and models for countries, sectors, and institutions due to differences in country, sector, and institution dynamics. In this respect, studies developed in the agriculture sector in the Netherlands (Diederen et al., 2002), in the construction sector in Canada (Anderson, 2003), in the industrial sector in Turkey (İstanbul Sanayi Odası, 2014), and regionally in the Aegean Region (Temel et al., 2016) are examples of specialized (for the region and sector) measurement tools.

The subject mentioned in this study has been discussed from different aspects. The biggest problem in performance measurement is determining the indicators to be used C. In this study, which focuses on the health sector, measurement tools that measure the national innovation performances of the countries in the health sector were examined. It has been observed that the measurement tools discussed could be more robust compared to other sectoral tools in terms of general acceptance and prevalence. This is because of the lack of a solid methodological background in measurement tools specific to the health sector and the lack of inclusive indicators (Cravo Oliveira et al., 2017). It has also attracted our attention that the current measurement tools only cover some countries and country's health systems. Because of this problem, in this study, the best-known measurement tools developed specifically for the health sector are discussed and analyzed in terms of the processes, dimensions, and criteria they cover. In this context, our study aims to determine which indicators are essential in measuring the national innovation performance of the countries in the health sector. As a result of the study, in line with the comparative analysis and evaluation of these measurement tools, the measurement tool framework has been presented by suggesting the dimensions and criteria that can be found in a model that will measure the national innovation performance of the country's health systems. Since country health systems have different dynamics based on policy and institution, it is

recommended that countries develop their own national performance measurement tools, considering their unique dynamics and using the framework proposed as a result of this study.

The study will first introduce the models used to measure the innovation performance of the countries' health systems. These models will be evaluated with qualitative methods regarding the processes, dimensions, and criteria they cover. Since the countries where the models are used are limited, the reasons for global diffusion and non-proliferation will be evaluated. Then, as a result of evaluating the results of the comparative analysis of the models by the grouping method, the dimensions, and criteria that can be included in a model that can be used to measure the innovation performance of the national health system will be presented.

It is unique in that it examines the subject in a sector-specific manner and covers the measurement tools in the relevant sector comprehensively. In addition, as a result of the study, dimensions, and criteria that all countries and health institutions can customize according to their own needs are presented.

CONCEPTUAL AND THEORETICAL FRAMEWORK/LITERATURE

Innovation Performance and the Importance of Performance Measurement in the Health Sector

In addition to the importance of innovation in the health sector, the Covid-19 pandemic, which affected the whole world in 2019, brought with it the obligation to innovate in many areas. The epidemic has deeply influenced the world, societies, economies, health, and welfare systems. On the one hand, necessary innovations were made to combat the epidemic's health problems, save lives, and plan the scarce resources at hand; on the other hand, the economic balance had to be maintained (Çırpan & Güner, 2021). At this point, innovative products, services, processes, and management styles have made it possible to manage systems more effectively (Akgün & Çini, 2021). Institutions and countries that have been successful in developing new products, adopting new management styles, and redesigning organizational and process systems in the new normal brought about by the pandemic have achieved a sustainable and inclusive recovery (Perker Cebeci & Karaman Akgün, 2021). Although the importance and need of innovation for the country and institutions is known, it has gained momentum in adoption and development with the pandemic conditions. Institutions and countries must be prepared for such contingencies and can initiate and adopt innovations (Mahroum & Al-Saleh, 2013). At this point, it is crucial to measure their innovation performance, to determine their level of being an innovative institution and country, and to know in which areas they need to develop strategies and policies to complete the development.

Innovation Performance Measurement Models in the Health Sector

Several models were developed specifically for the health sector to measure the innovation performance of the country's health systems. Among these models, "Innovation Indicators for Health Services in Developing Countries", "Medical Technology Innovation Scorecard" and "Global

Dissemination of Health Innovation" projects are the most well-known innovation performance measurement models. These models will be introduced under the following headings.

Innovation Indicators for Healthcare in Emerging Countries (IIHEC)

The IIHEC study is an innovation performance measurement model developed by the Deloitte consulting agency to compare the ability of developing countries to drive innovation in healthcare relative to each other and developed countries (Pefile et al., 2005)

The model's main purpose is to facilitate the promotion of innovation in health in the public and private sectors.

The framework is based on idea innovation depends on factors related to 4 main dimensions: development, ownership, diffusion, and environment. It also focused solely on healthcare technologies, excluding service innovation.

Medical Technology Innovation Scorecard (MTIS)

The MTIS study is an innovation performance measurement model developed by the consulting firm PWC "Price Waterhouse Coopers" to measure the change in the ability of nine countries to adopt innovation and innovation in healthcare (Price WaterhouseCoopers, 2011; Sullivan, 2018).

It measures the Innovation performance of Brazil, China, France, Germany, India, Israel, Japan, the United Kingdom, and the United States in the field of medical technology on five main dimensions. The main dimensions in the measuring instrument; are "Powerful financial incentives", "Leading resources for innovation", "Supportive regulatory system", "Demanding and price-insensitive patients", and "Supportive investment community".

Global Diffusion of Healthcare Innovation (GDHI)

The GDHI project is a critical study as it contains comprehensive and numerous indicators that can guide the "development of a global health innovation index". The study's main purpose is to encourage healthcare industry leaders to spread innovation and to lead the discussion on transforming healthcare systems into an innovative system" (A. Darzi & Parston, 2013).

Project studies were conducted in 8 countries (Australia, Brazil, England, India, Qatar, South Africa, Spain, and the United States) with 100 experts in 2016.

The study findings examine the significance of a set of facilitators and cultural dynamics defined by the Global Institute for Health Innovation as a framework for the global diffusion of health innovation(Cravo Oliveira et al., 2017)

Starting Point of the Research

With the importance of innovation performance measurement, besides the measurement models (independent of the sector) used to measure the innovation performance of countries, measurement tools containing indicators suitable for the distinctive structures of the sectors are needed for a more

specific measurement (Karaata, 2012b). For more precise measurements, measurement models should include indicators that meet the structures of the sectors. Measurement models are explicitly developed for sectors (eg, agriculture, construction, industry, etc.) (Anderson, 2003; Diederen et al., 2002; İstanbul Sanayi Odası, 2014).

When the health sector is evaluated specifically, the importance and priority of "human health" has aspects that distinguish it from other sectors. When the measurement models developed in response to this need are examined, it is noteworthy that they need to be more widespread and address all countries (LeCompte & Goetz, 1982). These measurement models were examined and evaluated in the second part of our study. It has been observed that the measurement models discussed do not cover all sub-sectors of the health sector (for example, the medical technology innovation scorecard does not focus on health service delivery, etc.) and does not include privatizations to cover the health system structures of all countries. Based on this review, it is recommended that each country develop its national measurement models, addressing the differences in health systems and policies, as well as their different structures. Since one of the most critical points in developing a measurement model are the indicators that the models will contain, the indicator set framework that can be used during model development is presented in this study.

METHOD

This study aims to determine the dimensions and criteria that affect innovation performance in the health services sector. For this purpose, measurement tools that are currently used but have yet to be widespread for various reasons have been evaluated together. The expected points and divergent measurement tool aspects were analyzed for similar purposes. Thus, emphasizing the expected dimensions and criteria presents a framework for inclusive measurement models that can be developed in the future.

This study was carried out with the approval of Istanbul Medipol University Social Sciences Scientific Research Ethics Committee numbered "E-43037191-604.01.01-11110". Document analysis, a qualitative research method, was used as a data collection method in the research.

The documents to be examined are the reports and website contents containing the measurement indicators of the "Innovation Indicators for Healthcare in Developing Countries", "Medical Technology Innovation Scorecard" and "Global Dissemination of Health Innovation" measurement models. The indicators of the discussed measurement tools were examined regarding the process, dimensions, and criteria they covered and analyzed with a comparative method.

The indicators (dimensions, factors, and criteria) of the measurement tools examined are presented. In the comparative analysis phase, content analysis and measurement tools whose content was analyzed in detail were compared and grouped within the scope of dimensions and criteria considered to be shared.

Measurement tools characterized as different from each other are classified and tabulated in terms of dimensions, criteria, and sub-criteria to enable common comparison.

In the Document Review method, the following steps were followed, respectively;

1. Access to Documents: With the literature review, measurement tools were scanned, and documents were accessed.

2. Checking Authenticity (Authenticity): The authenticity of original documents has been verified by finding from articles, original reports and websites.

3. Understanding the Documents: To understand the scope of the indicators, the reports of the measurement tools and academic studies on these measurement tools were evaluated together.

4. Data Analysis: The content Analysis method was used in data analysis.

5. Use of Data: Each measurement tool, whose dimensions, criteria, and processes were determined and analyzed by the content analysis method, was analyzed with a comparative method to achieve our study purpose, and grouped in terms of processes, dimensions, and criteria thought to be common.

A number of strategies have also been used to increase validity and reliability in qualitative research. To increase the study's validity, which indicators were classified under which groups while grouping was presented in detail in the findings section. In addition, the authors evaluated and reviewed the results individually and together several times to reduce bias in the research. LeCompte and Goetz used the strategy of involving multiple investigators to increase reliability (LeCompte & Goetz, 1982).

Analysis scope: Although there are a limited number of measurement models that measure the innovation performance of the health systems of the countries due to the originality of the subject, it has been observed that these measurement models cannot become widespread due to the fact that these measurement models are not suitable for the differing health system structure of each country. In this direction, in this article, internationally accepted "3 models that measure the innovation performance of countries in the health system" are analyzed with a comparative method. The comparisons were made in line with the scope, process and measurement criteria of the specified measurement models. While the scope and process comparison evaluations are specified in the text, the criteria comparisons are presented through tables for more explanatory purposes.

Table Description: The models in the row headings of the table are the innovation performance measurement models examined in our research. The criteria names in the columns are also the measurement criteria of the relevant model. The criteria scopes and explanations of each model included in the analysis were obtained by compiling from the model reports published as open source. The criteria found in common in all 3 models examined and whose criteria were analyzed were

grouped by naming them with a main criterion name. Thus, the measurement criteria that are common to all 3 models are presented to the reader in a more comprehensive way. Tables are used to make the grouping easy for the reader to understand. Table interpretations are also presented in detail in the "discussion and conclusion" section.

FINDINGS

When all three models are examined comparatively, the dimensions thought to be common are; Financing; Human Resources; working environment; Political and Legal Environment; Intellectual Property Rights (opportunities, facilitators, and intellectual resources); Information technologies; Cooperation Opportunities; R&D Activities; It is classified in 10 dimensions as Service Delivery and Innovation Outputs. Each dimension and the criteria it contain are presented in Table 1 below.

Within the scope of the "Financing" dimension, the criteria of financial resources allocated to health (assigned resources), incentives (incentives) for health innovation, and current opportunities (opportunities) that will provide an environment for sectoral innovation are discussed. All three measurement tools consist of indicators covering the "Financing" dimension.

Within the scope of the "Human Resources" dimension, the criteria for a qualified workforce in the sector (adequacy of human resources) and encouraging the workforce to innovate (Incentive for Innovation of Human Resources) are discussed. While making this classification, it is noteworthy that the MTIS model does not include an indicator that supports these dimensions and criteria within the scope of human resources.

Within the scope of the "Business Environment" dimension, the criteria for indoor opportunities that enable innovation (Indoor Environment (Building and Culture)) and outdoor opportunities that support innovation (outdoor environment) are discussed. All three measurement tools comprise indicators covering the "Business Environment" dimension.

Within the scope of the "Political and Legal Environment" dimension, "Political and Legal Regulations" and "Political and Legal Stability" criteria are discussed. Notably, the IIHEC model deals with the "Political and Legal Environment" dimension with many indicators.

Within the scope of "Intellectual Property Rights", the existence of opportunities that will provide an environment for the protection of ideas with intellectual property (creating a suitable climate for Intellectual Property) and intellectual property outputs that will provide resources for innovation (Intellectual Property Outputs) (with the possibility of commercialization) are discussed. It is noteworthy that the indicators that will cover the dimensions and criteria within the scope of Intellectual Property Rights are only found in the IIHEC model and that the MTIS and GDHI models do not contain any indicators that will show these dimensions and criteria.

The "Information Technologies" dimension has been handled with 1 criterion, namely the Dissemination and Use of Information Technologies. The MTIS model does not include an indicator pointing to this dimension.

The "Cooperation Opportunities" dimension is handled with 1 criterion: Cooperation with Internal and External Stakeholders. All three measurement tools comprise indicators covering the "Cooperation Opportunities" dimension.

The "R&D Activities" dimension is handled with two criteria: Resources Allocated for R&D Activities and R&D Activities. It is noteworthy that the MTIS model does not include an indicator pointing to this dimension. The other two models also consist of indicators pointing to this dimension.

The dimension of "Service Delivery" is handled by two criteria: the amount of service delivery opportunities and the quality of service delivery opportunities. Indicators containing this dimension can only be used on the IIHEC model.

The "Innovation Outputs" dimension is handled with 1 criterion: Income Generating Innovation Outputs. The GDHI model does not include an indicator pointing to this dimension.

Table 1. Comparative analysis of all three models and grouping in terms of common dimensions and criteria

Dimensions	Criteria	IIHEC	MTIS	GDHI
Financing	Allocated Resources	3.1.3. Out-of-pocket expenditure on health		
		3.1.1. Per capita expenditure on health		
		1.2.1. Public expenditure as % of GDP (Gross Domestic Product)		
	Incentives		1.1. Market incentives	1.2. Incentives and reward
			1.2. Healthcare incentives	
	Facilities	1.3.3. Venture capital availability	5.1. Investment environment medical	
		3.1.4. Growth in the pharmaceutical industry	5. Supportive investment community	
		3.1.5. Development in pharmaceutical imports		
		4.1.2. Real GDP growth		
		4.2.6. Financial market sophistication		
Human Resources	Quality of Human Resources	1.2.2. Total tertiary enrollment		
		2.1.2. Intellectual Property office staff strength		

Dimensions	Criteria	IIHEC	MTIS	GDHI
	Incentive of Human Resources to Innovation	1.1.2. Number of researchers		2.4. Supporting change champions
		1.4.4. Number of Clinical Research Coordinators		
Work environment	Indoor Environment (Building and Culture)	4.2.1. Ease of Doing Business	4.2. Needs and infrastructure	2.6. Changing inefficient working styles
			2.1. Innovation resources	2.5. Creating time and space for new ways of working
			3. Supportive regulatory system	1.1. Vision and strategy
			2. Leading resources for innovation	2. Cultural Dynamics: Organizational and Personal Behaviors Necessary for the Rapid Spread of Innovation
				1.6. Promoting innovation in healthcare
				1. Enablers (Facilitators)

Dimensions	Criteria	IIHEC	MTIS	GDHI
				2.3. Adapting innovations to suit the local context”
				2.7. Improving the next journey of system transformation”
	Outdoor	4.2.2. Regulatory quality		3. Systems Characteristics: Macro Impacts on Health Systems Innovation and Diffusion
		4.2.3. Corruption perception index		
		4.2.4. General infrastructure		
		4.2.7. Worldwide Press Freedom Index		
Political and Legal Environment	Political and Legal Regulations	2.3.1. Price negotiations	3.1. Regulatory approval process	1.8. Development of healthcare protocols
		2.1. Policy	3.2. Legal environment	
		2.3.1.1. Clearly laid out policies for Pricing		
		2.3.1.2. Unbiased policies for imports and local products		
		2.3.1.3. Opportunity to negotiate price with Government		

Dimensions	Criteria	IIHEC	MTIS	GDHI
		2.3. Ability to Price		
		2.3.2. Regulations influencing pricing		
		2.3.2.1. Absence of National Medicines List/ Formulary		
		2.3.2.2. Regulations against parallel imports		
	Political and Legal Stability	4.1. Political Stability and Economic Development		
		4.1.1. Political stability		
		4.2.5. Judicial independence		
		4.1.3. Macroeconomic stability		
Intellectual Property Rights (Possibilities, Possible Swords and Intellectual Resources)	Preparing the Right Environment for Intellectual Property	2.2. Intellectual Property (IP)"		
		2.2.3. IP protection and enforcement"		
		2.1.2. IP office staff strength		
		2.2.1. Index of Patent Rights		
	Intellectual Property Outputs	2.2.2. Period of data for new drugs		
		1.5.1. Number of drug patents filed in WIPO		

Dimensions	Criteria	IIHEC	MTIS	GDHI
		2.1.1. Number of pharmaceutical patents in the emerging market		
Information technologies	Diffusion and Use of Information Technologies	3.2.4. Total subscribers		1.5. Information communications technology (ICT) capability
		3.2.5. Technology readiness ””””		
		3.2.6. Technology usage ”		
		3.3.2. Number of MRI (magnetic resonance imaging) & CT (computed tomography) scanners per capita”		
Collaboration Opportunities	Cooperation with Internal and External Stakeholders	1.3.2. Strength of university & industry research collaborations	4.1. Healthcare demand	2.1. Leveraging the efforts of patients and the public
			4. Demanding and price-insensitive patients	2.2. Addressing concerns of healthcare professionals about outcomes and sustainability
				1.7. Communication channels across health care, with outside industries and with the public

Dimensions	Criteria	IIHEC	MTIS	GDHI
				2.1. Benefit from the efforts of patients and the public
				2.2. Addressing Healthcare Professionals' Concerns About Outcomes and Sustainability
R & D Activities	Resources Allocated to R&D Activities	1.3.1. R&D spending by companies		1.3. Creating research funding for R&D and dissemination
		1.1.1. Total GDP on R&D by government		1.4. Transparency and provability of research findings
		1.1.2. Number of researchers		
		1.4.1. Number of science parks		
		1.4. Facilities		
		1.4.2. Quality of scientific research institutions		
		1.4.4. Number of Clinical Research Coordinators		
	R & D Activities	1.4.3. Number of clinical trials		

Dimensions	Criteria	IIHEC	MTIS	GDHI
		1.2.3. Research publications		
		1.1. Plan (R&D Focus)		
		1.5. R&D Output		
Presentation of service	Quantity of Service Offering Opportunities	3.2.1. Number of hospital beds per capita		
		3.2.2. Number of physicians per capita		
		3.2.3. Number of nurses per capita		
		3.2.7. Number of medical schools		
		3.3.3. Number of patients organizations (per million)		
	Nature of Service Offering Opportunities	3.1.2. Accessibility of healthcare		
		3.3.1. Primary care immunization – national coverage rates		
Innovation Outputs	Income Generating Innovation Outputs	3.3. Outcome	2.2. Innovative output	
			5.2. Medical technology commercialization	

According to the scope of these classifications, “2.1.2. The criterion of “Authorization of Intellectual Property Rights Bureau Personnel” is handled within the scope of both Human Resources and Preparing an Appropriate Environment for Intellectual Property” 1.1.2. Number of Researchers" and "1.4.4. The "Number of Clinical Research Coordinators" criteria were discussed twice in both the "Quality of Human Resources" criteria and the "Resources Allocated to R&D Activities" criteria.

In addition to dimension and criterion comparison, the models were also examined regarding the processes they dealt with. It was seen that all three models could be handled in two processes, "Innovation Inputs" and "Innovation Outputs". The dimensions of Finance, Human Resources, Business Environment, Political and Legal Environment, Intellectual Property Rights, Information Technologies, Collaboration Opportunities, R&D Activities, and Service Delivery can be addressed within the “Innovation Inputs” process. The "Innovation Outputs" dimension can be considered within the scope of the Innovation Outputs process. An important point that draws attention when making process comparisons is that there is no indicator to cover innovation outputs in the "Global Diffusion of Health Innovation" model.

DISCUSSION and CONCLUSION

Indicators that will reveal the current situation are the most needed tool in policy and strategy development processes. A national and sectoral measurement model is needed to reveal the strengths and weaknesses of innovation policies and practices. Several models were developed specifically for the health sector to measure the innovation performance of the country's health systems. Among these models, the Medical Technology Innovation Scorecard (MTIS) is a study to measure the healthcare innovation and adoption capacity in nine countries. This card measures country performance over five components and 86 indicators that are thought to support medical technology innovation (Price WaterhouseCoopers, 2011). The obtained results are used to make inferences about the development of innovation performances of 9 countries. However, this study has been criticized for failing to adequately explain methodological choices (Cravo Oliveira et al., 2017). While the GDHI project is not a measurement model, it is a critical study as it specifies multiple indicators that can guide the “development of a global health innovation index”. The study's main purpose is to encourage healthcare industry leaders to spread innovation and to lead the discussion on transforming healthcare systems into an innovative system (Lord & Parston, 2013). Project studies were carried out in 2016 by interviewing 100 experts in 8 countries and by conducting surveys with 1,521 healthcare professionals and 772 sector professionals. The study findings examine the importance of enablers and cultural dynamics defined by the Global Institute for Health Innovation as a framework for the global diffusion of health innovation (Lord & Parston, 2013). The 2009 Index of Healthcare Innovation in Developing Countries (IIHEC) study, published by consultancy Deloitte, aimed to compare the capacity of developing and developed countries to foster innovation in healthcare (Pefile et al., 2005). The framework is based on the idea that innovation depends on factors concerned to 4 key components: improving, ownership, diffusion and environment. Also, it only focuses on

healthcare technologies, excluding innovations in supply and services. The development of "Global Health Innovation Index" study is a study to develop a global health system innovation index that analyzes countries' health systems. In the study, the indicators in the existing indices were examined separately for both all sectors and the health sector, and the evaluation of the indices was presented. It recommends involving experts and index stakeholders in the index development phase. In addition, he criticized the index studies proposed to measure the innovation performance of the health systems of countries, as they do not have a methodological infrastructure and are not widespread.

Although each of the studies mentioned above developed to measure the innovation performance of the country's health sectors is very valuable, it is seen that they are still in the early stages of general acceptance and dissemination compared to the innovation measurement tools (Global Innovation Index (GII) etc.) throughout the country. MTIS is only used to make inferences about improving the innovation performance of 9 countries. Since it is seen as methodologically weak, its value in contributing to policy development and decision-making processes could be higher (LeCompte & Goetz, 1982). While the GDHI study points to essential indicators, it does not provide a measurement tool. The IIHEC study needs to be more inclusive as it only focuses on developing countries. In addition, it does not focus on innovations in procurement and services, but only on health technologies.

When the current measurement tools are evaluated, it is seen that they cover only some countries and are not widely used. Although the reasons for this are that it is still in the stage of becoming widespread, it is not introduced enough, and there is no solid methodological background; the most important reason is; It is seen that the measurement tool indicators do not include indicators that will measure the innovation performance of the national health system of all countries due to the differences in the health systems of the countries. Evaluations made with the same indicators can be misleading in reaching the correct measurement result due to differences in the functioning of health systems and policies and health care providers between countries. In addition, the health sector; covers sub-sectors such as health service delivery, health tourism, health technologies, and health informatics. Each sub-sector has different dynamics due to its unique structure. For this reason, there may be differences between the indicators that will measure the innovation performance of these sectors. For example, innovation performance measurement in health informatics and health technologies will be a product innovation-oriented measurement. In contrast, innovation performance measurement in health service delivery will be process innovation-oriented. For whatever reason, the innovation performance of all countries in the health sector cannot be measured with the same indicators, nor can it be measured with the same indicators in every sub-sector covered by the health sector. Even if measured, this measurement will not be accurate. As a matter of fact, when the innovation performance measurement tools developed specifically for the health sector were examined, the reflections of this situation were observed. A measurement model that measures the

national innovation performance of country health systems and can be adapted to all countries has yet to be found. This study was planned based on this problem.

In this study, the measurement tools used in measuring innovation performance in the health sector were evaluated in terms of process, dimension, and criteria analyzed with a comparative method, and grouped according to their partnerships. As a result, the framework of which dimensions and criteria can be found in the measurement tools that countries will develop to measure the innovation performance of their national health sectors has been drawn. The proposed framework, a model to measure the innovation performance of the health systems of countries, Financing; Human Resources; working environment; Political and Legal Environment; Intellectual Property Rights (opportunities, facilitators, and intellectual resources); Information technologies; Cooperation Opportunities; R&D Activities; It has been seen that it can be evaluated in 10 dimensions, namely Service Delivery and Innovation Outputs. It is an original research work emphasizing the dimensions and criteria the measurement model will contain and creating a framework. This framework can form a basis for developing measurement tools specifically for the country.

The indicators indicated by the comparative analysis of the existing models are grouped in terms of dimensions and criteria that are thought to show commonality and summarized in 10 dimensions. National health sectors can be a source and starting point for developing a model to measure national innovation performance. The dimensions and criteria presented as a result of this study should be considered in the measurement models to be developed. This study will provide an important output in terms of analyzing current models and presenting indicators for future studies and will also point to an essential need in the field.

It is recommended that countries develop innovation performance measurement tools suitable for their sectors, considering their health policies, the dynamics of their sub-sectors in the health sector, and the special management structures of their institutions. Thanks to the measurement tools they will develop, they will be able to conduct situations and needs analysis with precision. They will also be able to monitor their progress by comparing measurements to be made in specific periods.

There are different points to be considered in measuring tools. One is to base the measurement tools to be developed on a solid methodological basis, as suggested in the Global Health Innovation Index study (Oliveira et al., 2017b). In addition, since only some indicators in the measurement tools can have the same importance, it is recommended to determine the weights of importance between the criteria for more accurate measurement results. Although this study provides a measurement tool framework, it can be further developed in future studies. In the model to be developed for future studies, it is recommended to develop a model that can be used in the sector, based on the country-specific methodological development, by supporting the qualitative methods with quantitative research methods and calculating the importance weights of the indicators.

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