The building industry in Papua New Guinea

Alan Stretton
November 1979

Institute of Applied Social and Economic Research
P.O. Box 5854, Boroko, Papua New Guinea
The building industry in Papua New Guinea

Alan Stratton
Dr Alan Stretton of the University of Hong Kong was a visiting research fellow at IASER during 1977. Some of the material in this paper was brought together while Dr Stretton was in Port Moresby. The Institute hopes that the research (on the building industry) proposed in this paper can in fact be carried out in the near future as we feel this is an important issue for Papua New Guinea. This paper was commissioned by the Institute and was presented in a slightly different form at the Waigani Seminar held in Port Moresby from 24 to 28 September 1979.
The building industry has an important role to play in urbanization in Papua New Guinea. The purpose of this paper is to stimulate interest in a detailed study of the building and construction sector and to suggest a possible framework for research.\(^1\) I begin with a discussion of the importance of the building industry in Papua New Guinea's towns and follow with an explanation of some of the problems likely to hinder the growth of the industry. I analyse in detail the problems of industry structure, work force requirements and fluctuating demand and also briefly mention some of the difficulties created by the supply of building materials and finance. I also discuss the implications of these difficulties and possible solutions. However the problems are complex and it is necessary to wait until sufficient information is available before deciding on the best policies. The following discussion is based on the experience of other Third World countries and presents a number of alternatives to be considered by policy makers as hypotheses for a more detailed study of the industry in Papua New Guinea.

As this paper was originally prepared for the Waigani seminar on urbanization, it considers mainly the building industry. However, much of the discussion may also be valid for the civil engineering construction industry. Most attention will be given to means of developing indigenous contractors, rather than the problems of overseas firms.

**The importance of the building industry in urban development**

Discussions on urban development invariably produce long arguments on the correct industrialization policy, the best means of providing housing and other social amenities to the urban population, and the effects of an expanding manufacturing sector on rural-urban migration, the labour market and income distribution. The role of the construction sector in urban development usually receives scant attention. However, in addition to its direct contribution to the level of output, the industry, both public and private sectors, employs a high proportion of the work force and is responsible for constructing the cities' infrastructures. Urbanization requires roads, water and sanitation schemes,

\(^1\) To this end, a list of the type of information that needs to be collected is included in the appendix.
factories, commercial buildings and houses. Unless the building industry is capable of constructing these, the quality of life and level of output in the cities will be extremely low. Hence the construction sector has a fundamental and crucial role to play in urbanization.

From 1972 to 1975 the construction sector in Papua New Guinea contributed more to gross domestic product (GDP) than manufacturing. Construction output accounted for 7.6 to 14.7 per cent of GDP compared to the manufacturing sector's 5.4 to 7.5 per cent (Bureau of Statistics 1978). Perhaps of greater significance is that the industry's output represents a high proportion of capital formation.¹

Virtually the whole infrastructure of the country must be assembled by the construction sector. Hence it is a potential bottleneck to the expansion of the country's capital stock. Planning for, and setting aside, sufficient funds to construct additional houses, factories, roads etc. is not sufficient to ensure that these projects will be completed. Unless there are contractors, private or government, who can bring together the required labour and materials, the new infrastructure will remain on the planning board.

This view is summarized by Arthur Lewis (1965:208-209) who states that given finance, suitable natural resources and appropriate institutions:

... the expansion of capital is a function of the rate at which the building and construction industry can be expanded. Plans cannot be executed if there are not the carpenters, the masons, the electricians and the engineers to do the necessary construction.... Hence the question how rapidly capital formation can be accelerated resolves itself first into the question how rapidly the building industry can be expanded.

In addition, an inefficient construction sector will increase the costs and construction time of infrastructure projects, reducing the social returns on such investment.

¹ Figures are not available for Papua New Guinea, but construction output usually accounts for approximately 60 per cent of capital formation in developing economies.
The above comments are valid irrespective of the urbanization strategy chosen by a government. Whether the cities are intended to be predominately service centres for rural development or whether they form the basis of industrial growth, the construction sector will be required to build the appropriate infrastructure. The ultimate contribution to development of the sector's output depends on the productivity of its construction projects. For a given amount of money the industry could build a luxurious dwelling for one family or erect a large number of low cost houses. Similarly, it could assemble a factory for an exporting company employing a large number of labourers or for an inefficient firm that relies on government subsidies. In both cases the building industry's output would be the same, however the contribution of that output to development would be quite different. The contractor does not choose between these options. Rather the decision is made by his client, who in turn will be influenced by the government's strategy on urbanization and industrialization. The construction sector does not determine its output mix, but once this is decided it is responsible for ensuring that the building and engineering projects are constructed efficiently.

The role of the building industry extends beyond the provision of capital stock. It can make additional contributions to urban development by generating productive employment. The building industry offers a wide choice of techniques for the construction of a given project. If the elasticity of substitution between capital and labour is high, the building industry might act as a sponge in absorbing some new entrants to the urban work force unable to obtain employment in the manufacturing sector. Turin (UNIDO 1969:24) has argued that employment in the construction sector 'traditionally serves as a transitional stage between unskilled, rural agricultural employment and skilled urban industrial occupations'. This implies that the building industry not only offers employment, but also provides some training from which the labourer's next employer will benefit. It further suggests that the building industry does not actively encourage rural-urban migration. Rather, the migrant is attracted by the prospect of employment in manufacturing and service sectors, and the building industry passively offers employment when jobs in the modern industrial sector cannot be found. If this hypothesis is true, the building industry may offer a partial solution to the employment problem, especially given the importance of the industry's output to economic growth.
An indication of the importance of construction in creating jobs in Papua New Guinea towns is gained from Table 1 which shows the proportion of the male indigenous work force employed in the sector in 1971 and 1973-74. Ignoring Arawa-Kieta-Panguna which were still in the construction stage of the Bougainville copper project, in 1971 the proportion of employed males working on construction sites ranged from 12 to 20 per cent. In each town construction activity created more jobs than manufacturing. The 1973-74 Urban Household Survey data suggest a slightly lower proportion of the work force employed in construction, but in all towns except Lae and Madang the industry provided considerably more employment than manufacturing. While the ranking varied among the towns, construction usually fell behind government services, private services and commerce in terms of employment created.

Table 1
Proportion of employed indigenous males working in construction sector, 1971 and 1973-74 (percentages)

<table>
<thead>
<tr>
<th></th>
<th>Port Moresby</th>
<th>Lae</th>
<th>Rabaul</th>
<th>Madang</th>
<th>Wewak</th>
<th>Goroka</th>
<th>Mt. Hagen</th>
<th>Arawa-Kieta-Panguna</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>18</td>
<td>18</td>
<td>12</td>
<td>16</td>
<td>12</td>
<td>13</td>
<td>20</td>
<td>47</td>
</tr>
<tr>
<td>1973-74</td>
<td>12</td>
<td>12</td>
<td>15</td>
<td>6</td>
<td>7</td>
<td>9</td>
<td>24</td>
<td>14</td>
</tr>
</tbody>
</table>


b Garnaut, Wright and Curtain 1977, Table 4.11. These figures refer only to males aged 15-44 years, while the census figures refer to all employed males.

Finally, the construction sector is usually associated with strong backward linkages. The expansion of building activity will mean increased demand for various building materials and service industries. In most countries building materials are produced locally, maximizing the secondary benefits of an increase in building activity. However

---

1 This may be related to the omission of males over 44 years from the 1973-74 figures.
data prepared by Baxter (1976) for Papua New Guinea for his 1972-73 input-output table suggests that only about 28 per cent of the output of the construction section in Papua New Guinea represents purchases from other domestic industries. Of this amount, 59 per cent is building materials while the remainder is from transport and service industries. Almost one-fifth of the sector's output is comprised of imported materials.

Because of their contribution to gross national product (GNP), capital formation, employment creation and the strength of backward linkages, the building and construction industries have a considerable role to play in the development of Papua New Guinea towns. It is imperative that plans for future urbanization consider the ability of the industry to fulfil its obligations. Is the capacity of the sector sufficient to construct the predicted expansion in infrastructure? If not, how can capacity be increased? How can localization of the industry be encouraged? Is the structure of the industry such as to ensure that projects are completed efficiently and at minimum cost?

These and many other questions should be answered. So far, this type of analysis has not been attempted, at least not systematically. It is difficult to begin the task as little information is available on the industry. Without the collection of a considerable amount of primary data, it is not possible to estimate even the current capacity or structure of the industry, let alone analyse how these might change in the future.¹

Structure of the building industry

(a) Special features

There are a number of features peculiar to construction activity that affect the economic structure of the industry. First, the industry

¹ To my knowledge there have been only three published studies that examine the problems of the building industry. Langmore (1967) provides some information on contractors working in Port Moresby. The usefulness of this study is diminished by the fact that most 'contractors' were engaged on extremely small projects and the time which has elapsed since the survey. Hutton (1968?) analyses the role of construction in development but uses only the limited amount of published data. Andrews (1975) examines the relationships between some contractors working in Port Moresby and the government departments trying to assist them.
experiences severe annual fluctuations in its level of output. For the contractor this problem is accentuated by the discontinuous demand for his services. His level of activity consists of a number of discrete jobs, and there is no guarantee that when one project is completed another will be available. Even during a year in which the industry's level of output is quite high, a contractor may experience periods of excess capacity or even inactivity. These fluctuations may result in high failure rates among construction firms. Long-term planning is difficult because of the uncertain nature of future demand, and problems are created for new firms attempting to establish a sound financial base.

Second, the industry's output is not standardized. Contractors are required to produce a wide variety of building in both size and type. These projects involve a wide range of techniques and equipment. Hence there is no optimum size firm. As a result, the industry comprises a number of subsectors or markets and while a contractor may concentrate on a particular section, he must maintain the ability to move into different markets if the output mix of the industry should change. This fragmentation of the industry implies that the government must adopt policies to encourage efficiency in each market.

Barriers to new firms entering the industry depend on the particular market. In some sections they are very low. This, combined with the fluctuations in demand, means that firms enter and leave the industry frequently so the number and composition of active contractors is continually changing. This increases the difficulty of measuring the industry's capacity.

Unlike most firms, contractors must produce their goods in the areas where they are demanded. Hence the mobility of contractors is very important, particularly in a country like Papua New Guinea. While large firms may be willing to work in any part of the country if the project is attractive enough, one might expect some reluctance among small local contractors to work outside their region. In provinces other than their own they may lack the contacts necessary to ensure a continuous supply of materials and labour. This problem may be increased by the animosity that sometimes exists between individuals of different ethnic backgrounds. It may be necessary to develop indigenous contractors in each main town.
(b) Output mix

We can gain considerable insight into the structure of the industry by constructing a matrix of total output by such variables as type and size of project, technological requirements, client, and region. This should give an indication of the output mix of the industry and of the relative size of the different markets. These data can then be combined with information on the number, size and technical capabilities of contractors to pinpoint areas where bottlenecks are likely to occur. Unfortunately, published data do not allow such matrices to be compiled for the construction sector. However, a little information is available on the composition of building industry output.

Non-residential building usually comprises 60 to 75 per cent of total output, although the ratio has varied considerably from year to year (Table 2). As non-residential buildings may vary from single rooms

<table>
<thead>
<tr>
<th>Table 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building industry output(^a) by type of building, 1965 - 1977</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1965</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>70</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
</tbody>
</table>

\(^a\) Based on date for building commencements.

to multi-story structures, this category needs to be further classified by size of project before the data will be particularly useful. Table 3 emphasizes the important role that the government as a client plays in the industry. In the years following independence, government contracts accounted for 75 to 85 per cent of the value of all buildings constructed. Even in periods of less uncertainty, the proportion was usually more than 50 per cent. This places the authorities in a strong position to influence such factors as fluctuations in the level of output, tendering procedures and assistance to local builders.

Table 3
Building industry output\(^a\) by client, 1965 – 1977

<table>
<thead>
<tr>
<th>Year</th>
<th>Government</th>
<th>Private sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965</td>
<td>71</td>
<td>29</td>
</tr>
<tr>
<td>6</td>
<td>71</td>
<td>29</td>
</tr>
<tr>
<td>7</td>
<td>65</td>
<td>35</td>
</tr>
<tr>
<td>8</td>
<td>55</td>
<td>45</td>
</tr>
<tr>
<td>9</td>
<td>52</td>
<td>48</td>
</tr>
<tr>
<td>70</td>
<td>52</td>
<td>48</td>
</tr>
<tr>
<td>1</td>
<td>36</td>
<td>64</td>
</tr>
<tr>
<td>2</td>
<td>65</td>
<td>35</td>
</tr>
<tr>
<td>3</td>
<td>43</td>
<td>57</td>
</tr>
<tr>
<td>4</td>
<td>74</td>
<td>26</td>
</tr>
<tr>
<td>5</td>
<td>73</td>
<td>27</td>
</tr>
<tr>
<td>6</td>
<td>85</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>51</td>
<td>49</td>
</tr>
</tbody>
</table>

\(^a\) Based on data for building commencements.


Tables 4 and 5 show that the role of the owner-builder has diminished considerably during the present decade. Contractors now account for a much higher proportion (80 to 90 per cent) of the value of non-residential buildings constructed. However, in the case of residential buildings, owner-builders have been replaced by government
day labour contracts. This was particularly noticeable from 1974 to 1976 when most dwelling construction was supervised by the National Housing Commission (NHC) or other government agencies. However, as the NHC is now using local builders to a much greater extent, one would expect that the proportion of residential buildings erected by contractors has increased since 1976.

Table 4
Residential buildings by type of builder, 1965 - 1977

<table>
<thead>
<tr>
<th></th>
<th>Owner builder</th>
<th>Contractor</th>
<th>Government day labour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965</td>
<td>12</td>
<td>75</td>
<td>13</td>
</tr>
<tr>
<td>1966</td>
<td>9</td>
<td>78</td>
<td>13</td>
</tr>
<tr>
<td>1967</td>
<td>22</td>
<td>68</td>
<td>10</td>
</tr>
<tr>
<td>1968</td>
<td>20</td>
<td>69</td>
<td>11</td>
</tr>
<tr>
<td>1969</td>
<td>24</td>
<td>67</td>
<td>9</td>
</tr>
<tr>
<td>1970</td>
<td>23</td>
<td>70</td>
<td>7</td>
</tr>
<tr>
<td>1971</td>
<td>23</td>
<td>76</td>
<td>6</td>
</tr>
<tr>
<td>1972</td>
<td>12</td>
<td>79</td>
<td>9</td>
</tr>
<tr>
<td>1973</td>
<td>6</td>
<td>81</td>
<td>13</td>
</tr>
<tr>
<td>1974</td>
<td>5</td>
<td>61</td>
<td>34</td>
</tr>
<tr>
<td>1975</td>
<td>3</td>
<td>61</td>
<td>36</td>
</tr>
<tr>
<td>1976</td>
<td>3</td>
<td>58</td>
<td>39</td>
</tr>
<tr>
<td>1977</td>
<td>4</td>
<td>72</td>
<td>23</td>
</tr>
</tbody>
</table>

* Based on data for building commencements.

Table 5
Non-residential buildings\(^{a}\) by type of builder,
1965 - 1977

<table>
<thead>
<tr>
<th>Per cent of value of output</th>
<th>Owner builder</th>
<th>Contractor</th>
<th>Government day labour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965</td>
<td>13</td>
<td>76</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
<td>87</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>15</td>
<td>75</td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td>20</td>
<td>65</td>
<td>15</td>
</tr>
<tr>
<td>9</td>
<td>15</td>
<td>70</td>
<td>15</td>
</tr>
<tr>
<td>70</td>
<td>16</td>
<td>71</td>
<td>13</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>77</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>84</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>90</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>88</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>79</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>84</td>
<td>10</td>
</tr>
</tbody>
</table>

\(^{a}\) Based on data for building commencements.


c. Number and capacity of contractors

The construction sector in developing economies often exhibits a dualistic structure. Discussing the situation in Kenya, Ethiopia, and Sri Lanka, Turin observed that:

The industry in these countries does not have a sound structural base on which to build a substantial expansion. In all three countries the structure of the industry is characterised by an extreme dichotomy: at one end, a large number of small and very small indigenous contractors or self-employed artisans, at the other a small number of large and very large private or public contracting organisations (Turin, et. al., 1972, p. c.3).

The large firms are often foreign owned. The small indigenous contractors account for only a minor proportion of the total demand as the
design and specifications of all but the simplest buildings are beyond their capabilities.

First impressions suggest that a similar state of affairs exists in Papua New Guinea. Virtually all large projects are built by overseas firms, some of whom remain in the country for only one project. While there may be some exceptions, most local contractors have limited technical experience and financial backing (Langmore 1967; Andrews 1975).

A disadvantage of a dualistic structure is that buildings outside the main concern of the two groups of contractors are unlikely to be efficiently constructed. Small firms may not have the competence to supervise these projects, while modern firms will only construct medium-sized projects when larger ones are not available. More importantly, this type of structure does not provide for developing the industry through medium-sized firms upgrading their capacity after the appropriate experience. Hence a dualistic structure could create a bottleneck to the expansion of the country's infrastructure.

The construction sector in Manila (Stratton 1978) and South Korea [de Wilde et al., 1973] is quite different from that described above. While the large firm and self-employed artisan play important roles in the industry, there are a considerable number of medium-sized firms with some expertise and experience. The benefit of such an industry structure was clearly illustrated during the years 1973-77. A rapid expansion in the number of high-rise buildings under construction meant that the capacity of firms that traditionally supervised such projects was inadequate. However, a number of medium sized contractors were able to move into this market and meet the excess demand.

An industry structure with various size firms allows greater flexibility in dealing with rapid growth in demand and changes in the industry's output mix. This type of structure also allows considerable interaction among firms at different points on the spectrum. The practice of sub-contracting, which is widely used in the building industry, means that many smaller firms rely on larger contractors for much of their business. As well as representing a source of work, this arrangement may result in the smaller firm gaining valuable experience and technical knowledge. The larger firm also benefits as the work is completed at lower cost and it is not required to hire additional skilled
labourers or purchase expensive equipment. However in a dualistic structure there tends to be little interaction between firms at either end of the spectrum.

What are the implications of this general discussion for the industry in Papua New Guinea? First, given the disadvantages of the existing dualistic structure, one would like to see medium-sized, local contractors emerge over the next five to ten years. Second, small indigenous contractors have an important role to play in the industry. They should be responsible for constructing low and middle income housing and small non-residential buildings. How else might such builders widen their experience and secure a sound footing in the industry? Third, while one might wish to see overseas firms in a less prominent position, this possibility is still far removed. In the meantime, foreign firms should be encouraged to assist the development of local builders.

In the remainder of this section of the paper I examine some of the ways in which small and medium sized local contractors might emerge and develop. First, smaller contractors whom one would expect to work on residential and smaller non-residential projects are likely to be skilled artisans who have risen to the foreman or contractor level. The technical, administrative and financial expertise required of these contractors will depend, to a certain extent, on the type of contract under which they work. Three alternatives are considered below. Initially, one would expect the first two to be more in line with the experience of most builders.

A system widespread in Manila involves the owner of the building hiring a foreman who supplies and supervises the labour for the project. The client is responsible for purchasing materials and paying wages on a weekly basis. As little equipment is used on such sites, the foreman requires no financial reserves before entering into this type of arrangement. The plans for the buildings are drawn by an architect or engineer who can be consulted by the foreman on particular technical problems. However, the foreman must be able to read plans and supervise his work force in the same way as any other contractor.

Individual or small firm clients would be most likely to adopt this type of contract. A similar scheme is often used by the Tolai when they construct a house in their village and some urban settlers hire skilled
carpenters to supervise the construction of their dwellings. This type of contract could become quite widespread if the government places greater emphasis on self-help housing in the future (Stratton 1979).

A second arrangement under which small contractors can operate is sometimes used by the NHC. In this case the builder submits a tender for a labour only contract. Hence he must be able to estimate accurately the amount and type of labour required to complete the project. He must also have sufficient working capital to pay wages until he receives his first payment installment. However materials are supplied by the client. If the contractor is accurate in his tendering and has sufficient working capital, this arrangement can allow greater scope for the commercial development of the enterprise. However, the risk of failure is also higher.

A third alternative is that the small builder be required to submit a full tender. This requires a much higher level of technical, managerial and financial expertise on the part of the contractor, but in return should offer greater independence. While some local firms in Papua New Guinea have been awarded this type of contract, they usually required considerable government support in the form of loans, advice on tendering and managerial assistance. Thus, the greater independence that this type of contract should offer the builder has not come about. Early experiences of this type of government assistance to local contractors have not always been encouraging (Andrews 1975). While this does not imply that such schemes should be abolished, their effectiveness should be investigated and alternatives considered.

One of the implicit aims of assisting local builders through Development Bank loans and Business Development supervision is to encourage the development of medium sized local contractors. However the Philippines' experience suggests that it may be more fruitful to rely on engineering and architecture graduates for this. Very few medium sized firms in Manila have been expanded by skilled artisans or foremen. Most are owned by engineers or architects who established their own firm after working for larger companies for a number of years.

It is possible that some graduates of the University of Technology might follow a similar path. If so, they should work with a large firm or government for several years to gain experience and contacts in the
industry. These contacts are likely to be the main sources of building materials, professional advice, foremen and possibly even clients when the individual attempts to establish his own business. Foreign contractors can contribute to this process by providing on-the-job training to young architects and engineers. It is important that the initial experience of graduates be in the field. There is a danger that some will be siphoned into more prestigious office jobs and their experience restricted.

Because of the varied tasks that members of the building professions engage in, their education should not be too specialized. Not only should their technical training be spread over the disciplines of architecture, building and the various forms of engineering, but their courses should include an introduction to the legal aspects of building, personnel and financial management.

Contractors from this background may experience technical and financial difficulties. Technical difficulties will depend on the experience of the contractor and the type of projects he undertakes. These problems may be overcome by using specialist sub-contractors if they are available. If not, it may be necessary for the firm to hire individual consultants for specific projects. Both of these methods are used by large contractors in all countries. The financial requirements of the builders will depend on the type of contract under which they work. In Manila, medium sized firms engaged on large projects usually require the client to pay a substantial deposit before the commencement of work. This acts as the firm's working capital. However, most governments are reluctant to adopt such arrangements and prefer to make payments on the basis of work completed. In this case the contractor needs to be able to borrow sufficient working capital. As banks usually regard contractors as poor credit risks, it may be necessary for the Development Bank to provide assistance. However, it is possible that they will find this type of aid more effective in encouraging the development of an indigenous building industry than that currently offered to small contractors.
Fluctuations in the level of demand

In most countries the building industry experiences severe fluctuations in the level of demand for its output. Investment in new factories, commercial buildings and housing is extremely sensitive to such variables as the rate of growth of GNP, performance of individual firms, businessmen's expectations and the credit policy of financial institutions. As well, the government's construction program will be influenced by its economic stabilization policy.

Figure 1 and Table 6 show that the level of building activity in Papua New Guinea has been quite variable and that non-residential building has been more volatile than residential building. Before analysing these phenomena in more detail, some limitations of the data need to be mentioned. While information is available on the value of buildings commenced, completed and under construction in a given year, we do not have data on the actual level of building activity in a period. Projects are not necessarily completed in the year building commences. Hence the value of projects commenced in a particular year will not coincide with the value of building output actually constructed in that year. Estimates of this latter variable can be obtained by assuming that work constructed in a given period will be a distributed lag of commencements in current and previous periods. The data in Table 6 and Figure 1 were calculated on the assumption that 70 per cent of the value of residential buildings was completed in the year commenced, and 30 per cent the following year. As non-residential buildings are usually larger than dwellings, a smaller proportion will be completed in the year commenced. Hence it was assumed that half (in terms of value) of the projects were constructed in the year commenced and the remainder in the following year.

Secondly, the data portrayed in Figure 1 are expressed in current prices. To analyse changes in the level of building activity over time one should deflate such estimates to exclude the effects of changes in prices and wages. However, an index of the cost of construction is not yet available. If wages and price of building materials have increased in each of the years under study, the effect of deflation on the series in Figure 1 would be to accentuate any decrease in the level of output, but modify any increase.
Table 6

Estimates of the level of building activity \(^a\) (K000, current prices)

<table>
<thead>
<tr>
<th>Year</th>
<th>Residential building</th>
<th>Non-residential building</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td>11582</td>
<td>15821</td>
<td>27403</td>
</tr>
<tr>
<td>7</td>
<td>13670</td>
<td>18488</td>
<td>32158</td>
</tr>
<tr>
<td>8</td>
<td>13434</td>
<td>16124</td>
<td>29558</td>
</tr>
<tr>
<td>9</td>
<td>11767</td>
<td>16431</td>
<td>28198</td>
</tr>
<tr>
<td>70</td>
<td>12145</td>
<td>20482</td>
<td>32627</td>
</tr>
<tr>
<td>1</td>
<td>12128</td>
<td>22087</td>
<td>34215</td>
</tr>
<tr>
<td>2</td>
<td>9180</td>
<td>19839</td>
<td>29019</td>
</tr>
<tr>
<td>3</td>
<td>8347</td>
<td>20680</td>
<td>29027</td>
</tr>
<tr>
<td>4</td>
<td>7191</td>
<td>18861</td>
<td>26052</td>
</tr>
<tr>
<td>5</td>
<td>8938</td>
<td>14568</td>
<td>23506</td>
</tr>
<tr>
<td>6</td>
<td>9051</td>
<td>20398</td>
<td>29449</td>
</tr>
<tr>
<td>7</td>
<td>12862</td>
<td>28638</td>
<td>41500</td>
</tr>
</tbody>
</table>

\(^a\) Estimated on the assumption that

\[
B_t = aC_t + bC_{t-1}
\]

where \(B_t\) = level of building activity in period \(t\)
\(C_t\) = level of commencements in period \(t\).

For residential buildings \(a = 0.7\), \(b = 0.3\)
For non-residential buildings \(a = 0.5\), \(b = 0.5\)

Figure 1 shows that the political and economic uncertainty following independence had a major effect on the level of building activity. The value of non-residential buildings constructed increased during the years leading up to independence but fell sharply from 1972 to 1975. This decrease was entirely the result of a fall in private demand. Government construction increased during this period. The level of activity increased again in 1976 and 1977. Initially this was the result of government demand, but the value of private buildings also rose in 1977.\(^1\)

---

\(^1\) Global inflation and the sharp rise in wages in 1975 suggest that part of the increase in building activity valued in current prices was the result of increases in the cost of construction.
Figure 1

Estimated Level of Building Activity
(current prices)

Source: Table 6.
The annual value of residential buildings constructed fell from 1967 to 1974. The rate of decline was much higher in the years 1972 to 1972, again primarily as a result of reduced private sector demand. In current prices, the level of output increased slightly in 1975, but in real terms this is unlikely to be significant.

By comparing the information in Figure 1 and Tables 4 and 5, we can analyse the extent to which contractors were affected by the fall in demand from 1972 to 1975. Regarding residential building, it appears that many government dwellings were constructed by day labour. The share of dwellings constructed by government day labourers increased from approximately 10 to 35 per cent over this period. At the same time, the proportion of output built by contractors fell slightly. Thus, the slump in residential building must have considerably reduced the level of activity of contractors. Not only did the total level of output decrease, but their share of the market also fell. On the other hand, in the non-residential market the opposite appears to have occurred. The proportion of the market erected by contractors increased. Hence the effect of the fall in output on contractors may have been cushioned slightly.

The data series in Figure 1 contains too few observations to allow generalizations as to possible causes of future fluctuations or the effectiveness of stabilization policies. Because of the different political and financial structure, the experience prior to 1972 cannot be extrapolated. From 1972 to 1975, the uncertainty following independence dominated all other variables. While this illustrates the sensitivity of investment to political uncertainty and businessmen's expectations, episodes of a similar scale should be infrequent in the future. An encouraging fact during this period was the way in which government demand tended to counter the fall in private investment. Without the stabilizing effect of government construction, the fall in industry output would have been even more severe. As fluctuations in the level of output create difficulties for both contractors and labourers, the government should attempt to program its building activity to offset any sharp movements in private demand. To the extent that private building activity is positively correlated with the general state of the economy, there should be little conflict between a stabilization policy for the economy and for the building industry. When export prices and the national income growth rate are high, private investment in building
projects may also increase. Hence government policies to control the level of activity in the economy could include delaying planned construction projects. This would counter the rise in the private demand for the industry's output. Similarly, when the economy is in a slump, an increase in government projects would boost both the economy and the building industry. Since the government accounts for such a large share of total industry output, such a stabilization policy could be effective. Yet, one of the main problems is that construction projects often entail both long gestation and construction periods. This makes fine tuning difficult, especially in the short term. In addition, fluctuations in private demand may not coincide with general movements in the economy. If so, stabilizing the level of output may be more complicated.

Fluctuations in demand are likely to severely affect small or inexperienced contractors particularly. Establishing a sound financial base and planning for future expansion of capacity and purchase of equipment are extremely hazardous under this uncertainty. If the government can be a stabilizing force in the industry it will be assisting local contractors considerably. However contractors will still need to take steps to minimize the effects of unstable demand. First, they may need to spread their interests over a wide spectrum of the industry. Specialization will be difficult, especially as the total industry demand is quite low. Contractors may need to undertake a wide variety of projects for different types of clients and possibly in different regions. Second, builders will need to minimize their long-term commitments and overhead expenditures to facilitate the expansion or reduction of activity at short notice. This may involve the use of sub-contractors, hiring rather than purchasing equipment and employing casual labour rather than permanent. However, availability of the first and second options to contractors in Papua New Guinea might be limited, at least for the next few years. Third, contractors may need to resort to a second job or business when contracting work is difficult to get. While this is far from ideal, it is a strategy that has been forced on contractors in many countries.

Work force

A third category of problems that may hinder the development of the building industry is related to its work force. The discussion
which follows will focus on the need to train skilled labour and on the reaction of labourers to the unstable employment prospects offered by the industry.

(a) Supply of skilled labour

Skilled labourers can be trained in at least three different ways: apprenticeships, informal on-the-job training and formal technical education. All methods are likely to be used as each section of the industry has varying requirements and will adopt different schemes. Apprenticeships usually take three to five years to complete. Contractors are required to employ the apprentice until his training is completed and will not offer such schemes unless certain of sufficient work. Hence this method will be used primarily by government departments and large contractors.

Some foreign firms that intend to work in the country only a short time may be reluctant to take on apprentices. However training of employees is one of the major benefits that foreign firms can offer Papua New Guinea. If offering apprenticeships is impracticable, they could be required to employ indigenous engineering and building graduates when sufficient numbers are available.

Apprenticeships usually provide a thorough training. However the period of instruction is quite long and the labourer may learn a number of skills he will rarely use. Hence if there is an acute shortage of skilled labour, this method is unlikely to be the most efficient way of increasing the size of the skilled labour force quickly.

Small contractors are likely to offer an informal type of training in which skills are passed on to younger members of the work force by the foreman or skilled labourers. While there is no legal requirement on the foreman to offer training, there are a number of reasons why he may do so. First, it will be advantageous to the foreman to build up a small group of skilled labourers whom he can transfer from job to job. This will reduce the amount of time spent recruiting training labour. Also, as such a group of labourers is likely to develop into a socially cohesive unit, it will reduce the incidence of personal disputes on the building sites. One way of forming such a group is to offer the labourers training that will eventually increase their income. Second,
small builders are likely to employ relatives or people from their own village or district. In this case there will be considerable social pressure on the foreman to instruct his wantoks.

Under this scheme the labourer is unlikely to obtain as broad a training as an apprentice. He will be taught primarily skills required by the foreman. In addition, the trainee will not receive formal acknowledgement (e.g. a certificate) that he has acquired certain skills. Hence if he transfers to another employer, he may need to accept a lower wage until he demonstrates the extent of his ability. However, the cost of this type of training is minimal as the labourer is engaged in activities to complete the project. Also, time is not spent in learning skills that are rarely used.

Instruction could also be obtained from technical schools. In this scheme the student could reach a high level of competence at an early age. The curriculum could include reading building plans, which other trainees would learn only at a much older age, if at all. Hence some of these graduates might become small contractors. A possible problem is that formally-trained students often expect a much better job after graduation than contractors are willing to offer. While the students may have received a good general training, they still need to prove their competence on the site. The extent of this problem will depend how the school is administered and its relations with the industry.

The main disadvantage of formal technical education is the cost. The student is not producing while learning and the cost of buildings, teachers and student allowances could be quite high. Hence one would expect this method of instruction to play a relatively small role, at least in the medium term.

(b) The reaction of labourers to uncertain employment

Because of fluctuations in the demand for the industry's output, building industry labourers often experience uncertain employment. Most are hired on a casual basis and are likely to have periods when they cannot find work on the building sites. How labourers react to this instability will affect both the industry and the urban centres. Evidence from other developing economies suggests a number of employment-migration patterns.
Turin (1972) argued that because of the instability of employment, labourers would remain in the industry for only a short period before moving to better paid, more stable employment. The work force would consist of recent migrants to the city who were using the industry as a stepping stone from agricultural to industrial employment. If this is the background of most of the work force, one could argue that the industry plays a useful role in urbanization. While not attracting migrants to the cities, it offers temporary employment when they cannot find jobs in factories or office buildings. However, in this situation the industry itself suffers as labour turnover is high. Difficulty in obtaining an experienced work force will affect both the quality and cost of construction. Training programs will also be less effective.

In contrast to this pattern, I found (Stretton 1979a and forthcoming) that most skilled labourers in Manila were committed to employment in the building industry. This is primarily the result of the relatively high wages skilled labourers receive although job satisfaction and difficulty in obtaining manufacturing employment also may be influential. These labourers cope with uncertain employment by adopting a migration pattern in which they leave their families in their village and move to the city when work is available. When the industry's demand for labour is low, the labourers return to their village. As they have maintained close links with their families in the village, making frequent visits and sending remittances, they are readily accepted back into the village economy.

This pattern implies that the building industry's fluctuating demand for labour places less stress on the city. When the level of employment is low, those who cannot find work return to their village. Yet the industry retains an experienced skilled work force. The alternative, as described by Turin, is that the redundant labourers remain in the city, swelling the number of unemployed.

Because of the implications of these employment-migration patterns, it is important to discover which labourers in Papua New Guinea adopt. Alternatively, they may use a completely different pattern. The disparate population structures among cities in Papua New Guinea suggest that the dominant pattern may vary from town to town. In urban centres where a high proportion of migrants come from the hinterland and where
the transportation network is relatively efficient and cheap, one might expect the pattern found in Manila to predominate. In other towns, the labourers may be primarily short-term migrants from more distant provinces.

Langmore's (1967) survey of contractors indicates that the pattern found in Manila may be significant in Port Moresby. About half of the contractors interviewed were born in the Marshall Lagoon area, while 75 per cent came from Central District. Most contractors employed relatives and friends from their villages. Hence in 1967, a high proportion of building labourers working for indigenous contractors had migrated from areas close to Port Moresby. In addition, some contractors returned to their village when work was not available. Remittances sent by labourers represented an important source of income for their village. This implies that the village, rather than the town, suffers when labourers are dismissed by the building industry. Not only do remittances cease, but the village must also support the returned labourers.

Additional problems

Contractors often have difficulty obtaining sufficient finance for working capital and purchasing equipment. I have argued above that the amount of finance builders require is at least partially dependent upon the type of contract entered into. For small builders this constraint can be removed if clients purchase materials and pay wages. Medium sized firms can agree to cost plus or fixed price contracts. In either case, if the client is willing to make an advance payment, this can serve as working capital. In addition, credit offered by material suppliers can provide some financial leeway to firms. However, to purchase equipment and in cases where contract payments are made only on the basis of work completed, the builder must rely on past profits or borrow money.

The availability of credit from suppliers and financial institutions is often a bone of contention among contractors. While some builders do represent poor credit risks, banks often extend this to a general reluctance to lend to contractors. This seems unnecessarily harsh. Firms acting in good faith and intending to repay their loans may experience short-term liquidity problems as a result of late payment by clients or
fluctuations in output. The financial institutions should judge each case on its merit, rather than adopt a blanket disapproval.

The supply of building materials can also represent a problem to contractors. The unavailability of certain materials can delay construction and increase costs. In Papua New Guinea this difficulty is accentuated as a high proportion of inputs are imported. The question of whether these goods should be produced locally will be determined by the country's industrialization policy. The building industry needs a continuous supply of materials at the lowest possible price. Hence to the extent that efficiency is one of the main criteria in determining the government's attitude to local industry, there should be little conflict with the industry's requirements.

Finally, there is the need to provide the client and public with some protection against unscrupulous builders. As virtually all countries have their share of jerry builders, it is unlikely that Papua New Guinea will be spared. Problems arise as the restrictions on entry into the industry are minimal, many clients have little knowledge of the construction process and it is impossible to supervise the contractor at all times. Also, if a builder is not engaged on a fixed price contract, he may lack the incentive to use materials and labour efficiently.

Governments and other large organizations are in a position to employ engineers or architects to supervise the project in their interests. However, individuals and small firms are very susceptible. While building regulations and government inspections are very necessary, they cannot provide complete protection. This is particularly true of low cost housing where it is usually argued that building regulations should be kept to a minimum. In this case, it may be possible for the residents' committees, which exist in most settlements, to provide some supervision. Most settlements will have skilled labourers able to inspect building sites and advise the client. On medium sized projects, clients would be well advised to ensure that their architect or engineer visits the site regularly.
Conclusion

I have argued that the building industry has a fundamental role to play in urbanization. Unless the industry can facilitate the efficient construction of the cities' infrastructure, the economic and social development of the towns will be restricted. As the industry consists of many different markets, policies are needed to assist the growth of various types of contractors.

Until now the government has attempted to encourage small, indigenous builders by providing loans plus technical and administrative assistance. In some cases this has resulted in public servants all but hammering the nails. While this approach has had some success, overall results have not been encouraging. Experience elsewhere suggests that in most cases builders with an artisan background are unlikely to expand into medium or large contractors. However such builders have an important function in the industry, namely constructing low and middle cost housing and small non-residential buildings. If the government were to encourage self-help housing, the demand for small builders would increase. Foremen would emerge to meet this demand and contractual arrangements would be settled between the client and builder. These small builders are also likely to make a significant contribution to the training of a skilled work force.

Engineering, architecture and building graduates may establish firms that will eventually be capable of constructing larger buildings. The government should use its position as the industry's largest client to assist this development. Apart from providing work for such builders, the government could permit more flexible contractual arrangements to reduce the financial difficulties of the firms. The government is in a strong position to do this as it has the manpower to supervise the progress and quality of work. The Development Bank may also consider the possibility of providing loans to such builders.

However, one of the main responsibilities of the government is to attempt to dampen the fluctuations in the demand for the industry's services. This instability adversely effects the contractor, building labourers, the urban centre and possibly even the villages from which most labourers originate. The extent to which a stabilization policy
for the industry can be incorporated into the government's stabilization policy for the economy has yet to be determined. Such a study should be given a high priority.

In conclusion, it must be remembered that the recommendations contained in this paper are subject to the limitations created by the lack of information on the structure and capacity of the industry. Only when such data are available will it be possible to accurately assess the main problems facing the industry, the solutions most likely to succeed and the priorities which should be accorded.
Appendix:

This paper has argued for a detailed study of the construction sector in Papua New Guinea. In particular, more information on the structure, capacity and functioning of the industry is required. A brief outline of the type of information that should be collected by such a study is given below. The list is meant to be indicative rather than exhaustive.

(A) Industry output

1. The current output mix by such variables as:
   (a) type of building or civil engineering project.
   (b) technological requirement.
   (c) region.
   (d) client.

2. Past fluctuations in the level of output and changes in the output mix:
   (a) how severe have the fluctuations been?
   (b) how do contractors and labourers cope with the instability?
   (c) what are the causes of the fluctuations?
   (d) possible stabilization policies.

3. Likely future growth in output and changes in output mix.

(B) Contractors

1. Number and current size of firms, in terms of:
   (a) amount of work completed.
   (b) work force.
   (c) type of work engaged in by technology and type of project.
   (d) catchment area.
   (e) equipment.
   (f) type of client.

2. Are firms working at full capacity? If not, in what areas can they expand and to what extent.

3. Are firms able to shift into other sections of the building industry?
4. The economics of firms in terms of overheads, profits, bankruptcies, financial structure etc.

(C) The following information could be obtained from a survey of building and construction sites:

1. size and type of firm engaged as main contractors.
2. use of sub-contractors.
3. how was the job obtained?
4. level of technology used in construction.
5. amount and type of labour and equipment used during construction.
6. time taken for different stages of the project.
7. cost breakdown.
8. work force characteristics, including
   (a) migration background
   (b) employment history, including periods of unemployment.
   (c) different employers they have worked for.
   (d) how did skilled labourers receive their training?
   (e) how were labourers recruited?
   (f) are remittances sent to village?
   (g) future employment/migration plans.
References


——— National Housing Commission. 'Annual Report', various issues.


Turin, D.A. et.al. [1972], 'Construction and development: a framework for research and action'. A paper prepared by the Building Economics Research Unit, University College, London for the International Bank for Reconstruction and Development.


INSTITUTE OF APPLIED SOCIAL AND ECONOMIC RESEARCH

Discussion Papers

Paper No. 1 A plea for language planning in Papua New Guinea by Ranier Lang, April 1976. (21pp.)


Paper No. 3 The 1974-75 Rural Survey. A study of outmigration from fourteen villages in the East Sepik Province by Richard Curtin, August 1976. (74pp.)

Paper No. 4 A population policy for Papua New Guinea. Three papers presented at the launching of the Population Research Programme, Port Moresby, 15 October 1976 by Hon. Stephen Tago, Charles Lepani and Henry ToRobert. (17pp.)

Paper No. 5 The community corporation in Papua New Guinea by Peter Fitzpatrick and Julie Southwood, November 1976. (45pp.)

Paper No. 6 The growth of Goroka: towards an interpretation of the past and a warning for the future by Ronald Skeldon, November 1976. (46pp.)

Paper No. 7 The Papua Bessa Movement: Papua Dainai, Tano Dainai, Mauri Dainai by Boio Bess Daro, December 1976. (36pp.)

Paper No. 8 The artifact industry: maximising returns to producers by R.J. May, January 1977. (27pp.)

Paper No. 9 Regional associations in Papua New Guinea by Ronald Skeldon, February 1977. (17pp.)

Paper No. 10 Family planning in the Goroka area of the Eastern Highlands by Ronald Skeldon, February 1977. (15pp.)


Paper No. 12 Reforming the government of Port Moresby by Hal Colebatch, June 1977. (31pp.)


Paper No. 14 The Rural Improvement Programme: does it improve access? by Hal Colebatch, September 1977. (34pp.)

Paper No. 15 The burden of agricultural export taxation in Papua New Guinea: a comparative analysis and a proposal by N.V. Lam, December 1977. (49pp.)

Evolving patterns of population movement in Papua New Guinea with reference to policy implications by Ronald Skeldon, January 1978. (47pp.)

Policy-making for rural development by H.K. Colebatch, February 1978. (30pp.)

Fiscal responses to export instability in Papua New Guinea by N.V. Lam, April 1978. (28pp.)

Monetary policies and options for domestic economic stabilization in Papua New Guinea by N.V. Lam, May 1978. (21pp.)

Recent urban growth in Papua New Guinea by Ronald Skeldon, June 1978. (19pp.)

The 'Big-man Model' reconsidered: power and stratification in Chimbu by Bill Stamdish, November 1978. (43pp.)

Stabilization policy in Papua New Guinea: A comment on the critique of Dr Ngo Van Lam by Anthony Clunies Ross; A rejoinder by N.V. Lam, January 1979. (67pp.)

Fertility change in Papua New Guinea during the late 1960s: evidence from the 1966 and 1971 Censuses by Thomas M. McDevitt, April 1979. (10pp.)

Rural-urban relationships in Papua New Guinea: case material from the Gulf Province on net flows by Louise Morauta and Morauta Hasu, August 1979. (36pp.)

Facing the facts: the need for policies for permanent urban residents by Louise Morauta, October 1979. (21pp.)

The building industry in Papua New Guinea by Alan Stretton, November 1979. (30pp.)

Eight discussion papers are published every year. Discussion papers cost K1, (postage 50 toea flat rate) or K8 ($US12) including surface postage per calendar year.

Discussion papers may be obtained from the Editor, IASER P.O. Box 5854, Boroko, Papua New Guinea.