

## Triple P Model: Publications, Patents, and Production

Alireza Noruzi<sup>1</sup> , Behzad Gholampour<sup>2</sup> , Sajad Gholampour<sup>3</sup> 

1. Department of Knowledge and Information Science, Faculty of Management, University of Tehran, Tehran, Iran. E-mail: [anoruzi@gmail.com](mailto:anoruzi@gmail.com)

2. Corresponding author, Parseh iMetrics Institute, Tehran, Iran. E-mail: [behzad903727@yahoo.com](mailto:behzad903727@yahoo.com)

3. Parseh iMetrics Institute, Tehran, Iran. E-mail: [sajad908919@yahoo.com](mailto:sajad908919@yahoo.com)

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### ABSTRACT

**Objective:** The aim of this study was to develop an indicator for measuring the relationships between publications, patents, and production (so-called 3Ps). The purpose of this study was to investigate these relationships further to propose a new model.

**Materials and Methods:** To examine the relationships between publications, patents, and production, several models in the field of science, technology, and innovation (STI) have been reviewed.

**Results:** The Triple P model assumes a tripartite influence connection among publications, patents, and production. The Triple P refers to publications, patents, and production of a particular country or institution in a specific field, subfield, or specialty in a given period. This model can be used as an indicator to measure the attention level of countries or institutions to a particular product.

**Conclusion:** The Triple P model refers to a set of interactions between publications, patents, and production, to foster scientific, economic, social, and technological development. This study presents the way to measure the interrelationships between the Triple P's of publications, patents, and production of a particular country or a specific field.

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### Introduction

In today's world, the comprehensive development of countries is based on science, innovation, and technology, in which publications and research are considered as science achievements (Schubert & Telcs, 1986; Chinennaya & Chebanenko, 2020), and patents are determined as a

measure of innovation and technology performance (Pavitt, 1985; Nagaoka, Motohashi & Goto, 2010; Dang & Motohashi, 2015). They are considered as one of the most important factors affecting the development of countries. Therefore, governments are trying to invest in development research, applied research, innovation, and technology, producing wealth from science by forming an innovation and technology ecosystem. To achieve these important goals, the policymakers of countries need to realize the relationship between academia and industry, support research projects and ideas of elites, especially inventors in society, and apply them in the form of products or improve the product quality.

In the meantime, the role of private and public companies and institutions, and at the top of them, knowledge-based companies, to achieve this goal is very important and significant. In fact, all governments and policymakers try to create wealth from science (scientific knowledge and research findings presented in the form of *papers*), innovation (*patents*), and technology (which may appear in the form of *products or goods*) to develop their economy and society.

Societies need to be able to turn science into technology breakthroughs and then into products or goods, and thus put science at the service of the society and economy and thereby solve the problems of their societies. In societies, the number of publications or research papers alone is no longer a criterion. It is the transformation into a product that matters; and the real basis of this transformation is the *patents*. Applying science and scientific research and turning them into a *product* in a knowledge-based economy and thus gaining currency and capital for the country would not be possible without planning. Success in these areas will be achieved if the relevant policymakers, officials and institutions pay more special attention to this issue.

The purpose of this study was to investigate these relationships further to propose a new model. To examine these relationships, several models in the field of science, technology, and innovation (STI) have been developed, some of which are as follows.

## Materials and Methods

This study is a short review examining the relationships between publications, patents, and production. To examine these relationships, several models in the field of science, technology, and innovation (STI) have been reviewed.

## Results

### *Triple helix model of innovation*

The *Triple Helix* model of innovation is a concept theorized and developed in the 1990s by Henry Etzkowitz and Loet Leydesdorff (1995, 1996) to describe and explain the interactions between the three spheres of the university, industry, and government in the innovation process. This concept was developed

to demonstrate the interactions between academia (universities), industries and governments, to foster the socio-economic development and its sustainability, as described in concepts such as the knowledge-based economy and knowledge-based society.

This model examines the various institutions involved in the innovation process (university, industry, and innovation), and the interaction between these three pillars become more prominent (Etzkowitz & Leydesdorff, 2000). The goal of the innovation system in the form of a triple spiral is the knowledge-based economy.

### *Quadruple Helix model*

In 2009, Carayannis and Campbell developed a model for improving the *Triple Helix* model, known as the *Quadruple Helix* model, which is conceptually broader than the Etzkowitz and Leydesdorff triple helix model. This *Quadruple Helix* model has conceptualized the three dimensions of the *Triple Helix* model by adding as a fourth helix the ‘media-based and culture-based public’ and ‘civil society’. In the *Quadruple Helix* model, special attention has been given to the knowledge democracy in terms of knowledge production and innovation (Carayannis & Campbell, 2014).

The *Quadruple Helix* model incorporates the public via the concept of a ‘*media-based democracy*’ (Plasser, 2004), which highlights that when the government is developing innovation and industrial policy more proactively to grow and strengthen the economy towards sustainability and technological change, it must clearly communicate its innovation policy with the public, civil society and representatives via the media to obtain public support to implement new policies, strategies, and initiatives (Carayannis & Campbell, 2009). In fact, the *Quadruple Helix* model is an extension of the *Triple Helix* by adding as a fourth helix the ‘media-based and culture-based public’ and ‘civil society’.

### *Quintuple Helix innovation model*

Carayannis and Campbell (2010) proposed the *Quintuple Helix innovation model*, which is conceptually broader than the quadruple model, covers all the concepts of the Quadruple Helix model by additionally adding the helix of the ‘natural environments of society’. This model is sensitive to ecological and environmental issues (Carayannis, Barth, & Campbell, 2012; Carayannis & Campbell, 2014). The *Quintuple Helix* supports the creation of a win-win relationship between innovation, knowledge, and ecology, strengthening synergies between society, economy, and democracy (Carayannis, Barth, & Campbell, 2012). The two models of *Quadruple Helix* and *Quintuple Helix* describe university-industry-government-public-environment interactions within a knowledge-based economy.

### *Triple P model*

The proposed models deal with the relationship between academia and industry, and the relationship between *publications*, *patents*, and *production* (so-called 3Ps) is not specifically studied in a particular country or field. Therefore, a new model is proposed for this purpose, which is referred to as the *Triple P* model. Based on the *Triple P* model, we can measure the number of *publications* (indexed in a bibliographic database such as Scopus, Web of Science,

PubMed, Dimension, and other documentation databases), *patents* (issued by USPTO, WIPO, EIPO, Lens, and other patent databases), and *production* (produced and exported by countries, registered in the OEC database or other databases) of a particular country. In addition, statistical information about products can be obtained from various websites such as [OECD.world](http://OECD.world), [statista.com](http://statista.com), [wits.worldbank.org](http://wits.worldbank.org), [tridge.com](http://tridge.com), and [trendeconomy.com](http://trendeconomy.com).

The idea of *Triple P* model was initially inspired by the *Triple Helix* model. The *Triple P* model aims to measure the relationships publications, patents, and production of a country, field, or sub-field, and intends to evaluate the status of each P's dimension. Therefore, the *Triple P* model is important for two reasons: First, the proposed model helps researchers and experts in a field of science to think more deeply about the relationships between these P's dimensions. Second, when using the *Triple P* model, it is easy to measure the number of publications, patents, and production of a country or a specific field together and evaluate the situation of the country or field in all three dimensions. The *Triple P* model is shown in Figure 1.

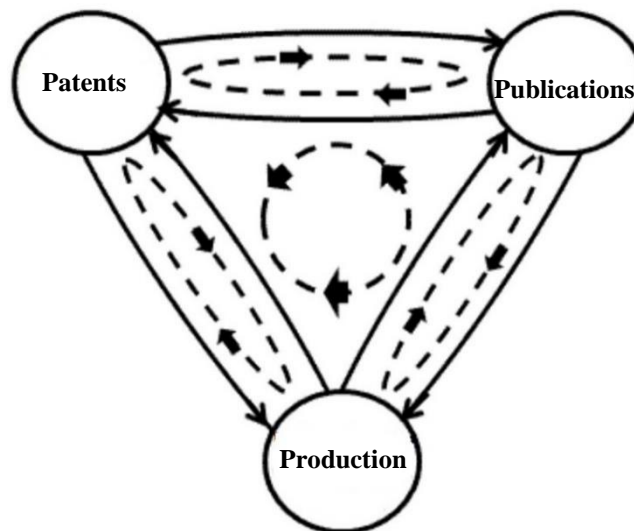


Figure 1. Triple P Model

#### First P: Publications

A tangible or intangible source of information that is published electronically or in print by an author, researcher, or organization in a variety of formats and made available to the target community, including original research papers, review papers, short communications, case studies, dissertation works, editorials, essays, letters, technical communications, technical papers, technical reports, monographs, books, book chapters, conference communications, and so on.

#### Second P: Patents

A patent is a form of intellectual property rights that grants its owner the legal right to prevent others from copying, making, manufacturing, adapting, using, selling, and importing a claimed invention for a certain

period of years, generally 20 years from the filing date of the application, in exchange for publishing an enabling public disclosure of the invention by a country's patent office (EPO, 2022; WIPO, 2022; USPTO, 2022). Patents are the most common way to protect the rights of inventors by a state or government. Generally, there are three types of patent applications approved by the USPTO: design patent, plant patent, and utility patent (USPTO, 2021).

### Third P: Production

By the term 'production', we mean any activity that leads to the creation of goods and services. It is the act of creating goods and services needed to satisfy human needs and demands. It is any activity that leads to the conversion of raw materials into finished products (goods or services). In fact, it includes the creation of tangible products, goods, and services rendered to people and paid for by them. It is also defined as follows “*an activity that leads to creation of products and services by using and organizing a series of factors and inputs, namely labor, asset, and natural resources.*” (Javanpour & Norouzi, 2014, p.7).

### Discussion and Conclusion

The *Triple P* model refers to a set of interactions between publications, patents, and production, to foster scientific, economic, social, and technological development. The types of items to be examined for each P are given in Table 1.

**Table 1. Items examined in each of the P's**

<b>Publications</b>	<b>Patents</b>	<b>Production</b>
Article	Industrial	Industrial
Review	Medicinal	Medicinal
Proceedings papers	Medical	Agriculture
Book	Herbal	<i>etc.</i>
Book Chapter	Tools	
Editorial	Softwares	
Case Study	<i>etc.</i>	
Short Communication		
Letter		
Note		
Meeting Abstract		
<i>etc.</i>		

Any type of information content that can be indexed in bibliographic databases, especially Scopus, Web of Science, and PubMed can be considered as publications. This content can be research articles, reviews, book chapters, short articles, etc. In addition, patentable inventions are new, useful, and innovative products or designs that can be published in various forms such as industrial, pharmaceutical, medical, tools, software, etc. They are any technical solution of a problem in any field of human activity, involving an inventive step, and is industrially applicable. Productions include products and goods. Productions can be industrial products, pharmaceuticals, agriculture, etc.

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### **Author Contributions**

A.N., B.G., and S.G.: conceived and designed the study, reviewed the literature, collected the data, analysis and graphs, contributed to interpretation and manuscript preparation, literature review, writing manuscript, and proofreading. All authors have read and agreed to the published version of the manuscript.

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Not applicable.

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### **Ethical considerations**

Not applicable.

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### **Conflict of interest**

The authors declare no conflict of interest.

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