Construction Industry Maturity Model

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Abstract: Construction industry is one of the most significant sector in national economic, but the portion of construction has been falling regularly with the regional development. In spite of decrease in economic portion, role of construction industry does not changed irrespective of development, as the foundation of development. To distinguish each state of the maturity, countries are grouped on GDP per capita, than compared with variance of GVA in construction and GFCF per GDP as level of construction industry. GVAc% and GFCF% shows corn-shaped plotting in increase of GDP per capita, and each value converge to around 20% and 5% as GDP per capita increase. The definition of maturity is consist of 4 stages; pre-developing, ascending, stabilization, and maturement. Maturity of construction industry is a term of broad sense of construction industry that is easily to figure current state of regional construction and shows what normal condition of construction is in regional economy.

Keywords: Construction Industry / Regional Development / Gross Domestic Product / Maturity Model

I. INTRODUCTION

Between 50 and 60 per cent of most countries' capital formation is in construction: houses, hospitals, schools, power stations, roads, railways, dams, ports and so on(Edmond, 1979). The role of construction in economic development is discussed either on the social level, i.e. its contribution to improving the standard of living, health, education, etc., or on the economic level, i.e. its implications for capital investment, rates of growth and the creation of infrastructure. To forecast national construction industry and make a reasonable development plan, it is important to comprehend the national development stage and industrial structure of construction area.

Countries' state of development & structure of construction industry are in different stages. These stages show divergent structure of industries and have various features in their regions; regional development, living standard, and convenience. The relationship between a country's stages of development and the level of activity in the construction sector was one of a major subject in macroeconomic researches. It means every countries are in various level of maturity and countries which have different maturity levels shows different levels of activity and types of activity in construction industry. Also these stages show divergent structure of industries and have various features in their regions; regional development, living standard, and convenience.

It drives construction industry transition of construction demand; new buildings, type of housing, commercial places, and social overhead capital. There is a link between economic development and construction as inverted U-shape relationship. In detail, various types of developing countries show numerous processes of development that derive diverse pattern of change in common indices. To comprehend their regional development and situation of construction industry, the accessible model is needed that applies those features and alternation.

Bon (1992) and Ruddock (1997) mentioned about difficulties in analyzing construction industry especially in developing countries because of data. It is Significant to analyze construction industry in developing country because of its importance in regional development. To comprehend their regional development and present situation of construction industry, the accessible index is need that reflects those features and alternation. It is necessary to make combined index for discriminating state of regional development and construction industry. This comprehensive index also represents current economic condition of construction industry. In this research, it is named as 'maturity of construction industry' that means how developed the countries and matured their construction industry. As construction industry is matured, its level of activity is dwindled down to reasonable level and the country (or region) is sufficiently developed to guarantee people's living standards with enough support of housings, commercial buildings, and SOC.

Current quantitative analysis of construction industry is focused on short term analysis based on macroeconomics. For long-term- approach, it is need to include structural analysis, a quantitative analyzing methodology is required that constraint condition of statistical data. But there is a lack of time series data related construction industry to examine overall alternation of construction industry. It is needed to find an index defined which can explain state the region and regional construction is in and related Policies (government) and statistics (enterprise) need to consider these levels.

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II. RESEARCH OBJECTIVE

Major object of this research is to derive quantitative model that applies regional developments and architecture of construction industry. To figure out the model, regional information is important background resource to figure out levels of regional development. The model represents current economic condition of construction industry. In this research, it is named as 'maturity' that means how developed the countries and matured their construction industry.

It means that embodies level of regional development and state of construction industry and available quantitative indices are used in cross-sectional analysis. The cross-sections are analyzed in several time period to discover common trend of development in view of construction industry unbound by time and to trace change of countries` construction industry. To develop quantitative model, maturity in construction industry by using quantitative analysis of regional perspective. This model can determine effect of regional characteristics for understanding of difference in specific characteristics in countries.

For maturity of regional construction industry, quantitative indices are selected that reflects regional development and level of construction industry. Those national accounts of regional development (statistics of formation, economy, and construction industry) are used to figure out relationship between 'regional development and state of construction industry'. But there is a lot of unknown variables that affects to the indices, it is needed to approach in a broad view that means analyzing in group with encompassed indices. To categorize countries for cross-sectional analysis, countries in similar state of development are grouped and removing outliers for general adoption. Then the maturity is analyzed by comparison of regions using cross-Sectional analysis in multiple times to find effect of time.

In economics, cross-sectional studies typically involve the use of cross-sectional regression, in order to sort out the existence and magnitude of causal effects of one or more independent variables upon a dependent variable of interest at a given point in time. By using cross-sectional analysis, the maturity is figured out that expresses relationship between regional development and construction industry. Those data are compare between the groups in different state, different transition in time period. Select major accounts of national development and construction industry.

III. MATURITY OF CONSTRUCTION INDUSTRY

A. Characteristic of Construction Industry

Construction industry is referred to as one of the most significant industry in countries irrespective of their development. Especially, construction industry in developing country is more important. The products of construction industry, which include several types of buildings, are the bases of other industries and living standards; housing, commercial buildings, manufacturing facilities, and Social Overhead Capital. The role of those product is invariant irrespective of regional states, but the importance decreases with the progress of development. It is reasonable that demand of construction is dwindle with decreasing necessary buildings; enough housing supply, commercial buildings, and satisfactory social capital.

B. Relevant National Accounts

In several related researches, Gross Domestic Product is used as common index of national development. GDP is developed as a measure of welfare. It is the main tool for measuring a country's economy. To eliminate effect of differing sizes of nations, GDP per capita is commonly used in figuring regional development. This term is used in this research as a term of regional development.

Also Gross Fixed Capital Formation is the major index of regional developing stage. Fixed Capital Formation is the value of non-produced assets in accounting period. It is also a term of gross net investment, which include fixed asset of nation; housings, buildings, roads, factories, etc.

Gross Value Added in construction is part of GDP, which includes value added by construction industry. This construction industry means the only construction industry excluding part of material, electric supplement, and mechanics, etc. GVA in construction is common proper term of construction activity.

Level of activity in Construction industry is decrease with the development of own region. This effect can be same word of industrial structure which change from depend on large portion of construction industry to apportion small part of construction industry. It is explicable in terms of GVA in construction per GDP.

C. Maturity of Construction Industry

Maturity is prevalent term in biology and social science as where the thing is in longitudinal stages. There is an order in stages, and each stage has differences in several areas. In this research, maturity of construction industry is a combined term of regional state of development and level of construction industry. It changes not only with time but with meaningful revolution of national state.

IV. STRUCTURAL CHANGE OF CONSTRUCTION INDUSTRY

This part is analysis of statistical features in construction industry to define maturity in construction industry. Each country has different level of development and economy, which has relationship with its construction industry. By using major indices of activity in construction industry and regional investment, statistical feature of construction industry as level of activity and national investment in each country are analyzed and maturity model is extracted based on those feature of each country in different development period. Each development period is defined as level of GDP per capita and major indices of analysis are portion of gross value added in construction in

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gross domestic product and gross fixed capital formation per gross domestic product.

The maturity of construction industry is made of indices mentioned above; GDP in capita, GFCF, GVA in construction. Those indices are collected from United Nations that is collected from UN statistics database of 1997, 2002, 2007, and 2012. Cross-matching is done to find available data.

In common practice, United States, Japan, Canada, Australia, New Zealand and Europe are considered developed region, though there is no established designation of "developed" and "developing" countries. In other words, numerous countries are classified as developing countries which are in different level of development. It is necessary to classify into detailed groups of development. Previous studies used GDP or GDP per capita as representative of development to group countries. Countries are grouped by GDP per capita in this research and categories are used as a proxy for the level of economic development for countries. As a discrete group of development, categories are separated in 6 groups as below. It is attempt to apply categorization of countries from least-developed to most developed countries. The categories are based on common criteria of development as with GDP per capita.

Group A: GDP per capita (US$) <1000;
Group B: >1000, but <2500;
Group C: >2500, but <5000;
Group D: >5000, but <10000;
Group E: >10000, but <30000
Group F: >30000

To figure relationship between indices, indices are plotted as below in internal analysis of each groups. Figure 1 is plotting of portion of gross value added in construction (GVAc%) and portion of gross fixed capital formation (GFCF%) of each groups. Average GDP per capita of group A is 520.98 USD, and average GVAc% and GFCF% are 5.32% and 19.89%. Below figures are showing distribution of portion of value added in construction and investment in each group of GDP per capita.

Inner group analysis represents relationship of gross value added in construction and gross fixed capital formation. It is that there is no certain linear relationship between GDP per capita and both indices. But in global view, GVAc% decreases by increase of GDP per capita. In group A and B, most countries shows large portion of GVA, but when the GDP per capita increase more than 1,000, several countries shows less depend on construction industry. In case of GFCF%, it seems similar distribution among the whole variation of GDP per capita. But GFCF% seems to have convergence value at about 25% as countries developed. It means normally proportion of gross fixed capital formation in GDP formed at around 25% which means prevalent ratio of regional investment per income is 23%.
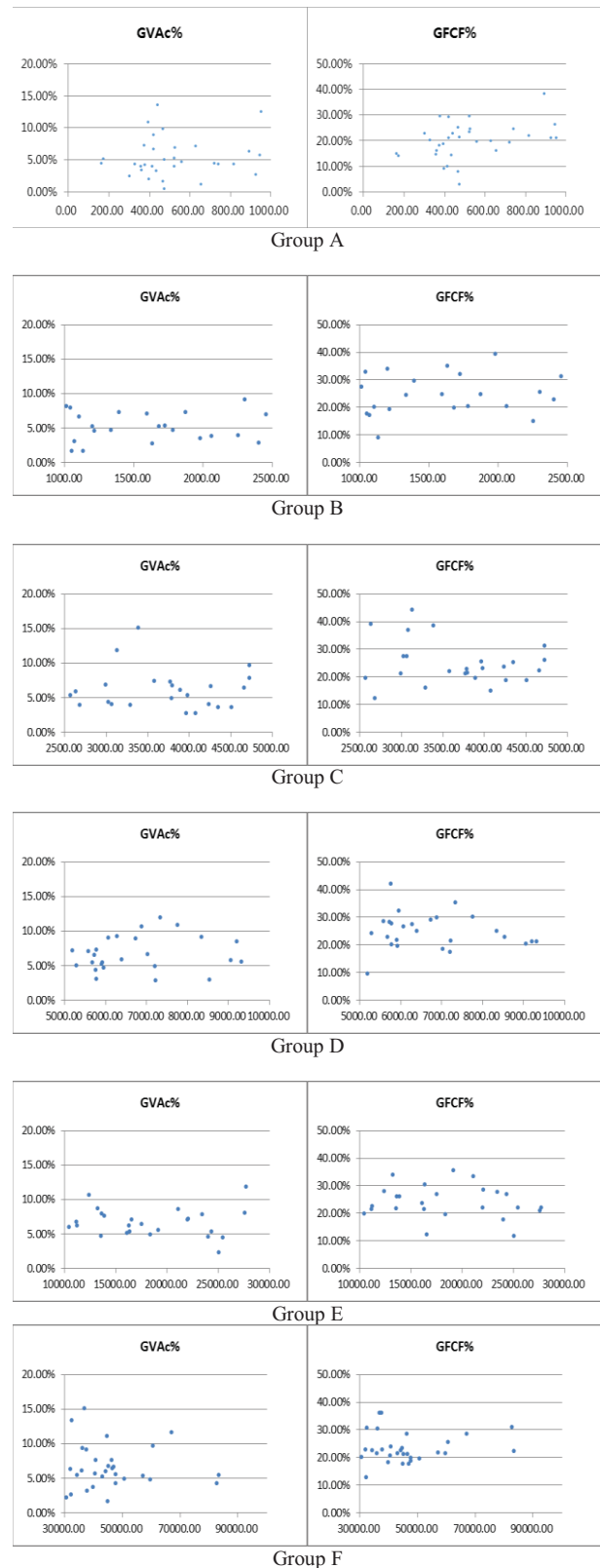

FIGURE 1
GROSS VALUE ADDED IN CONSTRUCTION AND GROSS FIXED CAPITAL FORMATION BY GDP PER CAPITA (2007)

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TABLE II
GROUP COMPARISON OF GROSS VALUE ADDED IN CONSTRUCTION AND
GROSS FIXED CAPITAL FORMATION

Group	GVAc%	GFCF%
A	5.32%	19.89%
B	5.21%	24.79%
C	6.98%	24.88%
D	6.74%	25.04%
E	6.71%	24.21%
F	6.61%	23.38%

As the result of analysis above, it is insufficient to conclude that GVAc% and GFCF% have positive correlation. To analyze in distinct account of countries, GVAc% and GFCF% are compared to analyze between groups features. As group is a proxy of national development level, it can be enumerated by group named and compared how GVAc% and GFCF% changed. Gross value added in construction increases up to 6.98% than decrease steadily. It shows that the importance of construction industry in national account decreases due to increase portion of other industries. GFCF% also decrease from group D to F, as about 25.04% is reasonable ceiling point of investment in fixed asset in nation. It decreases to 23.38% in group F but its distribution in group F shows the convergent point of GFCF% in about 20%.
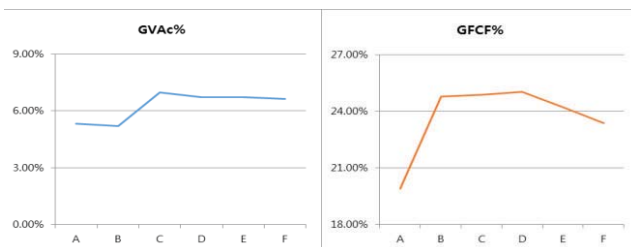

FIGURE II
CHANGE IN GROSS VALUE ADDED IN CONSTRUCTION AND GROSS FIXED
CAPITAL FORMATION

V. MATURITY MODEL OF CONSTRUCTION INDUSTRY

Maturity is term of representing the degree of regional developmental status and condition in construction industry. Each country has its own process of development, and it derives various change of national account. In this paper, the maturity is defined as qualified signification that consist of 4 stages. These stages are based on level of GDP per capita and adequacy ratio of GFCF and GVAc. In this paper, the terms of maturity stages are as follow; pre-developing, ascending, stabilization, and maturement. Table III is detailed meaning of each stages. To validate, several comparison analyses are performed that based on comparison of time sections. Bellows are comparison of maturity in time-sections database to validate the maturity model.

TABLE III
STAGES OF REGIONAL CONSTRUCTION INDUSTRY

	Meaning	Revealed in indices
pre-developing	Pre-developed countries	Low GDP per capita, GVAc% under 6%, GFCF% under 20%
Ascending	Regional developing increase, showing outstanding growth in demand of construction industry	Low GDP per capita, GVAc% increase over 6%, GFCF% increase over 20%
Stabilization	Progression in development, stagnation in pace.	Average of annual GVAc% range around 6%, GFCF% is over 24%
Maturement	Already developed and common construction moves to maintenance and rebuild.	As same as stabilization stage, but GDP per capita is over 30,000 USD and GFCF% is decrease under 20%.

Comparison in time sections

To figure out common trend of domestic investment and economic impact of construction industry, GFCF% and GVAc% are ploted by gross domestic product per capita. Below charts are based on gross domestic product per capita from 1997 to 2012.

GFCF% means ratio of domestic investment in fixed capital which is backbone of development.
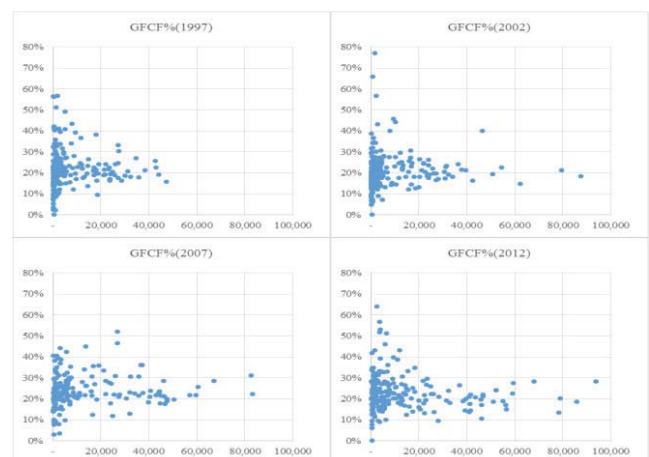

FIGURE III
DISTRIBUTION OF GFCF% IN TIME SECTIONS

As shown above, gross fixed capital formation per GDP is plotted in conical shape. In developing countries, especially in less developing countries that have GDP per capita less than 2,500 USD, show distributed in wide variance than other countries.

As similar to GFCF%, gross value added in construction per total gross value added converge at small range about 3 to 8%. When GDP per capita approach to 20,000 USD, shape of plot changes from conical shape to bar shape. Below table is average GVAc% and GFCF% of countries which have GDP over 20,000 USD. Average GVAc% of practical developed countries is 6.20%, and average of GFCF% is 21.93%.

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TABLE II
GROUP COMPARISON OF GROSS VALUE ADDED IN CONSTRUCTION AND
GROSS FIXED CAPITAL FORMATION

Year	GVAc%	GFCF%
1997	6.17%	21.04%
2002	6.07%	21.06%
2007	7.07%	24.73%
2012	5.48%	20.88%
Avg.	**6.20%**	**21.93%**

Growth of GDP per capita is proxy value of domestic economic development. As assumption above, effort of domestic investment is significant condition to enhance economic development of country. To figure out relationship between investment and economic development of construction industry, GFCF% and GVAc% of countries are compared with sorting in growth ratio of GDP per capita. As in part of sorted data by GDP per capita in 1997, it shows, developed countries (with bold) shows low level of developing ratio and stable indices of GFCF% and GVAc%.

Effect of regional characteristic; landlocked developing countries

Landlocked countries a country entirely enclosed by land, or whose only coastlines lie on closed seas. There are 48 landlocked countries in the world, including four partially recognized states. All but two of these landlocked countries are located in Afro-Eurasia. Bolivia and Paraguay are located in South America. The general economic and other disadvantages experienced by landlocked countries makes the majority of these countries Landlocked Developing Countries (seqq. LLDC). LLDC group shows similar GFCF% to that of common developing countries in every time sections. Plots of GFCF% in LLDC group show large variance in every time, but shows development of GDP per capita as time over.

GVAc% of LLDC have different alternation than GFCF%, variance of GVAc% in LLDC decrease extremely than other group and shows higher average value than non-LLDC group. It means relevant effect of GVAc% to development in GDP per capita of LLDC group which have territory of marine transportation.

TABLE V
GROUP COMPARISON OF GVAc AND GFCF IN Landlocked developing
COUNTRIES

			1997	2002	2007	2012
GFCF	LLDC	Avg.	0.21619	0.19730	0.22007	0.26302
		Std	0.12075	0.07796	0.08434	0.12366
	none	Avg.	0.22192	0.20198	0.23751	0.22875
		Std	0.08752	0.06422	0.08680	0.07833
GVAc	LLDC	Avg.	0.05759	0.05407	0.06648	0.07173
		Std	0.02961	0.02837	0.05027	0.05145
	none	Avg.	0.05951	0.05652	0.06383	0.06226
		Std	0.02870	0.02494	0.03452	0.03149

VI. CONCLUSIONS

Construction industry is one of the most significant sector in national economic, but the portion of construction has been falling regularly with the regional development. In spite of decrease in economic portion, role of construction industry does not changed irrespective of development, as the foundation of development. To figure current state of construction industry is crucial to understand its transition. The term of maturity of regional construction industry is proposed that is combined index of regional development state and level of activity in construction industry.

To distinguish each state of the maturity, countries are grouped on GDP per capita, than compared with variance of GVA in construction and GFCF per GDP as level of construction industry. Proportion of GVAc and GFCF in GDP are major indices of this research. GVAc% and GFCF% shows corn-shaped plotting in increase of GDP per capita, and each value converge to around 20% and 5% as GDP per capita increase. As touchpoint to maturity, each country of developing period shows similar pattern of GFCF% and GVAc% and these values are going to common average as converge point. To compare each group of countries, the definition of maturity is suggested and it consist of 4 stages; pre-developing, ascending, stabilization, and maturement. These stages are sorted by GDP per capita, GFCF% and GVAc% as regional indices of national development and construction industry state.

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