

THE CONTRIBUTION OF THE CONSTRUCTION INDUSTRY TO THE ECONOMY OF INDONESIA: A SYSTEMIC APPROACH

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ABSTRACT

Construction industry contributes significantly in terms of scale and share in the development process for both developed and developing countries. The construction products provides the necessary public infrastructure and private physical structures for many productive activities such as services, commerce, utilities and other industries. The industry is not only important for its finished product, but it also employs a large number of people (directly and indirectly) and therefore has an effect on the economy of a country/region during the actual construction process.

This research examines work done to determine the detailed effects of investing in construction. The effects considered are those on the micro and macro economy of the people directly or indirectly employed by the construction industry

The work is based on surveys, which were carried out in Indonesia to investigate how the money invested in construction flows through the economy. It also examines at which point in the construction process income is received, and at which point it is spent. The results of these surveys were analysed using statistical methods and combined with results from economic input-output modelling. The results were then used to build a system model.

A system model is developed to examine its use to compare labour intensive and equipment based construction methods. It was found that the construction sector provides a very important contribution to the national and local economy through its job generating ability for local people as multiplier effects. A system model developed is able to predict the effects of changes in policy on expenditure in the micro scale.

Key words: construction industry, labour intensive construction, micro and macro economy

1. INTRODUCTION

Output from the construction industry is a major and integral part of the national output, accounting for a sizeable proportion in the Gross Domestic Product (GDP) of both developed and underdeveloped countries (Tse and Ganesan 1997, Crosthwaite, 2000). Lowe (2003) further stated that the value added of construction is in the range of 7% to 10% for highly developed economies and around 3% to 6% for underdeveloped economies (Figure 1)

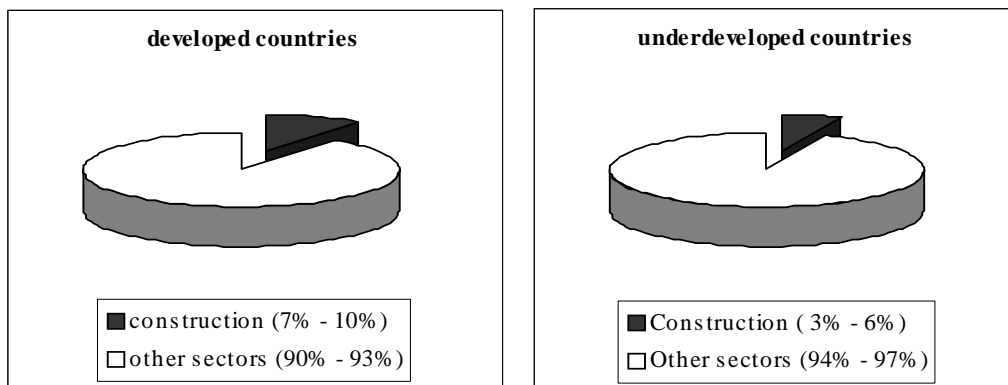


Figure 1: The Contribution of the Construction Industry into GDP (Lowe, 2003)

The estimates of construction value added in the developing countries could be higher as the figures may not include the informal sector, which could generate a significant casual employment in urban and rural areas (Ganesan 2000).

The construction outputs can be classified as a major component of investment and part of fixed capital. Both are essential factors for a continuous economic growth. Products of construction require a long period of gestation and are expected to supply services for a period of time. Investments in construction assume major importance since any expansion in the economy requires infrastructure investment as a precondition for potential economic growth (Ive and Gruneberg, 2000; Hillebrandt 2000).

The state of the construction industry will affect most common measures of a national economy, such as GDP as mentioned earlier. It will affect the availability of capital, the decisions a government makes and even the social health of the country. The construction industry also has significance interaction with other economics sector as multiplier effects through its backward and forward linkages.

The construction industry is frequently used as a tool by government to manage the local/national economy. For example, when it is recession and the number of unemployment is high, government uses the construction sector to increase the public expenditure (Ball and Wood, 1994). Therefore the detailed way in which the construction sector interacts with the national/local economy and wealth of people involved is not well understood. It needs methods to investigate the detail interaction between the construction industry and the national/local economy.

This paper elucidates study, which is an attempt to integrate a variety of aspects in order to model the construction industry and its effect on the economy in a developing economy especially on the type of construction method used (labour intensive and equipment based construction). This study used a survey and questionnaire that was done in Indonesia. A series of Indonesian input-output tables and system theory is applied in order to build a soft and hard system model.

2. THE CONTRIBUTION OF THE CONSTRUCTION INDUSTRY TO THE ECONOMY

The formation of the fixed capital investment is a vital concern for the state of the nation as it represents investment in the future of the economy of the country. Fixed investment usually consists of houses and infrastructures in both public and private sectors, as well as the business investment in plant and machinery of all industries.

The concept of the gross capital stock is useful in measuring the productive capacity of the economy. The underlying idea is that a machine or building continues to yield the same contribution to output each year regardless of its age, until it reaches the limit of its useful life, when this contribution falls to zero and it is scrapped (Ive and Gruneberg, 2000).

Investment in the construction sector can be defined as construction-related to the Gross Fixed Capital Formation (GFCF). GFCF is an expenditure on fixed assets (buildings, vehicles, machineries, etc) either for replacing or adding to the stock of fixed assets. These fixed assets are repeatedly or continuously used in the production process (Ganesan, 2000).

The construction sector constitutes about 40%-60% of GFCF in most developing countries. The proportion of investment that goes to entirely new construction is likely to be higher than that which goes to repair and maintenance (Ganesan, 2000). In developed countries, the construction industry accounts for approximately one third of the total investment in physical assets in the economy. This is about the same as the investment in plant and machinery (Ashworth, 2002).

The construction investment can be an important public policy tool that is often used by central and local government to accelerate development and create employment. This decision is not the result of consumers' expenditure on goods and services, but as an investment decision, which has an effect on money injection into the economy (Ive and Gruneberg, 2000).

The multiplier effect demonstrates the impact of a change in investment on the levels of income and employment in an economy. The main concept of the multiplier is based on the recognition that the various sectors that make up the economy are interdependent.

The construction industry has significant interactions with the other economic sectors as a backward and forward linkage (Bon, 2000; Ganesan, 2000). The backward linkages show the relationship of inter-industry purchases to total input, while the forward linkages show the relationships of inter-industry sales to total output.

3. SYSTEM THEORY

A system may be defined as "a set or arrangement of things so related or connected as to form a unity or organic whole" (Webster's Collegiate Dictionary). System theory has been proposed as being a means of modelling complex situations where a large number of components interact with each other. It helps users to view the problem from a broad perspective including its elements, structures, patterns and events (Checkland, 1981). Presenting a problem as a system should help decision makers to understand the overall behaviour of a system when any change happens in any part of the system. The main difference between system theory and analytical methods in investigating an issue is that in analytical methods, usually the whole 'problem' is isolated into small parts (Aronson, 2001). The small parts are studied and investigated without recognition of their interactions with others in the whole.

Systems theory is applied to examine the role of construction investment into the economy from a microeconomic perspective. The term of system is a vague word. In practice, people use this term for such common thing such as computer system, heater system, water system, political system, social system, industrial system and economic system. It seems that the word of system could be applied whether from a social or technical aspect.

Checkland (1981) has defined a system as:

"A set of elements connected together which form a whole, this showing properties which are properties of the whole, rather than properties of its component part."

Systems have particular aspects. These are (Wibowo and Mawdesley, 2002):

- A set of elements;
- Connected together;
- Forming a whole;
- Addressing a special purpose.

Checkland (1981) suggested that systems have been grouped into four categories:

- Natural systems (e.g. galaxy and biological systems);
- Designed physical systems (e.g. rocket and computer systems);
- Design abstract systems (e.g. mathematics and philosophy systems);
- Human activity systems (e.g. nerve systems).

Or two categories (Checkland, 1981; Checkland and Scholes, 1990 and Qambar.S, 1999):

- Hard systems that tackle well-defined problems and usually produce quantitative predictions to their behaviour (Walker.A, 1996). They rely on quantitative data. The hard system is oriented to goal seeking (Checkland, 1985).

- Soft systems that tackle messy and unstructured problems (Checkland and Scholes, 1990). The soft systems approach is often concerned with human behaviour problems (Walker.A, 1996). The orientation of this method is to learning, optimising, or satisfying rather than solutions (Checkland, 1985).

Systems methods have been proposed as a suitable approach to complex and unstructured problems. By applying systems theory, it means that the interrelationships of the parts and their influence upon the effectiveness of the total processes could be understood, analysed and improved (Checkland, 1981).

A systems model was developed from the interaction between the construction industry and the economy in Indonesia. The processes used in the development are, as follows (Wibowo and Mawdesley, 2003):

- Determine what systems models were available for the construction industry;
- Examine their usefulness for modelling the integration between the construction and the economy;
- Develop a new model;
- Use the model to determine what data were required;
- Analysis of the data obtained using statistical method;
- Translation of the data analysis into mathematical formula;
- Development of the model using entity relationship diagram;
- Examination of the links in the entity relationship diagram;
- Formulation of a spreadsheet model of the system;
- Verification of the model;

The data required for the model were collected using a structured questionnaire survey in Indonesia. The survey research was conducted to ascertain the money flow and the interaction between parties involved in a construction project and other industries in the national economic system. The data analysed were translated into a mathematical formulae. These formulae provide a quantitative model of the links between elements in terms of the money flow.

3.1. SOFT SYSTEMS MODEL

Soft system methodology is used to show possible interactions between the ten factors by employing a rich picture diagram as shown in figure 2. The ten factors are presented here in order to produce soft systems model. The possible interactions between factors are presented as verbal relationships. These relationships are simple to understand, but all the potential interactions are difficult to show in detail.

For example, the link between the elements 'suppliers and subcontractors' and 'construction operations' indicate that information flows from construction to the suppliers and resources flow the other way. These flows are simple representations of the complex interactions which actually exist.

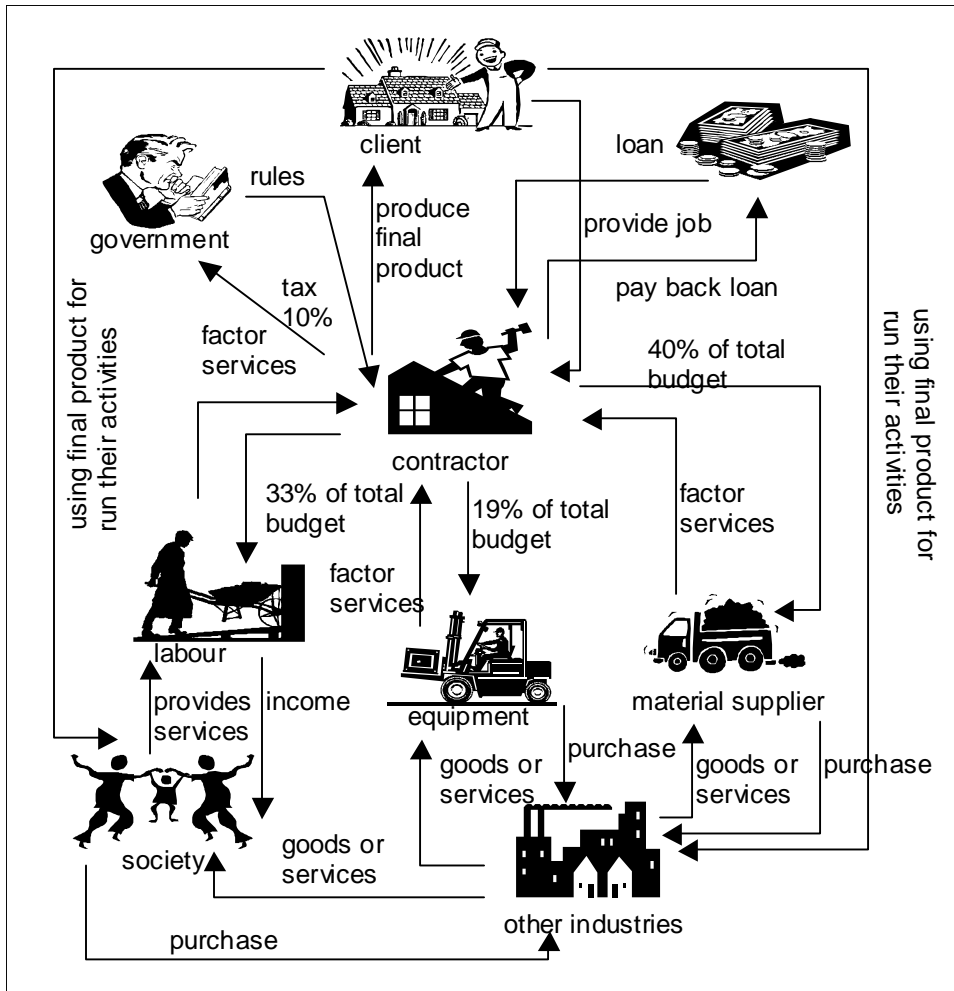


Figure 2: Rich Picture Diagram, Contractor expenditure

It can be seen from figure 2 that the money flow comes from the clients and passes through the contractor. The contractor has to purchase something from material supplier, hire equipments from plant supplier and pay the labour as the wages in order to construct the work. The contractor, also, should pay tax to the government when they finish their work.

The money received from the contractor can be used by the material supplier, plat supplier and labour to purchase something from the other industries. The other industries in turn produce products that can be used by the construction industry as an input factor to produce their final product. This process is a cyclic process.

The contribution of the contractor to the economy can be seen from figure 2 as follows:

- There is a link from the contractor to the material supplier which represents 40% of the total budget project for purchasing material.
- There is a link from the contractor to the plant supplier which constitutes 19% of the total budget project for rent the equipment.
- There is a link from the contractor to the labour which represent 33% of the total budget for labour's wages.
- There is a link from the contractor to the government which constitutes 10% of the total budget for paying government's tax

- There is a link from the contractor to the client where the contractor produce the final product then the client, the government, the society and the other industries could use this one to run their activities.

However, there is no exact number could represent the link from the contractor to the final product and the link exists from the final product to the society, the government, the bank and the other industries.

3.2. HARD SYSTEMS MODEL

Hard Systems have been successfully applied to many engineering problems since the 1950s. These systems rely on a solid or hard base of facts, which could be quantified and predicted. Hard Systems are based on the assumption that problems can be formulated in order to obtain the goal of the system. A definition of Hard Systems is given by Walker (1996). He defined that Hard Systems are able to tackle well-structured problems and it produces quantitative predictions.

Following construction of the soft systems model, an attempt was made to produce a similarly sized hard systems model. This contained the some factors and allowed a single link in each direction between each of them. The strength of these interactions was determined from data collected from the industry and using the soft system model as a base.

4. USE OF MODELS FOR DECISION SUPPORT

The models described in this paper can support managers charged with running companies in several ways. The followings are suggested as being of particular importance in the complex construction environment.

- ❑ Soft systems methodologies can be used to demonstrate the overall complexity of the area of interest. Here the soft systems diagram can indicate how a system might have wide ranging effects throughout the company
- ❑ In order to use hard systems (such as that shown in figure 3) in a particular company it is necessary to validate and calibrate the model for that company. This is because each company operates with different strategies and in slightly different environments. Each one will also put different emphasis on the various performance indicators
- ❑ The hard systems model will enable comparison between different strategies but will not select those strategies. Therefore in order to gain maximum benefit, the decision makers must decide on the strategies to be examined and run the model for each.

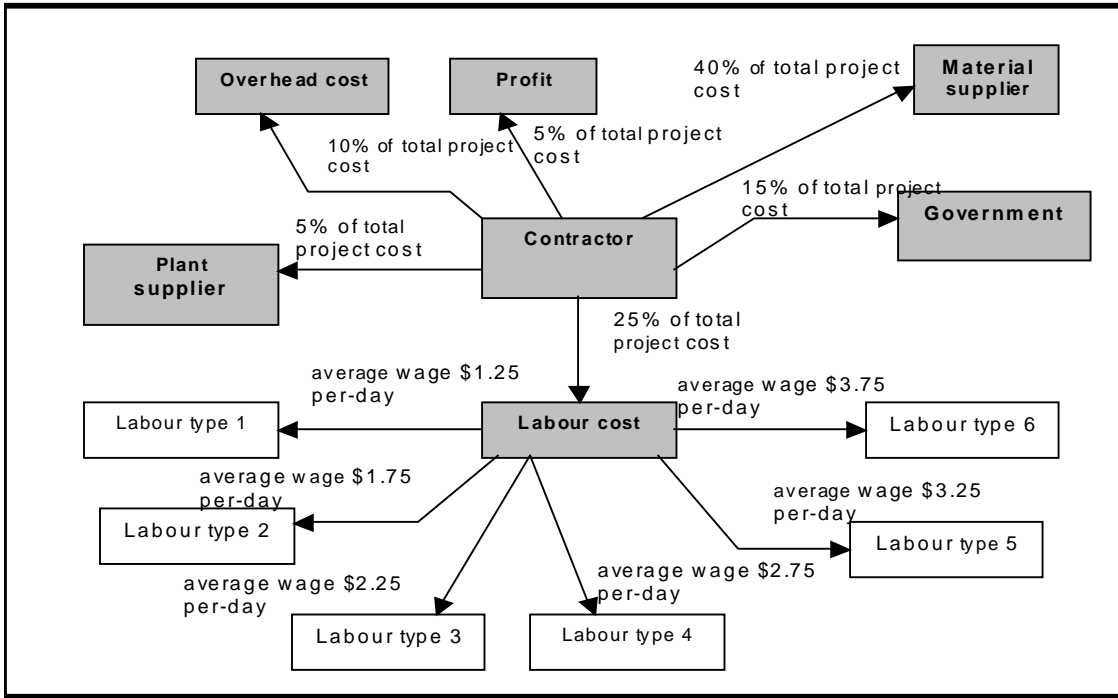


Figure 3: Entity relationship diagram, contractor point of view

Figures 4 and 5 illustrate how the system can be used to predict behaviour in the real world. They have been produced to demonstrate the effect of change in client investment on the spending of a typical household in a labour intensive construction market (Wibowo and Mawdesley, 2003). Figure 4 shows a client investment increasing from approximately 1500 to 5000 units (> 200% increase) at week 10. This leads to an increased payment to the contractor 16 weeks later. The increase is only in the region of 60%. Similarly, Figure 5 shows the effects on the household income and expenditure for a typical labourer living away from his family. The amount sent back to the family increase by 60-70%, the amount spent on food by 50% and the amount family spent on non-food increase by 100% although this remains very small. The system might also be used to model rates of changes of variables by suitable alteration of the variables.

Such analysis, if repeated for equipment based construction, can help government decide on what policies to adopt to achieve its aims.

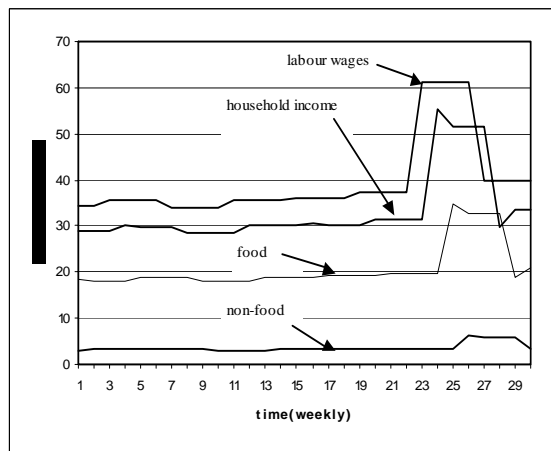
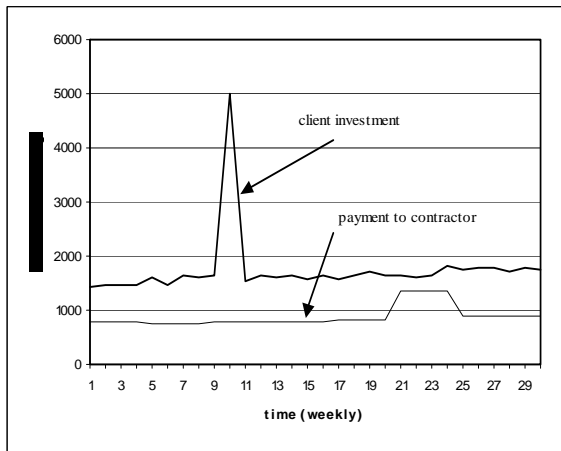


Figure 4: Client's investment and payment to contractor Figure 5: Labour wages and household income

5. CONCLUSION

The construction industry provides a very important contribution to the national/local economy through its job generating ability for unskilled, semi-skilled and skilled labour. The construction process needs inputs from other industries and production factors (labour, land and capital). This could generate considerable employment through multiplier effects.

The study has examined the actual mechanism of the role of the construction industry in the economy particularly in term of the money flow to the society. The System Theory, soft and hard system were explored to investigate the effect of the final demand change of the construction industry to macroeconomic level. The methods soft and hard models mentioned could provide a holistic interaction among parties involved.

A system methodology has been applied to model the role of the industry from the microeconomic perspective. It has been show that the model developed is able to predict the effects of changes in policy in expenditure on the micro level. It also shows the time-lag effect of the construction investment to parties involved. A worrying trend is the proportion of money allocated or paid to labour is significantly small in comparison with the total amount invested. This trend has a direct effect on income and expenditure of labour household. The authors are hopeful that the policy makers are aware of this problem and try and alleviate it in order to improve the role of the construction industry in the economy.

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