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Rethinking Productivity

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Abstract- The purpose of this paper is to highlight the major developments in the field of productivity as a concept and a measure. The concept of productivity is a managerial discovery that is of no less importance than the concept of division of labor in A. Smith's book "Wealth of Nations" 1776 and Henry Ford's assembly line in 1908, or any other effective method to measure performance at macro or micro levels. Productivity as a measure today faces different challenges represented by: 1) need to measure productivity in new fields such as knowledge work productivity and digital productivity, 2) productivity paradox revision in the light of new results that reduce the importance of this paradox and raising a new paradox in this field, 3) admixture and overlap of productivity concept with other concepts such as quality and effectiveness, 4) the need to develop and adopt green productivity in order to contain the environmental pollution caused by various business activities, and 5) dealing with multiple targets (social and economical) as in governmental productivity. This study discusses these challenges and provides some treatments that can contribute to the development of the concept and measure of productivity and to enhance its applicability.

1. INTRODUCTION

In business today, the transformations need more than any other time productivity manifesto. This is due to the importance of productivity being the most attention-grabbing measure since its first use by French economist of the Physiocratic school François Quesnay, 1766 (Tangen,2005, p35). Also, the numerous developments in the process of measuring and assessing performance, whether it is in industry or services, productive systems or markets, or even on basis of the different competitive priorities (cost, quality, flexibility, and innovation) have led to an admixture of concepts. . Mass production, which is considered a revolution in craft production, is not the only form that achieves the best business results. Nowadays, customers are not only concerned about low cost, but also, to a larger extent, they seek to meet their needs and exceed their expectations through flexibility and timely responses.

Although low cost in mass production and service, where one size fits all, attracts a wide range of customers, intermediate products or "make to order" can achieve satisfaction of another range of customers through differentiation. This leads to a question on how can assess productivity of very large production size and high output per hour in the first case, and low production size with low output per hour, when they both achieve customers' satisfaction, positive business results, and thus both obtain high productivity in terms of customer's satisfaction units and ROI.

Productivity today faces different challenges represented by:

- Adapting to new fields such as knowledge work productivity and digital productivity.
- Productivity paradox revision in the light of new results that lowers the importance of this paradox and raising a new paradox in this field.
- Admixture and overlap of productivity concept with other concepts such as quality and effectiveness.
- The need to amend the measurement method as in green productivity.
- Dealing with multiple targets (social and economical) as in governmental productivity.

The problem of this study is to highlight the developments that have led to these challenges that face productivity and their associated issues. This study will also present a managerial vision to help achieve a better understanding of productivity and the corresponding areas of development.

Concepts are like living organisms; they are born and they evolve with time. The more connected the concept to people's lives the faster the evolution happens and is continuously renewed. This applies to productivity; nevertheless, the problem with productivity is that it was converted into rigid forms having a measurement method that excludes several affective factors which in turn makes productivity suffers from abstraction just like any other quantitative model.

Multifactor productivity is defined as total output to total input (multifactor that contribute to achieve the total output).

Labor productivity, on the other hand, refers to output per unit of labor. Output is calculated in terms of units per hour; however, more than half of the business value and results are difficult to measure in this manner as products vary and services are unique according to customers' needs.

The concept of productivity is a managerial discovery that is of no less importance than the concept division of labor since A. Smith's book "Wealth of Nations" in 1776 and Henry Ford's assembly line in 1908, or any other method to measure performance at macro or micro level. Productivity has become the most important development in measuring and assessing business outcomes and has thus made it possible to manage it more easily; "what gets measured, gets managed". Productivity was behind Frederick Taylor's, the historical father of management, conviction that the conflict between capital and labor can be resolved in a win-win way: that is the win of both sides. This is opposed to K. Marx who believed that conflict between capital and labor has only one solution where one side wins on the expense of the other. Thus, productivity can achieve a "non-zero or positive sum game" for management and labor as opposed to the "zero sum game". It is the maximum productivity curve, which depends on both management and labor gains that makes up the biggest pie increasing the share of both sides, not one's share on the expense of the other.

Productivity is also one of the most widely used concepts in the twentieth century to the extent that made J.M.Juran (1993) says that the twentieth century is the productivity century, and the twenty-first century is the quality century. On the other hand, some believe the twenty-first century may be, in whole or in part, a century of productivity as well, but on another level of importance and more difficult in terms of measurement which is knowledge work. P. Drucker(1999) believes that management contribution in the twentieth century is represented by increasing worker productivity in industry; namely, the increase in knowledge work productivity and this represents the most important contribution of management in the twenty-first century. The highlight of the twentieth century was the production machine; yet, in the twentieth-first century it is knowledge workers and their production.

1.1. *Productivity and efficiency*

Productivity and efficiency are normally used in an interchangeable way which may lead to confusion in concepts (Johnston and Jones, 2004 and Simon, 1997). Until the first half of the twentieth century, productivity was the easiest to visualize and measure.

This resulted from the domination of mass production in which productivity and efficiency shared the measurement and assessment criteria for the worker and the company. Moreover, under the influence of the engineering vision, new concepts emerged such as "efficiency bible and efficiency cult" (Duncan, 1999, p52), "efficiency is everything"(Daft et al., 2010, p23), and technological orthodoxy which is the belief that all things should act efficiently (Alexander, 2008, pxi).

Despite the domination of mass production and the great admiration of efficiency and its results, Frederick Taylor underlined the one best way while Henry Fayol highlighted the economic man. This tendency expresses what can be called the rational productivity with its engineering-economic content represented by allocative efficiency and technical efficiency (Mandl et al., 2008, p3).

This arrangement was criticized in two aspects: the first aspect is related to the mechanical technical engineering dimension of productivity and efficiency. Faces of this criticism are that it leads to a mechanical conception of management, results in an invalid relationship between objectives and means in what is known as cruel efficiency, and draws attention to means and omits the objectives. The second aspect is related to concepts overlapping. Efficiency means the economic unit's output divided by its input. This indicates that efficiency corresponds to the meaning of productivity. This leads to the question: what is the difference between the two concepts? We think that the efficiency refers to making a fixed amount of output with fewer resources. In other words, efficiency is the use of the least resources to produce a fixed amount of output. However, productivity refers to desired (planned) output divided by desired (planned) input.

Efficiency is a narrow engineering concept that is identified by the inputs used to produce the standard rate of outputs. On the other hand, productivity represents a broad concept that focuses on both reducing the inputs and increasing the outputs.

Productivity and efficiency are two good measures in mass production as well as in mass service such as cafeteria line, AMT, and central mail services. Nevertheless, both measures face serious problems when they are used to customize (professional and job shop) production and services. In customized production and services, measures such as innovation (f_1), , differentiation (f_2), quality (f_3), rapid response (f_4), environmental effect (f_5), ethics (f_6) and so on, are more suitable and apt than productivity and efficiency. Thus, productivity must be transformed into performance through adding an equivalent component for each of these dimensions of performance as follows:

$$Performance = \frac{Output + f_1 + f_2 + f_3 + f_4 + f_5 \dots + f_n}{Input}$$

* Each of f_1, f_2…fn can take positive (improvement) or negative (decline) value.

This treatment can help dealing with the numerous

changes that require performance measurement and assessment. For example, efficiency engineering was based on standardization and depersonalization. However, the wide spread of talents in organizations today has made the "depersonalized relationships" a sterile bureaucratic policy that has negative impacts on the human capital within the organization as well as the relational capital outside the organization.

Therefore, attention and care must be given to human talents. In productivity, people measure millions of tons of materials and products; despite that, there are millions of feelings, relationships and values that are not measured; a lot of which are lost for no reason other than our inability to measure them accurately. Is this the extension of material paradox or is it the lack of response to the emergent development in wealth generators?

1.2. *Productivity and Residual Factors*

In spite of the emphasis that productivity will still be an important measure, it will also be the measure that overlooks many factors as in economics "the dismal science". It also doesn't respond to developments in several fields which need adaption of traditional measurement and assessment methods such as productivity and the development of new appropriate methods that are more convenient and stimulating to use the important resources in the new economy. Many changes have taken place since productivity transformed into a vital measure associated with increased productivity waves that occurred with work division and s-curves of new technology. Since the 90s of the last century, there has been a new era represented by knowledge management and economics. It is the era of intangibles that are based on hidden or invisible advantages (Low and Kalafut, 2002). The market value of corporations (with their tangible and intangible assets) is many times larger than their book value which is determined by their tangible assets only (Lev, 2001, p109). The headlines for this era are:

Economies of trust, Fokoyama 1995; knowledge economy, Rooney and Ninan 2005; the digital economy, Tapscott et al. 1998; the experience economy, Pine and Gilmore 1999; the loyalty effect, Reichheld 2001; economy of mind, Baker 2006; Emotionomics, Hill 2007; and Relationship Economics, Nour 2008. In a world where Google has larger market value than Boeing and Airbus combined, and Detroit spends more money on silicon than steel, the old notions of efficiency, productivity, cost accounting and how they measure wealth creation no longer apply (Baker, 2006, p5).

The focus in the new economy is knowledge, experiences, and relations which are all non-material, non-financial, and intangible; some of its characteristics are: lack of visibility, non-rivalry, partial excludability, non-tradability, non-separability, knowledge transferability, uncertainty, and perceptions of risks (Andrewsand de Serres, 2012). These characteristics causes productivity to face challenges in tracking achieved results which are in inputs to unforeseen production factors that convert into reputation, relations with loyal customers or employees 'experiences. None of these, which can be described using other factors, can be tracked using productivity due to their intangible nature and their association with knowledge characteristics, featured by self-generation cycle when exchanged (evolution upon exchange) and no value loss upon usage or exchange as opposed to the case of material goods. This is reflected on productivity as a resource measure. The many remaining factors that cannot be explained or included in productivity despite their high value may represent what Friedrich Hayek warned about when he said on the occasion of his 1974 Nobel lecture, "No economist's model would ever render fully intelligible the causes of market outcome of the consequences of government policies" (cited in Fryman and Goldberg,2007,p3).

1.3. *Reviewing Developments and Productivity*

The business sector, which was the general framework to the evolution of the concept of productivity and its applications, is also the field in which important questions regarding the evolution of productivity were presented as well as the great contribution to interpret productivity on the macro and micro scale. In order to present a broad review to the concept of productivity and its applications, the major changes can be identified to provide a larger picture of the dimensions of productivity review

1.3.1. *Waves of Increasing Productivity*

- Before the industrial revolution, craft production was based on one unit production, and despite how skilled the craftsman was, he couldn't create two completely identical units; hence, productivity in this production system was very low. However, with labor division, productivity increased significantly. Labor division prevailed in the history for a long time more specifically until the industrial revolution which is dated to Adam Smith's book "Wealth of Nations" in 1776. The first three chapters of the book address the division of labor, and he emphasized that:

(1) Division of labor: The first strong wave of increasing productivity was the division of labor. "The greatest improvements in productive powers of labor seem to have been the effects of the

division of labor" (Smith, 1976, Vol. I, p13). This was also confirmed by Charles Babbage as he addressed the benefits of labor division and specialty. With labor division, a big wave of increased productivity was launched and the craftsman became skilled in small piece of the work in which he is trained to do in minutes and repeats it continuously. Labor division 5 transformed the specialist into an expert in one small task allowing him to be more capable of developing a machine that can do these small tasks. This led to a new wave of increased productivity that is based on new technology which consequently led to the replacement of workers with machines, and manual skills with predetermined machine motions. The increase in productivity continued until it reached its peak with the usage of Henry Ford's first moving assembly line to produce T-Model in 1913 in less than two hours to reaching its next peak with the production of Liberty steamship during the Second World War in 48 hours (Duncan, 1989). The span that extends from the beginning of the industrial revolution until the end of the first half of the twentieth century can be considered as the golden age of productivity; however, there remain some points regarding this issue.

(2) The introduction of new methods and technologies required some time to achieve the significant increase in productivity. This was emphasized by Charles Babbage in his book "On the Economy of Machinery and Manufactures" in 1835 where he confirmed that: "In the first year after they spread over the soil they have comparatively little effect, but during the next four or five years their efficiency is considerable" (Babbage, 1835, p218).

Productivity is neither a technological nor a statistical concept; rather, it is primarily a great managerial innovation. The economist Douglas North, a Noble laureate, believes that the absence of appropriate institutions is the reason behind the gap of a long century between the dawn of the industrial revolution and thedramatic technological andeconomic expansion in the nineteenth century. The business analyst Alfred Chanlder believes that half of this change was a result of the organizational revolution rather than the technological revolution (cited in: Brown and Dayuid, 1998, p93).

(3) The increasing productivity that was achieved through division of labor had high humanitarian price as the worker is constrained to do the work according to a set of predetermined motions, a strict system, and an automated mentality that made the worker a small cog in a large wheel. This transformed the work into repeated routine motions that have no soul and without the worker's ability to improvise, innovate or think outside the box. That is, the increased productivity in worker's motions required ignoring his mental ability namely his characteristics and personal feelings.

Further, the technological innovation that led to increased productivity had social impaction both short and long terms. These impacts were not taken into consideration in many cases. For example, in the short term, technology caused the technological unemployment as well as other impacts on the social structures which required a social innovation that integrates with the technological innovation (Scott, 2007, pxiii). Moreover, the innovation of cars has made it easier to move; however, it changed cities' lifestyles and relationship with nature. Similarly, the innovation of phones, which enhanced people's communication, also limited the direct social relationships, and with the Internet the automated interaction and personal interaction are a basic need and the soul of Internet (Nunes and Kambil,2001).

1.3.2. *Customized Productivity*

Regardless of Kondratiev and Schumpeter's waves (The Economist, Feb 20, 1999), the development waves can be determined more broadly in:

(1) Natural resources wave (00-1770s) and its symbol "Earth" as in agriculture and raw materials.
(2) The hard industrial technology wave (1770s-1950s) and its symbol "the machine" as in (loom and steam engines).
(3) The soft information technology wave (1950s-00) and its symbol "the computer and computer networks".

According to the western vision, productivity coupling with technology is similar to the catholic marriage where technology became the first choice in decreasing cost as in labor-saving machines and the first source of increased productivity. However, the technology that led to revolutionize productivity in quantitative aspects also led to major problems in qualitative aspects related to weak response to the demands of the market and customer needs.

With the advent of new experiences, mainly in Southeast Asia which featured flexible and lean manufacturing systems and relied on Kaizen to attain better response to customer needs, it was apparent for

the first time that technology lacks some important aspects that determine success and failure in a competitive market. It was evident that productivity needs a human aspect not only in workers' related aspects but also related to customers and other external stakeholders. Thus, productivity became in need not only to physical technology but also to a new kind of technology, which is "customized technology" in its soft dimensions that are demand-driven as opposed to supply-driven technology, which was the case throughout the era of the industrial revolution. This means that productivity in its quantitative dimensions needs development and transition to customized productivity which is measured using both production units and customer satisfaction units.

1.3.3. Virtual productivity

The two previous waves, which were both based on natural and industrial resources, used to depend on manual and organizational skills on the one hand and on partial localized capabilities in space and time on the other. This is the reason why they required lengthy periods to reach their peak due to communication challenges, lack of integration due to technological limits and political constraints. The third wave, which is the wave of computers and the Internet, relied on intensive knowledge on the one hand and the work in integrated capabilities of time (24/7) and space at worldwide level where the Internet is the most globalized technology on the other. This wave is characterized by rapid evolving and what can be seen with the first Intel processor 4004.

The first microprocessor, the Intel 4004, could perform about 400 computations per second when it hit the market in 1971. IBM's first personal computer, introduced a decade later, executed 330,000 computations per second. Today a $500 PC can handle over 6 billion computations per second, or 15 million times what the 1971 Intel 4004 could do (McEachern,2012, p496).

This advancement in the power of performing calculations on a computer and then the Internet which works at a speed close to light speed has led to decreasing the transaction cost to zero where clicks equal transactions.

The high speed of work completion over the Internet has led to Wikinomics that work at the same speed of the Internet and changes everything (Tappscott and William, 2006, p.3). A computer with higher productivity (more computations per second) at a less price! This is a leap in work productivity that started in the 90s as the highest investment in information and communication technology. In this wave the heavy material density in atoms is transferred into high speed ethereal clicks.

1.3.4. Green productivity

Today's environmental problems are represented by climate change problems, the diminishing of natural resources, and the harmful pollutants (solid, gaseous, and water wastes). The problem raises the concept of silent economy as in the "Silent Spring" of Rachel Carson who sounded the alarm against the current direction in dealing with the environment in the same form of dismal science. However, this time it was not under the impact of population increase, but due to the growth that exceeds the limit of the environment in terms of resources and the rampant pollution.

Since the first report of "the club of Rome" in 1972 which was entitled "The Limits of Growth", the environment has become a constraint over growth besides being a constraint over productivity. Thus, productivity that is directed to growth regardless of the environmental demands is black productivity which as far as it produces benefits it produces pollution and wastes.

The term "wastivity" is used in literature to indicate to productivity of wastes and pollution (Mohanty and Deshmukh, 1999, p165). The environmental challenges require deep rethinking of the relationship between market demands to achieve high rate of growth (including high productivity) and environmental demands to decrease consumption, pollution, and wastes. To achieve a good balance between the two, it is necessary to adopt green productivity.

The concept of green productivity was first introduced by the Asian Productivity Organization (APO) following the 1992 Rio Earth Summit. Green productivity (GP) is a strategy for enhancing productivity and environmental performance simultaneously to achieve overall socio-economic development (Shireman, 2003, p11, Tuttle and Heap, 2008, p95). GP fosters smart growth (Johnnson, 2006, p1.5), helps to fill a long-existing gap in environmental performance evaluation (Gandhi and Santhi, 2006, p597) and involves a concern with using a customer focus (Tuttle and Heap, 2008, p95) (Table 1. contains comparison between black and green productivity).

Black Productivity	Green Productivity
- Exploitative view	- Sustainable view
- Zero sum game (win/loss thinking)	- Positive Sum Game (win/win thinking)
-Society Pays (Free pollution: externalities)	- Polluter Pays
	-Fit to smart use is

- More is efficient	effective
- Big is beautiful	- Small is beautiful
- High rate of growth	- Green/smart growth
- Economies of scale	- Economies of scope
- *BP = TO/TI*	*-GP = TO + PEI/TI + NEI*

Black productivity (BP) in pollution, wastes, "big is beautiful" and rapid growth economics is:

$$BP = TO/TI$$

where:

TO = total output

TI = total input (both TO and IT are calculated without environmental impact).

On the other hand, green productivity (GP) represents an approach to introducing the environmental impact in this productivity equation as follows:

$$GP = TO + PEI/TI + NEI$$

where:

PEI/NEI= positive and negative environmental impacts

In this equation, green productivity accounts to the positive environmental impact in output and the negative environmental impact (i.e. all positive and negative externalities) in the process of production.

It can also be said that equilibrium in the conventional economics happens when: MPC = MPB (marginal private cost equals marginal private benefit), but in ecological economics it happens (Gigg, 2002, p206):

$$MSC = MPC \pm Ex.$$

Or $MSB = MPB \pm Ex.$

Where:

MSC = marginal social cost,

± EX = negative and positive externalities and

MBS = marginal social benefit

1.3.5.*Productivity paradox*

In 1987 the Nobel laureate, Robert Solo, spoke about productivity paradox. He said "You can see the computer age everywhere but in productivity statistics". Since the 70s of the twentieth century, the developing investments in IT coincided with poor productivity gains. Much academic attention has been drawn to this issue known as "productivity paradox". Some have talked about reasons that can interpret this paradox while others confirmed the invalidity of the paradox, while some others presented a new paradox which is the exact opposite of Solo's paradox (Dedrick and Kraemer, 2001).

Greenman et al. believed that Solo wrote this result at a time when the U.S. economy was confronted with a prolonged period (since the mid-1970s) of poor productivity performance (Greenman et al., 2002, p.3).

According to Eric Brynjolfsson (1993) there are several explanations to the paradox. These explanations are (cited in: Jason and Kraemer, 2001,pp.2-3):

(1) Errors of IT capital measurement which results from the quick price and quality changes, and the inability of economic statistics to measure qualitative improvements in the output of service industries.
(2) Time lags, which is an argument made by Paul David (1990), who said that IT would not have a measurable impact on productivity until it reaches a critical mass of diffusion and experience.
(3) Management practices, which has yet to evolve to take advantage of technology potentials.
(4) Redistribution that is IT might help individual firms relative to competitors, however not to increase productivity in the whole economy.

Productivity paradox can be interpreted through the gap between introducing technology (technological wave) and productivity increase (managerial wave).

In the dynamo revolution, the slow pace of utilizing electricity in factories was one of the key reasons that delayed exploiting productivity improvements. This pace was also accountable for unprofitability of the replacement process i.e. replacing still serviceable manufacturing plants that use the old regime of mechanical power derived from water and steam. (David, 2009, pp.356-7). Another view is presented by Carlaw and Oxley who believe that there is no paradox because there is a real technology cycle that causes real productivity slowdowns (Carlaw and Oxley, 2008). It is only when the new technologies (such as computers) have been sufficiently diffused that we can see computers everywhere and in productivity.

The productivity paradox unveils that productivity is not just a pure statistical concept, but it is also a managerial concept in which the direct factors (as in introducing IT) are not enough to interpret the increase or slowdown in productivity. Moreover, companies are not equal in their ability to employ technology as such that increased productivity is achieved.

In the 21st century, with the increased importance of IT and the expansion of digital economy, there is a need to upgrade this paradox in consistency with this technology as indicated by many studies (Brynjolfsson and Hitt, 1998, Dewan and Kraemer, 1998 and 2000, Kraemer and Dedrick, 2001, Melville, 2001); the latter revealed a positive relationship between IT and productivity. The new reality of a positive relationship between IT and productivity replaces the old productivity paradox. It also makes "IT industry executives wonder why business executives do not invest much more in IT than what they already do, given the fact that the returns of IT are large and acknowledged by noted economists and

distinguished policymakers alike" (Dedrick and Kraemer, 2001, pp4-5).

The new truth of the waving relation between technology and productivity replaces the old productivity paradox yet IT-based productivity raises new problems regarding two aspects. First, computer-based or Internet-based service has an exchange value only when in use which is opposed to goods where the exchange value is separate from the use value. This means that there is an invisible component of productivity that depends on customers more than in the case of products that can be kept in stock. Second, the high computer-based productivity is based on the automated interaction and the predefined response model which relies on rules and models-based software which are as standardized and modularized as the predefined motions in the one optimal way of Taylor (Drucker, 1992). "At least this is the position of the more radical proponents of Artificial Intelligence, Taylor's true children or grandchildren".

1.3.6. *Productivity paradox*

Productivity increase when coupled with corporate sales increase in the market represents an important indicator of the organization's success. However, this success is accompanied by an increase in the corporate market value. In the digital age, this success means a significant increase of intangible assets' value in the organization. From an accounting perspective, the corporate market value represents the difference between the market and book value. Conventional accounting until today has limited recognition of intangible assets. For example it recognizes patents, copyrights, brands and goodwill. However, it neglects a significant portion of valuable intangible resources such as know-how, leadership, value of loyal customer and so on. In terms of intellectual capital, those intangible resources are human, structural, and relational capital.

Productivity measures must include the increase (improvement) or decrease (decline) in the market value of the company as it is a real part of the corporate performance. However, the current macro and micro productivity metrics neglect both cases. In other words, increasing productivity is no longer a simple indicator of historical comparison, but it is also an indicator for comparison with competitors, which is reflected in the market value of the organization. When productivity increases at a rate less than the competitor (or competitors), it will reflect negatively on the success of the company and its market value, which means that productivity has not improved in terms of market value; rather, it has declined.

1.4. *Conclusions*

Productivity has been the most important measure for an extended span due to the domination of the mass production. However, a profound rethinking of productivity and the need to extend the concept to cover the previously mentioned developments necessitates looking beyond productivity. What we conclude here is consistent with a broad trend of important revisions in many solid concepts. About half a century ago, Herbert Simon (Simon, 1997) criticized the concept of economic human, which realizes absolute rationality and cruel efficie- ncy. He emphasized the need for managers to adopt the bounded rationality, which considers the conditions that affect decision-making.

This thinking is in line with the increasing talk that "the economics does not tell the whole story" and thus there is an ongoing talk about "beyond economics" (Boulding, 1968), and "beyond rationality" (Hammond, 2007, pp288-9). It is time to put productivity into the real context of economic development.

What we propose in "beyond productivity" represents an attempt to contain all the previously mentioned developments which can be achieved by adopting a broader concept which is the "Total Performance Index, TPI". TPI is based on three indicators:

- Volume-oriented indicators: these indicators are related to conventional productivity (producing more output of goods and services with fewer resources) and efficiency (using minimum resources to achieve standard rate of output).
- Excellence-oriented indicators: these indicators are related to innovation (newness of products, services, and methods), customer satisfaction, and environmental, social, and ethical responsibility, etc.
- Intangible resource-oriented indicators: these indicators are related to increments or decrements in the market value (improving or deteriorating productivity).

TPI is a flexible measure to which we can add any business factor that is important in an organization's performance. Moreover, TPI can be developed or fitted for each industry and can be used as a benchmarking indicator for comparisons between the company and the best competitors or industry leaders.

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