Literature Review of Industrial Competitiveness Index: Research Gap

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Abstract:

The dynamic of the manufacturing industries is still the dominating drive in a nation[1] economic development. To develop a national manufacturing industries systematically, one needs to measure the country's special capability and develops comprehensive plans and policies that enable the government to exploit the country's economic potential. This qualitative study based on literature investigates and compares various competitiveness indices relate to industrial sector and their measurement methods. On national level, this paper reviews Global Competitive Index (GCI) and World Competitiveness Yearbook (WCY). On sector level, Competitiveness Industrial Performance (CIP) and The Global Manufacturing Competitiveness Index (GMCI) have been the objects of research. Despite of these indices and their benefits for measuring performance in industrial sector, however, this paper still argues that there should be a method that measures not only the country's potential capabilities but also its anticipated potential economic risks. Then, the paper shows the possibility to alter the method by incorporating the measurement of various risk scenarios in the future. By using the alternative method, one can hope to be able to measure the impacts of any possible economics shocks toward manufacturing industries performance. Finally, the results should also reflect the capabilities of manufacturing industries to survive in any economic shocks, and aid policy makers in developing effective policy for the industry.

Keywords: Performance measurement, Competitiveness, Manufacturing, Indices

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Introduction

Today's manufacturing sector is going to a challenging period consists of uncertainties. The uncertainties come from various sources, such as rapid technological changes, complex and global transactions in industrial systems, rapid manufacturing technologies and development, changes in global economy, volatilies of raw material cost, and recent volatility in exchange rate. These conditions raise industrial sector risks which make the measurement of industries' capability in firm, sector, or nation level becomes harder. One of several methods to measure the phenomena is by using composite index measurement. Currently, there are several competitivenes indices available for measuring capability of the sector. However, all of these indices do not measure the impact of possible crisis or risks in the sector. The purpose of this paper is to explain research gap in measuring industrial performance, especially in manufacturing sector. The paper describe research background and research methodology, various indices related to the industries, research findings and closing statement for future study.

Background and Research Methodology

O'Sullivan and Mitchell (2013) describes key features of the future manufacturing industries by highlighting the concept of system in the sector and its complexity. They argue that the decision makers or investors need to be able to view and measure the opportunities as well as risks in the investments. At the same time, the decision makers and government should be able also to view manufacturing sector as an integrated system in order to develop industrial policies as well as its performance measurement. This interdependencies and various interactions within the sector is the reason why it is more difficult to measure sector performance. First, on firm level, the nature of interdependencies can be observed in the complex coordination among, research and development, production facilities, manufacturing technologies, marketing, and finance department. Second, on sector level, government view

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interdependencies among, business regulatory frameworks, labor capacities and capabilities, infrastrutures, and market conditions. Finally, the performance of interdependencies will be tested as a system during crisis. This background becomes the basis of paper review of various competitiveness indices. The research is qualitative analysis from several literatures on competitiveness index. It explores the methodologies used in developing index and suggests several measures in the future performance measurement for improvement.

Concept of Competitiveness

In general, the concept of competitiveness is multidimension and very complex in nature. In economics, the term usually applies to competition in domestic or international markets. Initially, the concept has been explained more toward the concept of comparative advantage by David Ricardo *(Principles of Political Economy and Taxation, 1819).* Nowadays, as the world economy becomes more global, competitiveness also becomes the key success for firms, sectors or nations to participate in the global economy platform. Competitiveness on micro level, Lengyel (2005) states that "*the concept of competitiveness means the skill of position gain and self-maintainment in the market competition among companies, each other's competitors and - in respect of macro economy – among national economies*".

Due to its multidimensional and complex in nature, concept of competitiveness may be defined and measured differently. The reviews from several literatures explain that competitiveness concept can be applied and measured according to its level, such as firm, sector, or national levels. Although competitivenesss concept can be viewed based on the different level, there are connections one level to another. A competition on firm level may affect on sector level, and the competition in the sector level will have impact on national level eventually. On the other side, various conditions and factors in national level will affect sector level and firm level as well. This will ultimately define the industrial competitiveness regionally.

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At firm level, Edmonds (2000) describes competitivenes as "the ability to produce the right goods and services of the right quality, at the right price, at the right time. It means meeting customers' needs more efficiently and more effectively than other firms do". This also can be translated as a firm's effort in maximizing profit so the other firms can not earn profits and they are out of competition. In general, competitiveness in firm or micro level also means firms capabilities:

1. to acquire, to increase and to maintain market shares,
2. to adapt changes and to increase market share while maintaining profitability, current market, and business scale,
3. to sell the products with profit (Cockburn et al., 1998).

On sector level, Porter (1990) defines competitiveness as nation's capability to create sustainable value added thru business activities and to maintain high level of quality of live for its citizen. Furthermore, in his book "The Competitive Advantage of Nations", Saptana (2010) explains the concept of Diamond of Competitive Advantage which describes four factors that determine industrial competitivenes as the followings:

1. Factor Conditions that describes any nation's position in factors of production, such as skilled labor or infrastructure, necessary to compete in a given industrial sector.
2. Demand Conditions which desribes the nature home-market demand for the industry product or service.
3. Related and Supporting Industries which describes the presence of nation's supplier industries and other related industries that are internationally competitive.
4. Firm strategy, Structure, and Rivalry that describes how the national goverment supports business environment as well as the nature of domestic rivalry.

To understand and analyze competitiveness in industrial sector, one needs to have tools to measure the competitiveness in the sector. The following passages describes the competitiveness measurement in the sector.

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Competitiveness Measurement

Understanding the process of measurement is important, so the methodology has been performed, examined, and confirmed that the changes exist within a certain time interval or area. It can also be described as a process of assigning a number or simbol to a certain characteristic or property according to defined rules or procedures. The same concept applies to competitiveness measurement in economic activities, this measurement is done by using composite index methods due to its multidimension involvement.

According to Snieska and Bruneckiene (2009), competitiveness measurement can not compute by using one or several indicators due to its multidimensional and complex in nature. It combines and computes several variables or sub-index into a simpler and unique number or indicator. This multidimensional index should be developed credibly by structurizing systematically all variables and algorithms in an index calculation. The model then goes thru various validity and reliability tests.
The process has to involve various factors or variables and be multidimensional in nature. The problem with the composite index is the possibility of hiding or covering several collected data behind one composite index. This becomes worse as practicioners, in many cases, intentionally summarize complex and vague data into one index figure Nardo et.al, (2005).

Despite various problems during implementation, composit index process has been implemented in numerous fields, especially in comparing and measuring the difference between teritories, times, institutions, etc. On global and regional level, there are several economic and industrial indices, such as *Economic Competitiveness Index* published by *International Institute for Management Development*, *Global Competitiveness Indeks* published by *World Economic Forum*, *Small States Development: Commonwealth Vulnerability Index* prepared by *The Round Table: The Commonwealth Journal of International Affairs*, *The Economic Freedom of The World Index* prepared by *The Fraser Institute*, dan *The Human Development Index* published

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by *United Nations Development Programs,* and others. Some of these indices will be explained further in the paper.

Competitiveness Measurement Related to Economic and Industrial Sector

This paper reviews the following samples of measurement for benchmarking purpose and developing possible performance measurements in the future.

National Level

1. *Global Competitiveness Index* (GCI)

This index is published annually by *World Economic Forum* (WEF). It measures how competitive one country relatively to other countries. It shows investment climates and other factors in various countries.

Methodology:

It calculates several economic and social variables. These variables are grouped into 10 pillars in which each pillar consists several sub-variables or indicators need to be measured. The pillars, then, are regrouped into 3 main pillars represent development stages in each country as follows:

a. **Basic** Pillar consists of data regarding Government Institution, Macroeconomic Condition, Infrastructure, Public Health and Basic Education.
b. **Efficiency** Pillar consists of data regarding Trainning and Higher Education, Commodity and Market Efficiency, Money Market, Labor Market, Market Size and Technological Readiness.
c. **Innovation** Pillar consists of data on Advance Entrepreneurs and Innovation.

For the index computation, the composite index and its variables' value ranges from 1 to 7. There will be standardization of all variables, so they will categorically separated into a value ranges from 1 to 7. Then, it will apply weighted calculation, as follows:

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i. Sub-variables' values use *equal weight*
ii. Score on each pillar is valued *equal weight*
iii. Score for composite index is valued *unequal weight*

2. *The World Competitiveness Yearbook* (WCY)

This index measures and analyzes countries' ability to create condusive business environment. The index uses macroeconomic and various survey data.

Methodology:

Variables used in the index are macro-economic and social variables which are separated into 20 pillars. Then, these pillars form 4 main pillars which represent nation's industrial development stages. These pillars are:

1. **Economic performance** which measures domestic economic condition, international trades, international investments, labors and various price indicators. This pillar consists of 80 variables.
2. **Government efficiency** which measures public finance capability, fiscal policy, institution conditions, business policies, social conditions. There are 73 variables grouped in this pillar.
3. **Business efficiency** which measures productivity and effisiency of labor markets, financial markets, stock exchange, management, national attitudes and values. This pillar measures 70 variables.
4. **Infrastructure availability** describes conditions infrastructures, such as basic, technology, science, health and environment, and education. The pillar measures 108 variables.

The index measures both composite index and variables with value ranges from 0 until 100. It also calculates the standard deviation when computing the score. It uses weighting method on each pillar, in the followings:

i. sub-factor gets *5 percent weight*,
ii. for composite index computation gets aggregate factor STDs.

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Sectoral Level

3. *The Competitiveness Industrial Performance Index* (CIP)

This index, published by *The United Nation Industrial Development Organization (UNIDO),* measures nations' competitiveness on industrial sector.

Methodology:

It structurizes macro-economic data for variables that consists of 3 pillars which each pillar has 2 variables. Each pillar represents the industrial development stages on each countries as the followings:

1. **Manufacturing industries' capacity for productions and exports**. This pillar measures of the value of manufacturing sector per capita and the value of product exports per kapita.
2. **The technologies usages.** This pillar measures industrialization intensity level which comes from:
   a. The average propotion of added value generated by big and medium industries over GDP in manufacturing sector. Additionally, this pillar includes the proportion between added value generated in manufacturing sector over GDP.
   b. Export quality which measure the average value of export from big and medium industries over product export from manufacturing sector. It also measures the proportion of export value from manufacturing over total export value.
3. Contribution to global manufacturing industries and global economy.

Index value ranges from 0 to 1 for both variables and composite index. To get the value between 0 and 1, all variables are normalized. It applies weighted calculation: sub-score on each pillar is calculated with *equal weight* and composite index score is calculated with *equal weight.*

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4. *The Global Manufacturing Competitiveness Index* (GMCI)

GMCI is an index that measures nations' competitiveness in manufacturing industries. The index was published by *Deloitte Touche Tohmatsu Limited (Deloitte)* and *The U.S. Council on Competitiveness (Council).* The index measures countries' capabilities in driving the structural changes in manufacturing sector to anticipate global economy. There are 3 approaches used in developing the index, such as business confidence and current business environment, manufacturing competitiveness, and demographic.

Methodology:

This index uses data taken from survey. The data, then, are categorically separated into 20 variables. There will be 10 pillars which each pillar consists of 2 variables. Those pillars are:

1. Innovation drivers;
2. Various economic condition, such as trades, financial, finance, and taxation;
3. The availability of labors and raw materials and its associated costs of acquiring;
4. Supplier networks;
5. Legal system consists of laws and regulations;
6. The availability of infrastructures;
7. Energy policy and costs;
8. Local market interests;
9. Health systems;
10. Government contribution in manufacturing sector and innovation.

The index is based on value between 0 until 1 for both variables and composite index. All data go thru value normalization so it becomes variables with scale ranges from 0 to 1. There is also weighted calculation as the followings:

1. Sub-score on each pillar will be using *equal weight;*

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2. Final composite index will use *experience weight* which are presented into 4 areas: 3 areas with value 0.75, 2 areas with value 0.5, and 1 area with value 0.25.

The Current Measurement Limitations

Despite the indices have helped readers, especially analysts, to determine performance or competitiveness in industrial sector, these indices still have some limitations. It can be seen from the indices that they do not express the sizes and causes of gap between countries. These indices also do not measure and explain the impacts of economic crisis toward industrial sector. Manufacturing sector becomes more global and complex in nature. The sector will have exposures with respect of risks related to its operations. This impacts on sustainability and growth of the investmens. To summarize the review, the following description covers both similarity and differences among those indices and suggestions regarding some measures need to be included on the alternative methods.

1. **Measurement Concept**. All indices show similarity by showing competitiveness measurement based on various macro-economic variables available on each countries. In the future method, sector measurement should not only be focusing only to the current condition, but also should reflect the adjustment after impact of any relevant shock or crisis. The shock can be simulated with several scenario, such as currency exchange that increases or decreases significantly or as government imposes new regulation that affects the overall sector performance.
2. **Measurement Objectives**. Both GCI and WCY provide information on business environment at national level. Whereas CIP and GMCI can be used not only for gathering information on national competitiveness, but also providing tools for developing nations' industrial policies. The future method should be complementary to those competitiveness method by addressing induced risks on the sector.

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3. **Factors for Performance**. On national level, both GCI and WCY emphasize the importance of support that promotes business efficiency. While GCI, as well as GMCI, also includes the value of innovation, CIP includes the role of export and technological value in the measurement. Other than the above indices, the future method should include factors contribute to the sector risks both systematically and non-systematically, for example those risks associated with exchange rate, government policies, local regulations, and so on.
4. **Index Calculation**. Most of the indices are calculated from the combination of assigning a scale, for example 1 - 7 or 1 - 10, and applying weighted average method to come up with a unique index number. The number on the scale were taken thru surveys and normalized for further calculation. The future method should be able to use the available the official and unbiased statisitical data for further indexing process. This should reflect the performance capability of the sector closer to the reality.

Other than the above limitation, the studies in industrial performance should also concern about several criteria for measurement. Durand and Giorno (1987) states that index measurements should cover three criteria: first, they should reflect factors exposed to competition; second, they should indicate market codition; and, third, they should be constructed from data that are fully comparable internationally. After reviewing these indices, the study shows that the indices fail to fulfil the criteria. However, this becomes sufficient for approximating an ideal measurement, it requires more assumptions to be made in order to comprehend the competitiveness level on the industries.

Conclusions

Industrial sector still plays an important role in nation economic system. To measure nations' capability in this sector, decision and policy makers have been utilizing various competitiveness indices as references. These references have been the basis for developing comprehensive plans and policies that enable the government to

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exploit the country's economic potential. These competitiveness indices have been adopted to measure industrial or economic development across countries in the world. For reference, this paper reviews Global Competitive Index (GCI) and World Competitiveness Yearbook (WCY) for national level measurement. On sector level, Competitiveness Industrial Performance (CIP) and The Global Manufacturing Competitiveness Index (GMCI) have been the objects of research.

Despite of the informative nature of these indices, however, this paper still argues that there should be a measure that calculates not only the country's manufacturing sector but also its potential economic risks. This paper investigates and compares various competitiveness indices and their measurement methods. Then, the paper shows several limitations in those indices by incorporating the measurement of various risk scenarios in the future. The paper suggest to incorporate risk measures in the method, so one can measure the impacts of any possible economics shocks toward the performance in manufacturing sector. The results should also reflect the capabilities of manufacturing sector to survive any economic shocks, and aid policy makers in developing effective policies for improvement in the sector sustainability.

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Biography

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