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BUILDING AND CONSTRUCTION  
IN PAPUA-NEW GUINEA  
(WITH AN EAST AFRICAN PREFACE)

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They are not publications and are subject to revision.

INSTITUTE OF

BUILDING AND CONSTRUCTION IN PAPUA-NEW GUINEA'S  
DEVELOPMENT.

A Survey of Problems and Prospects 1968:

An East African Preface and Acknowledgements:

	<u>Page No.</u>
1. Introduction	1
2. Some Development Considerations.	2
3. Building and Construction Activity 1960-67.	5
4. Competative Structure and Framework.	7
5. The Commonwealth and Administration Works Departments.	14
6. The Works Programme and Forward Planning	17
7. The Problem of Leads and Lags.	19
8. Maintenance and Road Work Costs.	21
9. Housing Policy and Urban Needs.	23
10. Building and the Treasury Housing Division.	25
11. Low Cost Housing Developments.	27
12. The Formation of the Housing Commission. 1967- 1968.	30
13. Workforce Structure and Trade Skills.	32
14. Labour Productivity and Wage Levels.	34
15. Education and the Apprenticeship System.	36
16. Building Materials and Credit.	38
17. Research Needs and Indigenous Materials.	40
18. Retrospect and Prospect, 1968.	44
Tables: 1 to 15.	46 - 59

### An East African Preface and Acknowledgements

Between 1964 and 1968 the author was a Senior Research Fellow at the Institute of Applied Economic Research in the University of Melbourne and during this time I was mainly engaged on the preparation of a book on 'Building and Construction in Australia'. Arising out of this work during the second half of 1967 I spent some time in Papua-New Guinea under the auspices of the Myer Foundation with the New Guinea Research Unit. The main purpose of my visit was to assist R.K. Wilson with the 'Building and Construction Aspects' of a book he was preparing on industrial development within the Territory. The first draft of this paper was completed at that time, though it was somewhat revised and added to by R.K. Wilson after my departure from Papua-New Guinea in order to come to Makerere. Since that time the paper has been to and forth between Papua-New Guinea, Australia, and Uganda for various comments and revisions. It is hoped that this version can stand as a final draft of the report.

At this stage I would like to acknowledge that both I and R.K. Wilson have been greatly indebted to the Myer Foundation and the New Guinea Research Unit for their interest in and support of this work. Much of the material comes from published sources which are acknowledged in the usual way. However, we are also most grateful for other information which was gathered during interviews with Government officials and the proprietors and managers of building and construction companies throughout Papua-New Guinea. Our thanks are also due to Professor R.F. Henderson of the Institute of Applied Economic Research, University of Melbourne and to Dr. R.G. Crocombe of the New Guinea Research Unit for their support and assistance. We would also thank Mrs. B. Buick for assistance with the Tables and Mrs. M. Craigie who typed much of the manuscript. We have checked facts, references and names as carefully as possible, but this is a rapidly changing industry and some errors and omissions may well exist. To anyone we thereby unintentionally embarrass, our wholehearted apologies.

My main purpose in preparing this version of the paper is to both complete the draft in a finished form and at the same time to bring it to the attention of people in East Africa, notably those concerned with the relationship between economic development and building and construction programmes. During the past few years there has in fact been a growing interest in the problems of these industries in East Africa. Within Makerere the attention of readers is drawn particularly to the work of

C. Vincent (EDRF Papers 94, 115, and 153) and of M. Tribe (EDRF 114 and 145). The latter has also recently completed an M.A. thesis on the 'Housing Market in Uganda' which is under active consideration for publication as a book. The work of M. Safier on Urban Economics (EDRF 141 and 155) is also relevant to building and construction matters. Likewise at the Institute of Development Studies in Nairobi the work of E. Rado and J. Wells has been concerned with building and construction problems and attention is particularly drawn to their paper to the 1969 University Social Science Conference, 'The Building Industry in Kenya'.

Turning to useful points of comparison between the structural problems of these industries in Papua-New Guinea, in Uganda and in East Africa, a number of considerations arise. First it must be emphasised that Papua-New Guinea still has a Colonial and United Nations Protectorate status with the Commonwealth of Australia. In particular this means that the system of Government and of Public Finance is directly related to a very large annual grant from the Commonwealth Government to the Territories Administration for both capital and recurrent expenditure purposes. In contrast the East African Governments are now of course sovereign independent states and are autonomous in financial matters, though vitally concerned with loans and development grants from overseas. A second difference is within the Papua-New Guinea framework many Australian Commonwealth Government Departments including the Commonwealth Department of Works play a direct role in the development process. In contrast in the East African countries Government departments are the servants of the sovereign states and of the East Africa Community Organisation. Nevertheless there are some important points of similarity. For instance in recent years both the Papua-New Guinea administration and the East African Governments have laid particular emphasis on the need for greater development planning, notably under the stimulus of World Bank Reports and Aid. Moreover the type of problems concerning the organisation of building and construction activities are remarkably similar. Both areas have much difficult terrain and distances to contend with and their Government are necessarily engaged on a high proportion of public development projects; roads, dams and hydro-electricity schemes and the creation of a more balanced and substantial infrastructure government, health and education services. Likewise for the continual migration of people to the main urban centres and the need for effective response in terms of the provision of both service facilities and housing are apparent.

On the supply side of the industry other useful points of comparison also arise. In Papua-New Guinea and East Africa there is a heavy dependence on 'expatriate based' companies particularly for major projects. There are the usual problems arising out of the ease of 'entry' and 'exit' of individual contractors, of the extremely competitive nature of public tender work and of the risk, uncertainty and diversity of work to be undertaken. Market conditions in both areas often preclude contractors from developing specialisms in particular types of work so as to have some respite and security from competitive pressures. There is a constant danger of 'overtrading' leading to financial instability and bankruptcy. Other common features include the limited supply of good sub-contractors and the dependence of much of the industry on the limited number of 'expatriate' tradesmen who are prepared and able to act as supervisors, often in outlying areas and difficult conditions. Whereas many local people are increasingly demonstrating an aptitude for training and work as tradesmen as yet only a few have proved able to undertake responsible supervisory positions. Throughout there is an urgent need for an adequate apprenticeship and tertiary education system which will train more indigenous people to undertake supervisory and entrepreneurial activities. Finally much of the industry is highly dependent on the provision of credit and the maintenance of adequate supplies of building materials by local merchants while there is a continuing and urgent case for research and experimentation in the manufacture and use of local building materials.

In sum my hope is that this paper concerning the planning and organisation of building and construction in Papua-New Guinea will also highlight many of the problems facing the essentially similar industry in East Africa.

J. Hutton



BUILDING AND CONSTRUCTION IN PAPUA-NEW GUINEA'S DEVELOPMENT:

A SURVEY OF PROBLEMS AND PROSPECTS 1967

1. Introduction

Professor Arthur Lewis in The Theory of Economic Growth emphasises the important, but often overlooked relationship between investment, capital formation and construction activity (Lewis 196:213). He suggests that -

....the great importance of construction is not generally realised; many people think of capital formation mainly in terms of installing machinery, while in truth it consists to a greater extent of building structures of one sort or another; civil engineering is the key industry in capital formation, with mechanical engineering following some distance behind. This has its corollaries. One is that, given finance, the real bottleneck which holds up a rapid acceleration of investment is the capacity of the building industry to extend itself. Another corollary is that in the earlier stages of economic development the greatest need for capital is for public works and public utilities, which in these days are not directly open to private foreign investors; so private foreign investment is of limited relevance to the capital needs of the less developed countries.

Notwithstanding the strong contributions of private investment to Papua New Guinea's development many of the elements of Lewis's views about capital formation and construction apply. The emphasis of government policy is not, as in developed economies, on the role of building and construction as a potential regulator of short-term cyclical fluctuations but rather to its contributions to basic capital formation. As shown on Table 1, during the 1960s the monetary sector gross product at factor cost rose rapidly, from an estimated \$99.5m in 1961 to \$160.1m in 1965. During the same period the value at factor cost of building and construction activity rose from \$6.2m in 1961 to \$11.2m in 1965. Some two thirds of this work was undertaken by the government and included a wide variety of basic engineering works; roads, bridging, sewerage, drainage and water works, power stations, airfields and harbour works - together with housing, schools, hospitals and police establishments. In the private sector the emphasis was on housing - generally for company staff - and smaller types of offices, shops and factory establishments. It is relevant however that the industry definition used in this paper is that of the International Standard Industrial Classification suggested by the United Nations in 1958. It includes in Group 400: construction, repair and demolition of buildings, heavy construction projects, and special trade contractors; plasterers, carpenters, plumbers and electricians. Because of difficulties of data collection and comparability village housing does not come within the scope of this study, though in Papua New Guinea it is in such housing that 87 per cent of the population lives.

## 2. Some development considerations

The nature and pattern of building and construction activity should be seen within the structure of the economy in Papua-New Guinea. A basic feature is the Administration's dependence on direct financial support from the Australian Commonwealth government. The Territory has not as yet, developed a substantial tax base of its own and it is therefore dependent on an annual Commonwealth grant for direct budgetary support. In 1959-60 the Administration's total receipts were \$38.8m of which \$25.6m was from the Commonwealth government and only \$13.2m from internal revenue (Compendium statistics 1967:378). By 1967 the Administration's total receipts had risen to \$120m of which \$70m was from the Commonwealth, \$43m from internal sources and \$7m from loan funds. In recent years the Commonwealth government has also spent very substantial additional sums (partly on defence projects) which do not go through the Administration's budget. However they do represent a significant contribution to economic activity and capital formation - in the form of barracks and airfields etc. In 1964-65 and 1965-66 alone the Commonwealth Department of Works (C.D.W.) spent over \$38.5m on other than Administration work which was mainly concerned with the Army expansion programme (Table 8). It is apparent that building and construction activity is dominated by government work and the amount of this work depends on substantial financial support from the Commonwealth government. The nature of Commonwealth and Administration expenditure on building and construction work is discussed further at a later stage.

The Commonwealth government through the Department of Territories, has a direct involvement in the functioning of the Papua-New Guinea Administration. This contrasts to the situation in Britain's colonies and ex-colonies, where most developed a sufficient tax base to make them independent for annual budget purposes. However they do of course still rely on London as a source of development capital for both public and private investment. In contrast in Papua-New Guinea the present system of government necessitates a process of referral by the Administration back to the Department of Territories for Ministerial approval of even minor items of expenditure. For instance, in planning the works programme individual projects of over \$200,000 value must have the approval of the Minister and the Standing Committee on Public Works while details of all projects, of between \$100,000 and \$200,000 must be reported to the Standing Committee, but for information only. The procedures applied in formulating and carrying out the works programme are discussed in considerable detail later. Significantly the Administration has been unable to create an adequate Public Works Department (P.W.D.) of its own and indeed the Commonwealth Department of Works (C.D.W.) currently undertakes approximately half of the total works programme. Moreover a number of Commonwealth departments and agencies including those of the defence, etc. Civil Aviation, and the Australian Broadcasting Commission operate in the Territory under their own budgets and separate from direct responsibility to the Administration.

The report of the World Bank Mission of 1963 (IBRD 1964) injected a new note into this situation. It suggested the strengthening of the Administration's central machinery of government and in particular the creation of new planning machinery including the appointment of an Economic Advisor and Transport Co-ordinator, as well as a Housing Commission and a central road building authority. All of these suggestions have been implemented, though in the latter two cases the reforms have not gone as far as was suggested. An Economic Advisor who was appointed in 1964 has drawn up an outline five year programme<sup>1</sup> for the economic development of the Territory while a Transport Co-ordinator, who was appointed in 1966, initiated a comprehensive survey of the road system.<sup>2</sup> In 1967 another consultant advised on the setting up of new planning machinery and procedures. It is apparent however, that strong planning procedures can only be developed if sufficient trained and experienced officers are available. Consequently, at the time of writing the planners are mainly concerned with introducing greater co-ordination and order into existing procedures and developing a longer term view of needs - which can then become a basis for more informed discussions with the Australian government about the size and purpose of the annual Commonwealth grant. In the present circumstances no Australian Government is prepared to commit itself, more than one year in advance, to any volume of spending. The lack of certainty about the annual grant and how it will be spent inevitably leads to continual uncertainty as to the future volume of demand for the Territories building and construction industry.

Another important influence on development policy and the day-to-day working of departments - including those involved in building activities - is the growth of democratic government. Of particular significance is the growing influence of the House of Assembly and local government councils. Questions can be asked in the House and policies debated there while the enquiries and reports of the House of Assembly's Standing Committee of Public Accounts have also been particularly important. The fourth report of this Committee published in 1966, dealt with the activities and efficiency of the P.W.D. while the eighth report, published in 1967 dealt with the Housing Division of the Treasury Department. It should be emphasised that the increase of local criticism as to the functioning of government departments is welcome though the Committee has proved unable to make relevant departments adopt some of its recommendations.

One other general development difficulty lies in the Territory's rugged terrain, tropical location and wide dispersion of population and main centres. Building costs are high, often twice those which apply in Australia. Most highly manufactured and processed materials have to be

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1 Economic Development of Papua and New Guinea, 1967, roneoed.

2. Road Inventory, Vols. 1 to 4, T.P.N.G. Department of Public Works 1967.

imported while local materials are often in short supply and of uncertain quality. The transport of men and materials to remote locations is costly in itself and requires the establishment of expensive stocks and stores. Skilled labour, expatriate and indigenous, is scarce and has to be provided not only with high wages but also with housing and transport facilities. Most supervisory labour staff is still brought from Australia and indeed good supervisors are essential in the Territory's rugged working conditions. However, because of these conditions, they are difficult to retain, notwithstanding high salaries, free housing, transport and other benefits. The inability of companies to obtain or retain good site supervisors capable of working in remote and difficult conditions and of effectively overseeing both expatriate and indigenous labour is a basic cause of company and project failures. Sound management at local levels is of overriding importance to building operations in Papua-New Guinea.

### 3. Building and construction activity 1960-67

The rapid expansion in building and construction activity is shown in Tables 2, 6 and 8. In the public sector the total value of the works programme<sup>1</sup> rose from just over £17m in 1963-64 to an estimated £23.8m in 1965-66 - a rise of over two-fifths in current values in two years. But this was the least dynamic sector as in the subsequent two years the programme barely increased at all. Table 6 shows that in this same five years private building rose from £2.7m to £7.6m in value, an increase of two and one half times. These and other indicators are brought together on Graph 1 which emphasises the steep rise in C.D.W. expenditure. A comparison of the planned expenditures of the works programme as shown on Graph 1 and the steep rise in C.D.W. expenditure (mainly for defence projects) suggests that the works programme was deliberately held down from 1964-65 on, because of the steep rise in Commonwealth works. Whether this restraint will be relaxed as expenditure on the defence projects declines is an important question. Within the makeup of the works programme the most significant development was the growth of engineering as opposed to architectural items (Table 2).<sup>2</sup> Whereas in 1963-64 architectural items represented over two thirds of the total value of work, by 1967-68 this had fallen to just over half of the total. Conversely during the same period engineering's share of the works programme rose from just over one quarter to nearly one half of the total. Further details of the architectural items are shown on Table 3. By far the largest expansion occurred in accommodation which rose in value from nearly £2.5m in 1963-64 to an estimated £7.3m in 1967-68 - a threefold rise in the five year period. Schools absorbed nearly £3.2m or over one quarter of the total at the beginning of the period, but by 1967-68 Administration expenditure on schools had fallen to approximately £1.9m or one eighth of the total.<sup>3</sup> Agriculture and police expenditure remained reasonably constant but work on government offices fluctuated sharply, reflecting the 'lumpy' nature of capital investment in office facilities. Table 4 shows the variations in engineering items. The major growth sector was roads and bridges on which projected expenditure rose from £1.4m or just under one third of the total in 1963-64 to almost £5m or nearly half of

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1 It must be emphasised that the works programme is an estimate of intended expenditures. The actual amounts spent usually differ; they are not published and are probably not compiled in a comparable form to the works programme.

2 Engineering items include: roads and bridges, wharves, surveys aerodromes and water supply; while architectural include: accommodation, offices, hospitals, schools, agriculture, police and higher education items.

3 The rate of school building may have changed much less than these figures suggest. Many are now built by villagers using bush materials under oversight of local government councils.

the total in 1967-68. Most of the other categories, wharves and beacons, aerodromes, water supplies, sewerage and sanitation were fairly stable but during the three years 1966 to 1968 the growth of expenditure on surveys, investigations and consultant services is noteworthy - a reflection of the increasing tempo of development planning.

Building activity both public and private is shown in Table 5 by type of builder. Between 1961-62 and 1966-67 the total value of new buildings rose from nearly \$9.5m to \$29.8m. Of this work approximately three quarters was carried out by contractors, the remainder by owner-builders and government day labour. The contribution of owner-builders rose sharply towards the end of the period though still reaching only 15 per cent. Table 6 gives further details of the value of new houses and flats and other buildings between 1961-62 and 1966-67. Through the early part of the period the construction of houses and flats represented just under half and other buildings just over half of the total value. Likewise in both the housing and flats and other buildings categories government building work was approximately two thirds of the total output in most years. Table 7 shows the value of additions and alternations which has generally been under \$500,000 and Table 11 shows houses and flats completed between 1962-63 and 1966-67. The most significant feature is the massive increase after 1965 to 2,241 units compared to only 517 units four years previously.

#### 4. Competitive structure and framework

An examination of the structure and operating characteristics of the industry reveals some features which are inherent and other which are almost unique to New Guinea.

In most countries the industry tends to be labour-intensive, highly competitive with its output differentiated rather than being mass-produced. In advanced countries including Australia, there is a wide range of sizes of building enterprises. There are still a considerable number of the traditional 'spec. builder' constructing a few cottages<sup>1</sup> at one time by rule of thumb methods and for immediate sale. There is also the larger building firm with a range of equipment and numerous employees, able to undertake both cottage and multi-storey or industrial work. More recently there has emerged the specialist firm which undertakes the main contract but acts mainly as a manager of a wide variety of specialist sub-contractors who do most of the actual construction. The effective timing and control of sub-contractor's operations by main contractors is a sine qua non for commercial success. Some larger building firms tend to specialise and increasingly they are able to offer 'package deals' in which from a client's intimation of requirements they can, because of their specialised experience, offer a design and a price to complete a building or construction project. The advantages for the client are that he deals with only one firm and the price is known from the beginning. The advantages for the builder are that many of the leads and lags of traditional operations are eliminated and the client does not have the opportunity to change the design as the work proceeds.

In the civil engineering construction industry firms are usually larger than in building, partly because many construction projects are on a very large scale. Sub-contracting is not nearly so ubiquitous as in building, and employment is still concentrated in the main firms rather than in sub-contractors. But in recent years, in both branches of the industry the use of equipment has become more important. This is partly because of the greater height and scale of many building jobs, as well as the need to economise on labour costs as individual wages rise. For public authority work the general rule has remained, open public invitations to tender for work already designed by another body. The 'package deal' has thus not found its way into public authority building and construction. Most tenders for large contracts or those of unusual design offer an 'alternative materials' clause under which a tenderer may offer to re-design the work using alternative materials. Selective tendering, in which only a limited number of suitable builders are invited to tender, has been widely adopted by private firms, and it is generally thought that it has tempered the

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1 Trade term for single houses.

excesses and risks of unfettered competition. As yet public authorities have generally avoided highly selective tendering, and in Papua-New Guinea, the two works authorities have not adopted it. The argument in favour of selective tendering is that incautious or desperate managements need to be protected against their own weaknesses. Moreover clients suffer as much as builders when there is a failure following excessive price-cutting by a successful tenderer.

In Papua-New Guinea there is practically no 'spec. building' or subdivision of suburban tracts, though some might have developed in the past had land been readily available as freehold, rather than sparingly available as leasehold. Sub-contracting has developed to only a minor degree and firms therefore undertake the greater part of their own work. The pressures of competition are heightened in New Guinea because the majority of the industries output is marketed on a competitive open tender price basis, and there can be no certainty as to the long run volume or pattern of demand. Conversely most basic inputs of materials and equipment are obtained on a fixed price basis, and credit from merchants and other suppliers is often of crucial importance. Moreover in the short run skilled labour is in relatively inelastic supply and presents a constant challenge to costs. On the other hand semi-skilled and unskilled labour is abundant and it is largely this group that absorbs the shocks of slackening of demand for building output. Mainly because of the nature of the work, particularly the absence of multi-storey building, the industry in New Guinea generally uses less equipment relative to labour than in more advanced economies, though proportionately more equipment is required on the civil engineering and construction side.

The basic financial requirements to become a small builder or contractor are not large and there is an easy 'upward' mobility of expatriate labour from tradesmen to entrepreneurial status. As a result established companies are always liable to the competition of newcomers. Much of the industry in the Territory consists of small local companies and teams of sub-contractors who operate with limited reserves of capital and are heavily dependent upon the technical skill and commercial acumen of their proprietors or partners. If demand expands rapidly it is comparatively easy for both established companies and newcomers to tender for projects and obtain work. However, it is also easy for individual companies to over-extend their resources of technical skill, capital reserves and management control. This is particularly likely to be the case when small companies are extending their production from such comparatively simple jobs as the erection of cottages, small structures and simple contracting work to larger and technically more difficult projects. More substantial resources of capital and construction plant are necessary while estimating and engineering skills become of prime importance.

Within the Territory there are usually some 200 separate business organisations directly engaged in building and construction activity

(See Tables 13 and 15). At the base of the industry are perhaps 150 small contracting and sub-contracting organisations, the great majority of whom work on a sub-contract basis for the P.W.D. or for larger private builders. Some of these sub-contractors have expatriate management and are mainly concerned with such technically-based trades as electrical work, ventilation and refrigeration engineering, structural steel erection, plumbing and drainage contracting. However, there are also various indigenous contracting organisations most of whom are concerned with unskilled or semi-skilled work.

In their account of the industry in 1962, Alcock and Richards (1963:32) mentioned the large number of indigenous jobbing contractors who contracted for labour work in both the building and construction industry. Many acted as sub-contractors to expatriate contractors while others were engaged by the P.W.D. and C.D.W. for small works which otherwise would have to be done more expensively by day labour. The contracts were usually lump sums for all the labouring on jobs which were explained verbally on the site, at prices generally suggested by the departments. A few contractors completed building contracts except for plumbing and electrical work which were done by the P.W.D., which also supplied all materials for houses and provided concrete mixers on loan. To the authors of the report in 1962 it seemed that the 'rise of the indigenous contractor is in sight' (1963:33), but for the problem of credit for materials, plant and equipment. They recommended that the (then) Native Loans Board and the Department of Trade and Industry should be asked to do what they could to foster indigenous contractors.

The Kila Kila (co-operative) Building Society of Port Moresby illustrated one possibility and its difficulties. It was a group of indigenous builders who began contracting in 1953 and carried out a number of jobs, including an education centre costing \$70,000, until forced into liquidation in 1959. The reason for failure was given as 'too much consideration for social obligations to members whose numbers had increased from fourteen to one hundred and twenty (Alcock and Richards 1963:34)'

Later in 1965 Mr. John Langmore attempted to survey 116 contractors said to be operating in Port Moresby (Langmore 1967:41-58). Of these, 71 were successfully interviewed while the remaining 45 were either absent from Port Moresby or were not carrying out work at the time of the interviews. Of the contractors interviewed half performed jobs of an unskilled variety including such basic activities as excavating, drain digging, grass cutting and various types of roadwork. Among semi-skilled work, stone pitching and concreting were principal trades. Painting contracts included such simple tasks as painting roadside fences and houses. Carpentry construction work ranged from simple repairs, to the building of a hostel and a church. Other contractors interviewed undertook transport work and other miscellaneous tasks. The classification of indigenous sub-contractors has presented some difficulties to judge from the variations in published statistics (see Table 13).

Overall it would seem that during the past decade only limited advance has been made in this field. Indeed until there is a determined effort to foster indigenous contractors (and it would probably need to be made not only in business methods but in the technical fields of estimating and tendering as well) no further improvement seems likely to occur. Perhaps other obstacles would be removed if the aspiring contractor could rent a site for his equipment or materials on an industrial estate, might obtain equipment from a central body on hire and could be supervised in his use of credit by the Development Bank.

The second group of companies are some 50 small local building companies which generally confine most of their activities to one of the major centres. Most of these companies have been formed in recent years and their proprietors are frequently ex-tradesmen who came to the Territory in the employment of somebody else, often on the staff of the government works departments. They may also have spent some time working as sub-contractors for larger building firms. A few of them have grown to a substantial size and have become one of the ten or twelve leading firms. For instance, the proprietor of Morobe Constructions of Port Moresby, Mr. G. Sicklinger, originally came to New Guinea in the late 1950s as an artisan and subsequently built up a substantial business. Mr. G. Constantinou of Papuan Transport and Contractors, came to Port Moresby as a tradesman, and after branching out built up a substantial business particularly on the construction and earth-moving side. The history of Leydon Constructions in Lae and A.M. Jennings in Rabaul is similar. On the other hand the firm of John Stubbs and Sons has been established as a builder in Port Moresby for more than twenty years. Also more than twenty years old is a group of small Chinese-owned building companies in Rabaul, now combined as United Builders.

Not surprisingly most of the smaller local companies have very limited reserves of capital and rely heavily on credit from major suppliers and trading companies. However, they have usually acquired such assets as a joinery shop, vehicles, and some plant and equipment. They have also established a group of skilled tradesmen and workers. The perennial problem for this type of company is the extreme uncertainty and diversity of work which it is necessary for them to undertake. The changing and limited nature of the local market precludes them from developing strong specialisation in any particular direction and they are often also engaged in other trades including haulage contracting, ship building and general woodworking.

A crucial management decision is how far to expand the building business within the existing framework of capital and skilled labour. During the growth of recent years, several companies have tried to extend their activities to more than one centre and to outlying areas. However, some quickly discovered that a scattered and diverse range of activity presented them with severe logistic and other management problems. One such company

was Delta Constructions which originally commenced operations under the name of Bradford Bros. in 1957. The company expanded rapidly and successfully undertook a wide variety of building and construction work. It also diversified into concrete block production, service station management, motor vehicle sales and a hire service for earthmoving equipment. By the end of 1966, its construction branch had construction and building projects to the value of \$2.4m under way. Yet shortly afterwards it was revealed that the construction side of the company was in serious financial and management difficulties and the building subsidiary went into liquidation.

A third type of building and construction company embraces the few larger Australian and overseas contractors who have been attracted to Papua-New Guinea, on a short term basis, to undertake major development and defence works. These large companies generally have the contacts and resources available to bring in the skills necessary for the successful completion of major contracts. A leading company in this category is P.D.C. Constructions (N.G.) which came to New Guinea in 1965 to undertake a \$24m army contract. However, at the end of 1967 with the completion of this contract the company was preparing to leave New Guinea. Another Australian company is the Brisbane-based family company of Barclay Bros. which has also undertaken army construction contracts valued at \$11.1m. Another Queensland-based company with extensive interests in Papua-New Guinea is D.C. Watkins.

Two other substantial companies with Australian connections are Dowsett Engineering (Australia), and Hornibrook Constructions who specialise in structural steelwork. Another recent and major entrant to New Guinea was the Dillingham Corporation of Hawaii which in 1966 bought the plant, equipment and land of three local companies, W.N. Johns, Ready-Mixed Concrete Industries and Crushers and Engineering, all of Port Moresby. Since that time Dillinghams have undertaken the \$3.2m Eastern Highlands Highway project which included improvements to the Kessam Pass and the Kainantu-Goroka road and the construction of a road from Gusap to Dumpu in the Markham Valley. More recently the company has also been awarded a \$500,000 contract to drill an exploratory sampling tunnel at the D.R.A. copper prospecting site on Bougainville.

The combined turnover of the six leading companies in 1966-67 might be estimated at approximately \$20m. Only a small share of their turnover should be credited to smaller sub-contractors as the big firms generally carry out all but painting, electrical and perhaps plumbing work themselves and most reported no more than 10 per cent of expenditure as going to sub-contractors. As compared with the position in Australia the lack of reliable sub-contractors was a major complaint of most firms. Most building firms had therefore established their own joineries, while the civil engineering and construction firms pointed out that they could not hire plant as they would be able to in Australia.

Alcock and Richards (1963:30) suggested that in the early 1960s the few larger firms of that time could only compete with the smaller contractors if the Administration offered them work on a large scale beyond the scope and competition of smaller firms and at higher prices to cover the heavier overheads of the larger firms. As evidence they pointed to the lower price for building a few residences at Goroka, than building a larger number of similar houses in Port Moresby. But they also emphasised that the opportunity was much greater in the smaller centres for private agreement among contractors not to tender below certain prices and thus to drive up market prices over time. This practice could only be revealed by a comparison of prices for similar work in different localities. By 1967 the cost of similar designs was some hundreds of dollars cheaper in Port Moresby than in remote towns (Eighth Report, 1967:24). To combat excessive prices in tendering, it was generally the rule that if prices exceeded C.D.W. estimates by more than 10 per cent, the construction branch would be asked to tender and if their price were appreciably lower, C.D.W. would do the job.

The managements of some long-established business claimed that since 1962 competition had increased greatly. The management of some smaller builders stated that this had affected their profitability and tendering practices, so that whereas a few years ago they might have aimed at a considerable margin on turnover, now they were forced to aim at 5 per cent or less, especially on building jobs. In contrast the margins sought on construction projects were usually much higher than this. Managers pointed out that achieving these margins was subject to many hazards, particularly material shortage, wet weather, alterations by the client, faults in construction, and where sub-contractors were used, failure to carry out the sub-contract on time or to standard.

In one attempt to minimise the uncertainty of the tender system some few years ago several leading local builders had agreed to 'take turns' in tendering. However the agreement failed as new entrants, particularly the overseas companies, could not be allowed for. Additionally the increased size of tenders presented an acute problem to many small companies. In 1961 Port Moresby firms formed a consortium to tackle a contract of less than \$1m for 80 houses for the Administration. At that time no local firm had sufficient resources for the job yet they wished to keep Australian firms out. Later the established builders became apprehensive that the C.D.W., intended to look closely at the ability of New Guinea firms to carry out large tenders, and that this inspection would result in their exclusion from a \$6m contract for housing.<sup>1</sup> In the event the contract went to Dowsett Engineering (Aust.). Later in 1967 some members of the Master Builders Association supported the idea of a grading system for contractors

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1 South Pacific Post, October 18, 1965

(or selective tendering system ) who would then be permitted to tender only for contracts equivalent in size to their past experience and resources.<sup>1</sup>

Management of some of the 'local' companies also complained that they incurred costs from engaging apprentices (and housing them) which some overseas companies who did not employ apprentices were spared. They suggested that they should be allowed a margin on a contract to compensate them for this difference, and subsequently asked for a government subsidy to help with the costs of training apprentices. Yet in the long run they should of course benefit from the lower costs of using indigenous skilled labour rather than having to import such labour on two year contracts from Australia and elsewhere. The management of one or two large 'expatriate' companies who do not train local apprentices pointed out that being in Papua-New Guinea for perhaps only one large contract, they would not be able to take apprentices through their term.

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1 Pacific Islands Monthly, April 1967

## 5. The Commonwealth and Administration Works Departments<sup>1</sup>

As indicated previously within the Territory two separate government departments are responsible for carrying out the works programme. The largest is the Commonwealth Department of Works which came originally in 1945 and which between 1947 and 1955 was the only government construction authority. The C.D.W. has remained in Papua-New Guinea by the invitation of the Administration to assist in major construction projects. In recent years the work of this department has expanded rapidly, arising out of the growth of the economy and the build-up of Commonwealth expenditure for development and in particular for defence projects. As may be seen on Table 9 in 1960 the C.D.W. had a total expenditure of over \$8.2m of which over \$6.8m was on behalf of the Administration and \$1.4m for other than Administration projects. Work for the Administration continued to represent the majority of C.D.W. expenditure until 1965. However, during the period 1965-67 the expansion of Commonwealth government defence expenditure (Graph 5) within Papua New Guinea shifted the balance in favour of other than Administration work. By 1967 the C.D.W. planned a total expenditure in New Guinea of \$39.1m or nearly five times as much in current values as it had undertaken seven years previously. Of the 1967 expenditure over \$16.1m was for the Administration and over \$22.9m for other than the Administration, which was mainly concerned with the army expansion programme. At that time the C.D.W. employed over 3,000 persons in Papua-New Guinea of whom approximately 500 are overseas staff mainly engaged in administration, finance and construction work while the remaining 2,500 are locally employed day labour, artisans, and casual workers. The department works extensively through contractors and in 1967-68 they probably employed between 4,000 and 5,000 local workers. In total the C.D.W. is indirectly responsible for employing 7,000 to 8,000 persons. Apart from its civilian staff the department also uses the Australian Army's 19 C.R.E. Engineers which operate in the Northern District as a District Works Office. The army thereby gains for its engineers, valuable training experience in development and tropical conditions. Nearly one-third in value of the C.D.W.'s present activity arises out of work in Papua-New Guinea.

The second government department engaged on the works programme is the Public Works Department (P.W.D.) which was reintroduced in 1955. The previous P.W.D. had ceased to exist during the Second World War and was only re-established for a brief period between 1945 and 1947. It is primarily responsible for the maintenance of Administration buildings, the maintenance and construction of roads in remote areas, for minor new works and the operation of certain public utilities. As with C.D.W. the expenditure of the P.W.D. has expanded rapidly and today it is responsible for over half of the

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<sup>1</sup> Information included in this and the immediately following sections is based on interviews with government officers and the Fourth Report of the Standing Committee on Public Accounts - House of Assembly, 1966.

total works programme directly undertaken by the Administration through its own budget. In 1960 (Table 9) its total expenditure was over #5.9m of which nearly #2.5m was for architectural, over #2.7m for maintenance and #742,510 for engineering works. By the 1967 estimates the P.W.D.'s total planned expenditure had risen to nearly #22.2m or over four times as much in current values as it had undertaken seven years previously. Of this expenditure nearly #3.5m was ascribed to salaries and administration, nearly #6.4m for maintenance and nearly #12.3m to capital works and services. In order to carry out this work the department directly employs over 4000 persons of whom <sup>some</sup> 400-500 <sup>are</sup> overseas officers, nearly 1,500 local officers and apprentices, and 2,000 labourers.

Through the past decade there has been criticism of the operations and efficiency of the P.W.D. A team of technical experts enquiring into the building and construction industry in the early 1960s pressed the need for it to carry out unit costing-per man, per day or per mile (Alcock & Richards, 1963:24) as being the only methods which would test whether work was being done economically. They seem to have assumed (23) that the ten-existing system of accounting would provide an accurate recording of expenditure but this seems doubtful. A review of P.W.D. costing followed and an attempt was made to introduce a detailed costing system in 1963 but the Treasury view was that 'staffing and other difficulties precluded introduction of the proposed system without extensive and expensive increases to the existing establishment (3rd Treasury Minute on Fourth Report, Standing Committee on Public Accounts, 1967:2)' The P.W.D. has been required by the Treasury Department to follow a normal departmental accounting system which meant that both the P.W.D. and the Treasury maintained duplicate financial records at the local level which were eventually reconciled with the Treasury's central control ledger. This proved to be an extremely cumbersome procedure and did not provide, at either district or headquarters level, sufficient information to facilitate effective control of projects. However, from 1959 onwards a form of regional accounting system was slowly introduced. Today the P.W.D.'s four regional engineers in the New Guinea Islands, Papua, Highlands and the New Guinea Mainlands regions have the authority to transfer staff and machinery and the oversight, if not control of funds, voted to their districts.

A second group of related problems arises out of the lack of an effective system of financial control of projects. As late as 1966 the department had no system of 'commitment recording' in operation. Thus as a Treasury observer stated to the Standing Committee on Public Accounts (Fourth Report, 1966:13-22) '...As far as I am aware, there are certain entries in the book that show a Local Purchase Order number on which different items are purchased, but they relate to various notes and there is no running record of what funds still remain available for expenditure.' The effect of the lack of 'commitment recordings' is indicated by expenditures in 1966-67. At a public hearing on the 12th October, 1966 it

was revealed to the Committee that the P.W.D. was '...over-expended in thirteen districts, including a substantial over-expenditure of \$125,000 in the Eastern Highlands District, which neither Public Works Headquarters, nor Treasury, knew of until June, 1966 (Fourth Report:53).'

There was also a lack of effective costing or management control by the Department. Under the existing Treasury Accounting system the financing of works projects is divorced from their planning. In the opinion of the Standing Committee of Public Accounts this has '...resulted in repeated, poor estimation and holdups in the execution of projects.' The true costs of general plant and equipment, freight and labour are not shown in project costs. For instance cement is normally quoted at a Vocabulary Stores Index price, yet in reality its cost varied widely, from \$32 a ton in Madang to \$116 a ton at Mount Hagen (before the opening of the Highlands Highway) with airfreight added. Likewise in the costing of labour the positions of foreman and above are known as 'residuals' and their salary costs are not ascribed to the cost of projects. Moreover, under the present accounting system there is an inevitable tendency in considering such overheads as plant and equipment as 'constant' and to project previous years expenditure as a future need for funds. The committee gave its opinion (1967:53) that '...a full cost accounting system is essential to the proper functioning of the Public Works Department,' having been impressed by the system used by C.D.W., based on a Trust Account. It remains to be seen whether this recommendation will be implemented as the Treasury view is that 'the present arrangements go as far as can reasonably be expected towards charging direct costs to projects and to go further would involve a process of analysis, dissection and collation of costs at a staff cost by no means commensurate with the value of the data produced (3rd Treasury Minute:2).

The apparently anomalous situation of the existence of two works departments side-by-side, where one only would seem necessary, has been commented on by many observers. The C.D.W. was invited to New Guinea because P.W.D. could not expand itself sufficiently to carry out all the required public works. But the failure of C.D.W. to adapt to New Guinea conditions has been pointed out (e.g. Alcock and Richards 1962:13) (Eighth Report, ). The C.D.W. operates mainly in Australia where relatively high standards involving the use of complex methods and costly materials prevail. But in New Guinea it has often found woefully inadequate labour and materials to meet these standards. Only by importing skilled artisans and high quality materials from Australia could it maintain its normal high standards. Moreover it appears to have shown little interest in training indigenous tradesmen.

The P.W.D. on the other hand has been <sup>apparently</sup> more ready to adapt, improvise and economise in carrying out its work and is/better suited to operating in the low-level economy of Papua-New Guinea. The P.W.D. also first

tested and later used low-cost materials; was wholehearted about training apprentices and using semi-skilled indigenous artisans; it also has attempted to use the maximum number of indigenous sub-contractors. In 1963 Alcock and Richards recommended that the P.W.D. should be strengthened through purchases of more adequate plant and some of its own transport, through improving recruitment and by offering short-term contracts (now the rule) to professional staff, who might not wish to commit themselves to a career in the service at a time of impending political change. Such a strengthened P.W.D. could then take over from C.D.W. through a transfer of property, equipment and operating responsibility, area by area. That this has not come about, and <sup>indeed</sup> if anything C.D.W. was relatively more important five years after these recommendations, <sup>This</sup> is almost certainly due mainly to the very rapid increase in the volume of building and construction work since 1962. Consequently both works authorities have had to expand considerably in Papua-New Guinea and a transfer of a substantial relative volume of local work to the P.W.D. seems further away than ever.

#### 6. The works programme and forward planning

The rapid growth in the Administration's receipts and expenditure, including the works programme, is well known. As is indicated by Table 8 and 9, between 1960 and the estimates of 1967 total expenditure on behalf of the Administration by the C.D.W. and P.W.D. combined rose more than threefold from nearly \$12.8m to over \$38.3m in current values. Moreover apart from work through the Administration's budget the value of direct Commonwealth Government work in the Territory also rose substantially. During 1966 and 1967 the C.D.W. planned to undertake an additional \$15.5m and \$22.9m in other than Administration work, which mainly consisted of direct Commonwealth spending on the Army expansion programme including new barracks at Port Moresby, Wewak and Lae. It was thought from the outset that these additional defence projects were likely to impose a substantial strain on resources of labour and materials and special conditions were therefore imposed on the contractors requiring them to limit their calls on local supplies of certain materials and skilled labour.

The Administration's works programme, which goes through the Territory's budget is based on a complex and lengthy forward planning procedure. The main emphasis has been on the physical aspects of design and construction work. It has been difficult to relate this directly to financial resources partly because of the dependence on the annual grant from the Australian Commonwealth Government. <sup>The</sup> District Co-ordinating Committees, of which the District Commissioners are Chairman, are expected to see a need for building or construction work and having assembled the essential documentation may then submit requests to the Assistant Administrator (Services). In the case of

roads, bridges, aerodromes and harbour works it is then sent on to the Co-ordinator of Transport. In the past Town Advisory Councils and local Chambers of Commerce sought to influence the nature of the programme. More recently with the increasing strength of some local government councils and of the House of Assembly, pressure from indigenous local interest groups for particular projects has become one of the features of political life.

Listing of proposal normally involves three stages: the admission of a proposal to a 'needs list'; the admission of a needs list item to a 'design list' for which one of the works department is authorised to prepare design and documentation; finally the admission from design list to a Works Programme on which expenditure is authorised. The Economic Adviser provides a preliminary phasing of the 'needs list' by assembling items for integration in a continuing five year programme. The final inclusion of any item on the works programme is determined by the Works Consultative Committee which acts as an advisory body to the Administrator for all aspects of the works programme. It is chaired by the Assistant Administrator (Services) and is attended by the Economic Adviser, the Works Manager, the Treasurer, the Co-ordinator of Transport, representatives of the two works Departments and the Assistant Administrator (Economic Affairs). After the Committee has considered the Territory needs list, selected items are then placed on one of three design lists. Design List A is for priority projects which are likely to be included in the next years programme. This allows for full documentation which is everything to bring projects to the tender stage. Design List B is reserved for larger works, generally those requiring 12 to 18 months preparation of working drawings, specifications and bills of quantities. Design List C authorises, for very large projects, the investigation and design work necessary to enable them to be submitted to the Standing Committee on Public Works. Proposals approved by this committee may then be considered for admission to Design List B and planning can then proceed beyond the stage of preliminary design work.

In August and September of each year the Design List is sent to Canberra for the Minister's approval. Only when this approval has been obtained do the C.D.W. and the P.W.D. have authority to expend money on surveys for particular projects. In February the works programme begins to firm as by this time the Works Consultative Committee has a provisional budget with which to plan. At this stage the amount of the forthcoming Commonwealth grant is of cardinal importance. Projects costing more than \$200,000 are placed before the Standing Committee on Public Works in Canberra for approval as items in the works programme. The Standing Committee also receives a list of all projects costing between \$100,000 and \$200,000, but for information only.

Projects in the main centres are allocated to C.D.W. while the P.W.D. handles those in outlying areas. The provisional programme is revised in the

light of changes in the provisional budget as these become known to the Works Consultative Committee in Port Moresby. One other important function of the committee is to facilitate close contact between the construction authorities and the client departments. It is a common occurrence that an organisation may be half way through the design of a project when the client begins to add further requirements. Much clearly depends on the completeness of the original brief, and the effectiveness of liaison between the client department and the construction authority.

During August, the works programme is tabled, along with the budget papers, in the House of Assembly. Until this time, the two construction authorities are unaware of the total final programme as it is confidential until it is tabled. Construction of new work begins in September and the revote system is used to ensure continuity of work beyond the financial year. The two departments decide whether each project shall be carried out by contractors or by their own day labour force. If the work is carried out by a contractor it is based on a tender price, governed by a letter of agreement and schedule of conditions and supervised by a Works Supervisor who authorises progress payments.

Five per cent proportion of the contract price is withheld by the works department from the contractor until the project is completed satisfactorily, and a further  $2\frac{1}{2}$  per cent is retained during the maintenance period. When day labour is used the officer-in-charge draws up lists of the materials required and obtains these from the Stores and Supply Section of the Treasury Department and a charge is made against the cost of the project. Labour hours are recorded as a cost against the project for all persons below the position of foreman. In practice the C.D.W. lets some four-fifths of its projects out to contract whereas the P.W.D. relies substantially on its own day labour force for maintenance and minor new works. <sup>The</sup> P.W.D. also undertakes a considerable amount of minor new works for District Commissioners up to a cost of \$6,000.

## 7. The problem of leads and lags

Whatever the planning procedures followed, major projects are inevitably prone to leads and lags in activity. Because of the climatic conditions and the rugged nature of the terrain seasonal logical factors present recurring problems. For instance during January 1966, work on the Highlands Highway-Kassam Pass project was seriously delayed by wet weather. Damages cost \$60,000 to repair and in addition greatly delayed deliveries of materials to another major building project, the Base Hospital at Goroka. Though the contractor should have completed \$333,000 of work on the hospital by the end of June, this was underspent by \$85,504. Other leads and lags clearly arise out of inadequacies in procedures

covering the financing of projects. While progress is reviewed at three-monthly intervals, the P.W.D. day labour teams have at times been partially unemployed due to the lack of work in the revote period. Careful management control and progress planning would appear to be a solution to this type of problem. At the time of writing use is being made of the Queensland University computer to provide information on the progress of projects including a breakdown of the activities of both contractors and day labour. It is to be hoped that this will result in a more even flow of work.

Other planning problems arise out of the extremely uncertain nature of projects coming forward. Apparently between 1958 and 1963 there was a fairly smooth flow in the movement of planned works from the needs list to the works programme. At the time five year targets had been prepared by departments and these largely determined the needs list and indicated priorities in the design and works programme. The effect of the World Bank Mission in 1963 was to change markedly the emphasis of development (refer Graphs 3 and 4) and thereby to alter radically the five year targets which had been guides in the preparation of the works programme. Thus the immediate effect of the increased tempo of development activity was an apparent reduction in the effectiveness of planning. Moreover as has been indicated, on the advice of the World Bank Mission many changes were made in the organisation of planning. It is hardly surprising then, that there has been considerable confusion over the nature or pattern of the works programme.

In 1966 the Standing Committee on Public Accounts recommended a '...precise delineation of the functions and powers of the bodies involved in works planning (Fourth Report, 1966:33)', and the granting of statutory powers to the bodies concerned with the programme. In particular it emphasised the need for basic principles to be made clear to both construction authorities and to client departments, on the processing of works items, and especially for the Department of Education to adhere to strict timetables in providing its works needs. In the early 1960s schools had been built according to a special Schools Building Programme, outside the normal works programme but this procedure was given up as demands were being made on P.W.D. at too short a notice. But other instances were cited of school construction being delayed because the Department of Lands, Surveys and Mines had not been informed of the need to acquire a site and where there had been delays in the provision of essential services to sites and of materials for day labour projects.

Another recommendation was the need for prescribed standards to be applied by the Works Consultative Committee to all projects which came before it. At present the Commonwealth Works Department and the P.W.D. operate to dual standards. It was therefore suggested that legislation should be introduced to establish a statutory Territory Standards Association

and preliminary discussions have taken place with the Master Builders Association. Moreover as indicated previously one other basic problem is the well known dichotomy between the planning of works items and arranging for their funding. Moreover many other uncertainties also effect the design of the works programme. These include the availability of labour and materials and likely demands from the private sector. Nevertheless a firm commitment by the Commonwealth to support the Five Year Plan being drawn up by the Administration would go a long way towards providing guidelines within which the building and construction industry could operate. It would provide the private sector with the necessary confidence to make realistic plans for investment, production and employment in the foreseeable future. However, if as seems likely, reliance on overseas aid from quarters other than Australia should increase yet one further uncertainty will be introduced into works planning.

Overall the committee believed that while the P.W.D. had attracted much attention owing to defects in the implementation of the works programme, the basic problem was lack of continuous, co-ordinated oversight of the programme.

#### 8. Maintenance and road work costs<sup>1</sup>

In Papua New Guinea roadworks and their maintenance represent one of the major development costs. In 1950 it was estimated that there were 2,693 miles of road of which 1,345 were suitable for heavy and medium traffic and 1,348 for light traffic. By 1967 a new road inventory conducted by consultants for the P.W.D. estimated that there were 7,170 miles of trafficable vehicular roads. In the 1966-67 Budget just over £9m was appropriated for general maintenance work. As has been indicated the P.W.D. is responsible for most of the maintenance services of Administration assets while C.D.W. is concerned with the maintenance of major roads under its direct control and maintenance of Commonwealth buildings. Thus in the 1966-67 budget only £2.9m was voted to C.D.W. for maintenance of which over £2.1m was for roads and bridges. Maintenance is more efficiently carried out for being under the single control of the P.W.D. though their system is weak in lacking a proper register of assets, and as already indicated their costing of road maintenance does not include costs of plant, equipment or day labour. The great variety of roads and weather conditions increase the difficulty of arriving at realistic costs of road maintenance.

The World Bank report gives the annual maintenance cost per mile of P.W.D. roads as being about £400. It must be borne in mind that the

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1 This subject is dealt with in the Fourth Report of the Standing Committee on Public Accounts, Chapter 4, p.29-34.

department is largely responsible for secondary or feeder roads and that this figure does not include plant and equipment charges or labour costs. Moreover in some outlying areas (the Western and Southern Highlands for example) the department still has the use of free labour on a one day a week basis. In contrast the annual maintenance cost of C.D.W. roads is given as between \$500 and \$2,000 per mile. As the C.D.W. ascribes all costs to projects these figures are more accurate. The C.D.W. was responsible for major highways including the Lae-Wau road, and the Highlands Highway from Lae via the Kassam Pass to Goroka and Mount Hagen. The initial construction costs on these projects were very high particularly because the Commonwealth Department builds to high standards - considerably above those which apply in the Territory as a whole. For instance the extremely mountainous Kassam Pass single lane road cost some \$200,000 per mile to construct compared to about \$34,000 in rolling easier terrain. These costs included drainage but not bridging work. Moreover during 1966 because of extremely heavy rainfall the maintenance cost on the Kassam Pass section rose in total to \$60,000 or \$7,000 per mile. After the 5 year stabilisation period it is estimated that this cost should be reduced to \$2,100 per mile. In 1966 \$184,000 was provided for the Lae-Wau road, 89 miles long and including 22 bridges. Painting and repairing these bridges which include the 1,700 ft. long Markham River bridge every two years costs \$10,000. River erosion repairs take a further \$20,000, maintenance of 40 miles of undulating road \$40,000, improvements in road and river protection \$26,000, maintenance of 13 miles of mountainous road \$48,000, and the maintenance of 19 miles of mountainous road through gorges \$38,000.

One of the most interesting and important developments has been the introduction of local government council contracting for road maintenance and some road construction projects. As more indigenous people came under the influence of the councils it was no longer feasible to carry out the old system whereby local people gave one day a week free labour to road construction work. Under the new system maintenance agreements are drawn up in a contract form for educational purposes. They are assigned by the Department of Public Works for a 4 year period and contain penalty clauses if the work is unsatisfactory. The main clause in the agreement is that the maintenance of satisfactory road conditions will consist in '...regular filling of pot holes and ruts with a suitable road surfacing material' compacted or stamped into place. In the supervision of these contracts the local government engineer of the P.W.D. acts as a general adviser while the P.W.D. staff train and oversee council employees. Some of these have also been given supervision and tractor and trading training at departmental expense. From 1963 onwards experience with these types of contracts was obtained over a total mileage of 303.6 miles at a total cost of \$147,607, an average cost of \$487 per mile. The maintenance of the Kassam Pass to Goroka section of the Highlands Highway has now been largely taken over by councils. From experience of council work it has now been decided that in

future agreements, far greater use will be made of mechanical graders and the P.W.D. will be restricted to the repairing of bridges and major road damage arising out of floods, earthquakes and landslides. In social terms the greater use of sophisticated equipment rather than unskilled local labour may seem to be a retrograde step though the influential factor in this choice may be the chronic shortage of supervisors for road gangs. Councils are now being organised to pool their workshop facilities, to create better equipped centres for plant, and to employ highly paid expatriate mechanics to train apprentices. Standardisation of heavy earthmoving equipment and tractors will also allow for the establishment of central stores for spare parts.

The P.W.D. has also recently signed agreements for the maintenance of air strips in various areas and the construction of strong permanent bridges. In 1966 the largest construction contract successfully completed by a council was for the Mapi Bridge near Finschhafen. The council tendered \$42,000 for the project whereas an imported steel bridge, to be constructed by an overseas company, was quoted at \$150,000. It is apparent that the developing system of local government councils has a substantial potential to carry out construction projects and to relieve P.W.D. staff for other work.

#### 9. Housing policy and urban needs

The provision of adequate housing is a fundamental problem in any society. In New Guinea as in most other under-developed economies, it raises particularly complex issues, by no means all of which are directly associated with building activity. Village people rely for housing on traditional building with local materials, which include, pole timber, bamboo sago stalks, grass, pit-pit (sugar cane) and palm leaf. There is also an increasing use, in the more accessible areas, of such processed and manufactured materials as cement bricks, sawn timber, hardboards and galvanised iron and aluminium sheeting.

In the urban or settled areas, where expatriate influence predominates, a tradition of paternalism applied in the provision of housing, as indigenous employees lacked financial resources and most expatriate employees expected housing to be made available. Under the Native Labour Ordinances private employers were required to provide accommodation for their indigenous labour and also generally made subsidised housing available for expatriate staff. Likewise the government has also normally provided accommodation for both indigenous and overseas officers. Inevitably two standards of accommodation developed. For indigenous people accommodation was cheaply erected, houses and other structures costing at current prices perhaps \$2,000 per family. However, for expatriate staff total housing costs at current prices range between

£10,000 and £15,000 per family as housing standards must approximate to those in Australia. In most urban areas housing has been constructed of a combination of local and imported materials, timber, fibro-cement, iron or aluminium roofing and concrete blocks.

Since the end of the Second World War housing needs have also been markedly influenced by the growth and change in the economy as a whole. The non-indigenous population rose from 6,200 persons in 1947 to 35,000 persons in 1966, the great majority of whom live in the urban areas. Approximately 80% of all housing for expatriates is estimated to have been built since the end of the war. At the census of 1961 there were just over 7,000 dwellings of permanent materials and the Administration probably owned over one-third of these. Dwelling statistics are collected only from areas where Building Boards operate (that is in urban areas and townships), for structures which cost over £1,000 and for substantial additions or repairs to existing structures. As has been said (see Tables 6 and 8) in recent years there has been a very rapid increase in the number of new houses and flats completed, from 517 in 1962-63 to 2,241 in 1966-67 of which nearly one quarter were flats. The World Bank Mission recommended in 1963 that the Administration should seek to charge economic rents for its expatriate-type accommodation (I.B.R.O. 1964:354-61). It also considered that it should try to provide housing which would be acceptable to both junior expatriate staff and the more senior indigenous public servants - and intermediate house. A medium style house costing about £5,000 was suggested. A design has since been drawn up and prototypes let, costing £5,500 in Port Moresby for a house of approximately 7 squares (700 square feet floor area). Two of these houses can be placed on the normal single block thus economising on land. It is likely that this design will become the standard for a good deal of housing erected (for the Administration) under the 1968-69 Works Programme. However, in more remote areas building cost for an equivalent house would be generally higher.

While the Territory is still far from being a highly urbanised society a significant feature has been the migration of many indigenous people to the urban areas. Some of these people are relatively skilled and educated and work in government and private businesses. Many more are unskilled and have created the beginnings of a substantial under-employed urban proletariat. It is of cardinal importance to housing policy to obtain a clearer idea of the motivations and long-term aspirations of indigenous people in towns. For instance in connection with the choice between rental and purchase, do applicants for housing intend to remain in town or is their eventual idea to return to their villages? A survey would need to cover not only existing town dwellers, but also their 'one-talks' who had returned home recently. In 1966 Messrs. Brealey and Hogan estimated that there were approximately 24,000 indigenous inhabitants in Port Moresby of whom 18,000 were migrants.\* Most of them came from under-developed areas

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\* Add census figures

to which there is apparently little incentive for them to return.<sup>1</sup> The town's indigenous population was estimated to be increasing from migration by upwards of 1,000 indigenous persons a year and in the opinion of the authors, few at that time had any intention of returning to their villages. Similar trends are also apparent in Lae, Rabaul, Madang and other centres. Assuming that this situation persists, the question arises as to how these people are to be housed?

Experience in some African countries suggests that it is feasible for governments and private industry to provide subsidised hostel accommodation for migrating workers who eventually return to their own villages. However, when a permanent urban population develops the cost of subsidising housing becomes unmanageable, particularly because few of the workers at current wage levels and other costs can afford to pay much for housing. One possible solution, suggested by the World Bank Mission, is 'self-help' housing which could be built by indigenous people on demarcated plots which are provided with a minimum of essential services. The purpose is to provide plot holders with security of tenure and to assist them with the construction of shelters on their plots. Such an arrangement would break down some of the problems arising out of squatter settlements and shanty dwelling and has been embarked on in Wewak and is being considered seriously in Port Moresby and Lae. A second and related proposal was for the government to create a central housing authority with responsibility for housing programmes in urban centres. The Administration has partially implemented this proposal by the formation of the Housing Commission which is considered in a later section.

#### 10. Building and the Treasury Housing Division<sup>2</sup>

In recent years approximately one quarter of the Administration's expenditure on capital works (Table 3) has been devoted to accommodation, because public servants expect to be housed. The Housing Division of the Treasury has been responsible for this accommodation and the rentals and accommodation section of the division planned the Administration's housing needs. In 1965-66 accommodation expenditure for both expatriates and indigenes totalled nearly \$5.2m of which rather more than half was devoted to the latter's needs. In 1966-67 the budgeted accommodation figures was lifted to \$5.4m which would cover the cost of 339 high covenant and 654 low-covenant houses. Moreover a further \$1.2m was to be expended on the special housing programme, originally begun in 1964-66 to '... provide accommodation for the additional overseas recruits who would be necessary to achieve the real life in economic development foreseen

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1 Information in this Section is based on discussions with Mr. T.B. Brealey and Brealey and Hogan, 1966.

2 Information in this section is based on interviews with Government officers and the Eighth Report of the House of Assembly Standing Committee on Public Accounts, 1967 dealing with the Housing Division of the Treasury.

as essential in the World Bank Report.<sup>1</sup>

Despite this volume of spending there has been substantial criticism of the Administration's failure to provide adequate housing for its staff. Attention has been drawn, to 'the tremendous physical shortage of accommodation for local officers,' and that '.....many existing housing units are deficient, in some way or another.' (Eighth Report:48). The figures for recruitment and housing needs in a recent year illustrate the position. In 1965-66 the public service received a net gain of 306 overseas officers (excluding 309 temporary staff who are eligible for housing only after two years), and 1,147 local officers. During the same period only 263 high covenant and 575 low covenant houses were erected. At the end of October 1966, 1,127 officers were awaiting accommodation. Of these 193 were overseas officers and over three-quarters of them were married. Serious accommodation shortages were apparent in all the major centres. In Port Moresby alone 112 overseas officers and 439 local officers required accommodation. For overseas officers there was an up to three year wait for married accommodation while for local officers there was said to be an eight to ten year wait. As an example of some of the deficiencies in housing, in Wewak it was found that more than 100 indigenous public servants were forced to squat on tribal land because they had no other housing. In Vanimo in giving evidence, the assistant district medical officer, Dr. Melleforn said that -

....speaking of the indigenous married quarters in particular they are under-sized, under-ventilated and under-lit and there is no provision for toilets. There are open fire places and so on, and all these things are health hazards.

I would say that if we wanted to design a house in which we could cultivate the spread of tuberculosis, we would probably come up with something similar to this style of house (Eighth Report:37).

Following on a similar recommendation of the World Bank Mission the Committee suggested that as an answer to the accommodation problem the Administration adopt a special low-cost housing programme. Such a programme would include the 'intermediate' type of house<sup>2</sup> suitable for the 'heightening aspirations of the more educated local officers (p.5 and Eighth Report:25)'. Further, the potential of District Commissioners to construct low cost housing should be assessed and funds made available. It was pointed out that in some areas private building and construction companies would soon be retrenching numbers of artisans following the run down of existing defence and other contracts. This labour could be

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1 Treasurer's Budget Speech, House of Assembly Debates, Vol. 1, No. 10:1579.

2 See page 37.

encouraged to undertake the construction of low cost housing on a contractual basis for the District Commissioners' minor works housing programmes. One model to follow would be that adopted by Mr. T.W. Ellis, until recently, District Commissioner of the Western Highlands District (Eighth Report:26). In 1964-65 Mr. Ellis received an additional #12,000 on minor new works for the construction of low cost housing. The houses built had a concrete floor, sawn timber frame, iron roof and only the walls and ceilings were of native materials. The fittings included a shower, an outside toilet, fuel stove, kitchen bench and window-lite windows. 22 such dwellings were constructed for #12,000 an average cost of #545 each. Had this sum been spent on standard houses built by private contract it would have been possible only to erect 4 houses at an average cost of #3,00 each.

The Administration's housing needs are assessed in the same way as other items on the works programme which does not necessarily give them the highest priority. The building of Administration houses has been largely the responsibility of the P.W.D. while the C.D.W. has assisted on an agency basis. However, both departments have complained of the effect of the lack of adequate sites and a new Engineering Services Committee has recently been formed to look into this. Part of the problem no doubt arose out of well-known difficulties of acquiring suitable plots but the case for a study of service needs, such as water and sewerage in probable housing development areas, was also emphasised. Another difficulty for the P.W.D. is that planning ahead is inhibited by the lack of prior knowledge of the draft works programme. This has not been such a problem for the C.D.W. which programmes construction of houses for Commonwealth departments independently of the works programmes and concentrates on housing work in the major urban centres where there is a fairly predictable flow of work.

#### 11. Low cost housing developments<sup>1</sup>

From time to time the Administration has introduced various low cost housing schemes which apply to urban dwellers other than its own officers. Under the Housing Loan Ordinance the Treasury Commissioner of Housing is able to make loans for houses. In practice it has proved impractical to make cash loans to indigenous people but as an alternative the government constructed a number of houses which were rented for a probationary period of two years, when the tenants had the option of purchasing. In 1964-65 the Commissioner constructed 40, two-bedroom houses for #90,000 and in 1965-66, 20 three-bedroom houses for #48,000 and 30 two-bedroom houses

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<sup>1</sup> This section is based on interviews with government officers and on Brealey and Hogen 1966.

for \$60,000. Both the P.W.D. and C.D.W. were involved in these projects. The economic rental for these houses is about \$4 to \$5 a week.<sup>1</sup>

In the Port Moresby area most of the houses constructed for the Housing Commissioner have been in concrete blocks which was considered to be the cheapest form of construction available. One contract for 40 houses was accepted under the alternative materials clause, which allowed for pre-cast concrete slab construction under which whole wall sections were pre-cast, transported to the site and erected by crane. Whatever method was used, various sizes and prices of houses were experimented with. The largest concrete blockwork design was for three bedroom houses of 7 squares which included a kitchen with fuel stove, water closet, shower, laundry troughs and clothes boiler, all with water connected and plumbing. These houses cost \$3,200 each and were let by the Commissioner for 'A sub-economic rental' of \$4.65 a week.<sup>2</sup> The two bedroom houses of 5.5 squares, with the same facilities cost \$2,500 to erect and are let for the sub economic rental of \$3.93 a week. An even smaller house in concrete slab was 2.88 squares in area and comprised 1 bedroom, 1 livingroom, a kitchen annexe, fuel stove, shower cubicle, W.C., 2 wash troughs all connected to water supply and sewerage. The house had no sink or tap in the kitchen and electricity was supplied through a slot meter. The total cost of construction was \$1,860 per unit and these were let at an economic rental of \$4.40. In other urban centres housing follows the usual Administration design. A typical house would be of 3.8 squares with two bedrooms, living area and kitchen, water closet and shower. Facilities include sink, fuel stove, wash troughs under eaves and reticulated water and plumbing connections. Construction is of timber frame with flat asbestos cement lining and a corrugated iron roof. In Rabaul such houses cost \$2,300 to erect and are let at sub-economic rentals of about \$4 for intending purchasers and \$4.95 for renting tenants only.

Plainly an important design decision is whether to construct in concrete blocks or with a timber frame. Masonry construction requires less maintenance and permits a 30 as opposed to a 25-year amortisation period. However, outside Port Moresby timber is generally preferred as it is more readily available than concrete blocks and suitable for use in small contracts. A third possibility is the increased use of stabilised earth bricks but this requires labour skilled in bricklaying work. Whatever materials used and the prices charged at least half of the applicants for the Commissioner's houses have been unable to afford any of the houses

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1 An economic rent is a fee levied so that the capital cost shall be amortised at the rate of interest at which the money was borrowed, over a period linked either with the life of the house, or that of the loan (Eighth Report, 1967:9).

2 A 'sub-economic rental' is a figure somewhere between the nominal rent charged of previous years, and the economic rent recommended by the World Bank Report (Eighth Report, 1967:9).

mentioned above.<sup>1</sup> To accommodate most of these people a house must be produced to have an economic life of at least 25 years and to cost no more than \$1,000. Such a house could be economically let for \$2 a week.

One attempt to provide such very low cost urban housing was at Sabama,<sup>2</sup> an area near Port Moresby. The first houses built there were 4.8 squares in area, constructed with simple timber frames and sheeted with corrugated galvanised iron to window sill level with sago matting above, while the roofs are also of corrugated iron. The material content of these houses is only \$500, so facilities are limited to a chula cooking stove, a pit shower and a water sealed pit latrine. Electricity and water supply have not been connected to individual houses nor is there any drainage. The basis of the Sabama scheme was intended to be self-help when owner-builders put up their own house, or else houses could be constructed by indigenous contractors for a negotiated price.

Owner-builders were required to demonstrate to the Land Board that they were capable of putting down \$250 for the first part of a five-stage house. This would pay for the materials for the first stage, and the total cost of all stages would be \$1,500. Stage one supplied basic living quarters for the owner-builder. Technical help and advice was provided on the site by a P.W.D. tradesman, and a depot of building materials was on hand. The plans were carefully drafted in pictorial form so that no reading skills were necessary.

Experience suggests that not enough people requiring this cheaper transitional type of housing were able to find sufficient money even for the first stage though 48 successful applicants convinced the Land Board that they had \$250. It was expected that those taking part would be mainly newly-urbanised unskilled workers, or occupants of squatter camps. It is probable also that the credit arrangements were too unusual and it was calculated that over twenty applications, declarations or legal steps were required of the would-be owner-builder. Naturally few persevered: the few who did begin building houses have found it hard to save for the subsequent stage. The rate of erection of self-built houses has been extremely slow, and the objective of self-help was seen as unfeasible.

As the project did not move ahead as anticipated it was handed over to the Housing Commission, for whom P.W.D. has completed 21 houses to be let under the Commission's thirty year rental-purchase scheme at \$2 a week. Some of the new tenants of the Sabama houses have complained of the low standard of facilities, such as the lack of electricity. Many of them are more sophisticated Port Moresby workers of fairly long standing, who have rented Sabama houses because of the housing shortage. However, the same

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1 Brealey and Hogan, 1966, Ch.3:3.

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houses have been built for rental to local public servants at Kerama, and are reported to be readily accepted there. Both at Sabama and Kerama the P.W.D. method of prefabricated construction has proved itself cheap and capable of completion by only semi-skilled labour. Thus this concept of low-cost self-help housing while a proven success economically and technically, fell down on the sociological and administrative side. This is a common fate for many otherwise well-conceived schemes in New Guinea. Finally in both the Sabama scheme and that in Mount Hagen the authorities see owner-occupiers as preferable to tenants. In Sabama the reason for the preference was that it started as an attempt to involve people living mainly under shanty conditions in improving their housing. At Mount Hagen the reason for the preference is that tenants are unlikely to carry out routine maintenance and because parts of the buildings are of bush materials it is apparently expected that there will be a constant need for maintenance.

12. The formation of the Housing Commission 1967-68

The World Bank Mission of 1962 had recommended the formation of a housing commission with responsibility first for Administration housing and later for general urban housing, and the Administration slowly implemented this proposal over the next three or four years. The passing of a Bill to create a Housing Commission by the House of Assembly in March, 1967 and the appointment of commissioners a year later, gave additional scope to the Administration's involvement with the urban housing needs of the population as a whole.

The Standing Committee on Public Accounts implied that this slow pace was too leisurely (Eighth Report, 1967:13). It was apparent that the Treasury was reluctant to take this step, and the reason was very likely that listed by the Treasury (Eighth Report:14) amongst the issues to be faced by the Commission:

'the desirability that, whilst houses were provided to meet the known requirements, it would be done in such a way that the former position where everybody provided his own (sic.), did not change to a position where the Administration was everyone's landlord.'

In the light of this and other evidence the committee felt (Eighth Report:14) that the:

'Administration is not unaware that a housing problem exists, but apparently believes the solution must be accorded a subordinate priority to that of economic development. The findings of our tour have convinced us that any (economic) development is attendant upon the improvement of morale and efficiency, in the public service which is expected to implement such development.'

The function of the Commission, which is a statutory body is to: improve existing housing conditions. In relation to those eligible; to provide adequate and suitable housing for letting; to sell houses; to make advances to would-be owners; to develop land for housing and related purposes; to provide adequate and suitable housing by sale or lease to approved applicants; and the provision of associated buildings (Ordinance 27, 1967: Clause 31). Clearly, the question of who is considered to be eligible for the Commission's housing will be of crucial importance in deciding the size and nature of its programme.

The Housing Commission has been created against the background of the growth of the indigenous urban population together with a breakdown of the traditional paternalistic arrangements whereby private employers provided free or highly-subsidised accommodation to their work people. The first task of the Commission is to develop a standard design for a house of \$2,000 or less and to encourage the gradual creation of a work force of indigenous sub-contractors who are capable of building such houses under Commission supervision. In the short run the design and supervision of Commission housing will remain with the P.W.D. and it appears that most of its houses will initially be erected on a contract basis by established expatriate-managed building companies.

An associated and vital task for the Commission is to ensure that sufficient land becomes available, from the Lands Department for housing sites and that these are then serviced. Underlying these developments is the need to evolve arrangements to enable the Commission to be financially self-supporting and, able to provide, on a rental or rental-purchase basis, adequate housing for a proportion of the urban population who have a family income of between \$10 and \$20 a week. An estimate based on applications to the Housing Commission on 13 October 1967, appeared to show that out of 407 applicants 51 had a family income of less than \$10 weekly while most of the remainder had an income of under \$20 a week.<sup>1</sup> Half of all applicants had from one to three dependents. It is considered that most of the \$10 to \$20 a week families could afford a rental of up to \$4 a week. This would be sufficient in the Port Moresby area for a house of 4 squares with water and electricity laid on and valued at \$2,000. Terrace houses have been built and shown to be cheaper than equivalent single structures. They were 25 per cent less in building cost and each saved 75 per cent of normal costs of land. The Commission's initial annual budget is \$500,000 which it is hoped will be increased to \$1 million in 1969 and \$1.5m in 1970. On the basis of the 1968 budget the Commission plans to begin building 120 single

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1 This estimate is very much less than that of Brealey and Hogan given on p. above for a year earlier. Where the Commission figures take account of only 407 applications, the earlier figures for 1 May, 1966 covered 1394 applications and must be considered more indicative of the true position, that is that half the applicants earn less than \$10 weekly.

unit dwellings and 64 terrace dwellings in Port Moresby. It also plans to build 60 single units at Lae and 30 at Madang and Rabaul. Further, by taking over Sabama the Commission has been confronted with construction partly in bush materials, at lower cost than it had envisaged for its own programme. Whether this experience will confirm the Commission in its initial preference for permanent imported materials or lead it to experiment further with lower-cost building systems remains an open question. It will be recognised that the general intentions of the Commission are only a limited attempt to deal with the urban housing problem which is becoming apparent. It may be doubted whether in the longer run the Administration will be able to avoid the decision that some form of subsidised urban housing programme is essential. Alternatively as mentioned already indigenous people will increasingly be allowed to erect their own shelters on supervised and serviced plots which will carry no minimum covenants. Experience suggests that of necessity both solutions will eventually be adopted.

### 13. Workforce structure and trade skills

Changes in the size and structure of the workforce have been especially significant in the last five years. Table 11 shows the increase of indigenous workers in the workforce as a whole and in building and construction. While the indigenous workforce increased by a quarter between 1960 and 1966 from 72,971 to 94,191 persons, indigenous employment in the building and construction industry rose relatively more rapidly, from 3,768 persons in 1960 to 11,973 persons by 1966 (Graph 6) or from just over five per cent to approaching 13 per cent of the total. Moreover in the last four years of the period private employment rose faster than government employment. Whereas in 1963 only 2,031 or some two-fifths of the industry's workforce were privately employed, by 1966 5,913 or nearly half were. A census of the private sector of the industry in June 1967, put private employment as high as 7,876 (Table 15). As has been emphasised, during these three years Papua-New Guinea experienced the massive expansion of defence project expenditure which was supervised by the C.D.W. and which attracted several large Australian companies to undertake projects. Previously just over half of all government work had been undertaken by the P.W.D. which relied more substantially on its own day labour force.

Table 13 shows the pattern of employment in the building industry alone between 1962 and 1967 classified by contractors, sub-contractors and wage earners and by race. During the early 1960s the building workforce grew rapidly from 2,349 to 9,952. In March 1967 there were 65 contractors in the Territory of whom all were of European or Asian origin. These contractors

employed 8,324 persons of whom some seven-tenths were indigenous people. In 1963 there had been 57 indigenous contractors recorded by these were not counted as such in subsequent years. There were also 136 sub-contractors who employed 1,427 wage earners most of whom were indigenous people. The number of indigenous sub-contractors classified as such also declined sharply after 1964. Perhaps the most remarkable feature of the industry's structure is the apparently limited role of sub-contracting activities and the continued dominance of main contractors as the principal source of employment. In contrast in Australia much of building employment has fallen to sub-contractors while main contractors have in large part adopted the role of 'risk taker' and supervisor of the work of teams of sub-contractors. Large scale sub-contracting applying to all building trades does not appear to have made substantial impression in Papua New Guinea. However, as indigenous people acquire greater skills and more financial expertise, it may be hoped that this mode of operations will develop further.

Table 14 shows the structure of the present work force divided into the five main groups of tradesmen and sub-divided by race. Overall there is one expatriate worker for each seven of other races. But in terms of skill the most significant feature is that just over a third are carpenters. Another third consisted of labourers, the great majority indigenes. Miscellaneous or other workers made up a further tenth. There were relatively few painters, plumbers and electricians and very few bricklayers and no related trades such as tile layers, plasterers etc. though some were probably included in 'other.' In 1966-67 Table 12 includes 27 plasterers. The balance of the workforce in favour of either carpenters or labourers as opposed to other trades reflects the traditional structure of the building industry and its requirements. Hitherto most buildings have been of a timber frame type with asbestos cement or metal sheeting construction and the main labour demand was for carpentry and labouring skills. Moreover because of this building pattern most new building apprentices are also concerned with carpentry, plumbing and painting. The possible use of concrete bricks or blocks or fired clay bricks for cheap housing construction is referred to below. At the present time the lack of bricklayers, both in the trade and in training, clearly represents some limitation to the potential use of bricks.

14. Labour productivity and wage levels

Building and construction activity is normally highly labour intensive and short term opportunities for rapid improvement in labour productivity are uncertain. Thus any sudden increase in the industry's output also involves a substantial and immediate increase in employment. Even in developed economies an inelastic supply of skilled tradesmen is a common cause of the industry's failure to expand output quickly when effective demand increases. In Papua New Guinea, the works authorities sought to compel the tenderers for big military contracts in 1965 to promise not to draw on 'local resources', particularly not to take labour away from established builders. The figures given previously suggest that the local industry was able to expand both its output and workforce rapidly more or less in line with the great expansion of demand in the mid 1960s. And indeed after one complaint of poaching of labour from smaller builders by larger contractors had been investigated by the Department of Labour, it seems to have been realised that it was impossible to prevent labour mobility, and that one part of the industry could not be isolated from general economic factors.

It is not possible from the statistics available to measure the nature of changes in productivity during this period. Building output is non-homogenous and changes rapidly, as do the inputs of labour, capital, technology and basic materials. Much of the recent expansion of output has been associated with substantial engineering and construction projects and large-scale barrack and housing schemes. Thus it is impractical to seek to compare the productivity or efficiency of this type of building work with the more limited and small scale activity which preceded it. The increased use of off-site manufactured inputs such as pre-cut timber frames, pre-cast concrete components and hardboards, result in substantial changes in the cost structure of building operations and of the work required on site. In broad terms, whatever the mode of production approximately half of all costs are ascribed to wages which are generally divided between the direct wages and salaries paid by contractors and their payments to sub-contractors. In civil engineering and contracting work the greater use of plant and machinery brings the share of wages and salaries down to between one third and one quarter of costs.

Wages and salaries for expatriate tradesmen and skilled staff are only marginally higher than those which applied in Australia. For a good expatriate tradesman or foreman the average wage would range between £60 and £80 a week or up to £4,000 annually though many earn much more by working long hours of overtime; the prospect of which is often the main incentive for coming to New Guinea. For more senior managerial and professional staff salaries normally range from £4,000 to £10,000 a year, dependent on skill and seniority. A number of managers suggested to the author that the loss, in recent years, of a substantial direct wage differential for expatriate

in New Guinea as opposed to Australia was a main reason for many of the industry's difficulties. If we were '...prepared to pay more for tradesmen we would be able to attract better men from Australia' was a usual comment.

Yet if employers felt expatriate overseers to be essential, why then did they permit the differential to be lost? Some employers claimed that the current intensity of competition and the generally low margins on turnover allowed them little scope for wage increases. Further the recent rapid expansion of the industry in Australia, and particularly in northern Australia has no doubt absorbed tradesmen who hitherto might have been attracted to Papua-New Guinea by a wage differential. When pressed, one or two managers suggested that they felt that a wage differential would merely result in the same rather unsatisfactory recruits being paid more. It was noticeable that the one or two large companies whose management appeared to be above average, and who obviously took care to sign on only tradesmen with good references, had few complaints. Apart from the direct cost of wages and salaries there is the additional charge, of providing such benefits as return air tickets to Australia on a biennial basis, subsidised housing and transport. Managers sometimes suggested that because of these other overheads it costs an average company approximately £1,000 or £1,500 per annum more to maintain a tradesman in New Guinea than in Australia, and for higher managerial staff from £2,500 to £3,000 per annum more. Similar extra costs also apply to the expatriate staff of P.W.D. and C.D.W. as indeed to most expatriate employees in New Guinea.

Indigenous wages vary widely but are generally about a quarter of those paid to expatriates. Table 12 has been abstracted from a compilation of weekly wage rates extending beyond the building and construction industry. Nevertheless it is probably a fair indicator of building industry wages except at the lower levels where some workers in rural non-village centres, such as mission stations have obviously been included. Urban workers are unlikely to be receiving less than £6 a week.

Carpenter's wages are probably the best indication of the range. Only 275 out of 3,200 carpenters receive less than £5 weekly, and 24 per cent receive from £4 up to £8 weekly. 49 per cent earn between £8 and £15.50 weekly and another 25 per cent between £15.50 and £25.50. Very few indeed are more highly paid. Only the top quarter are between a quarter and a third of the expatriate tradesman's rate, and the ratio between the mid-point earnings of the racial groups is more than six to one - £11.50 compared with £70 weekly. If the figures are loaded a little on the low side as suggested, the mid-point of all indigenous carpenters rates above £6 a week is still only £11.

Proportionately few labourers are paid more than £8 a week, and most between £4-5 or £6-7 weekly. Almost a third of painters are paid between

11 and 15.50 placing them proportionately higher than carpenters. Most managers said that they considered the existing differentials between indigenous and expatriate wages were a reasonable and fair reflection of the relative productivity of average members of the two groups. However as long ago as 1963 it was suggested (Alcock and Richards:51) 'that the skill and output of certain indigenous individuals was equal to that of many Europeans and in fact better than some.' Some of the managers interviewed in 1967 also said that many indigenous tradesmen are beginning to achieve a level of technical skill and supervisory ability which will enable them to compete effectively with their expatriate counterparts. This type of 'responsible' indigenous labour is in strong demand and there is constant pressure to raise their wages nearer expatriate levels. However the basis for setting wages seemed to be what other employers might offer them, not a comparison with expatriate rates. Plainly many employers would prefer to engage a good indigenous worker rather than an expatriate because of the lower overhead cost involved. Most employers saw a necessarily increasing importance of indigenous tradesmen as the outstanding development of the future, and the need therefore for more training as one of its greatest problems.

#### 15. Education and the apprenticeship system

It is difficult to overstate the importance of education and the apprenticeship system for the future of the Building and Construction industry. Well trained apprentices provide the skilled tradesmen of the future, who with further experience and education are also potential management staff. Moreover with commercial acumen former apprentices may themselves form the operate building companies. In Papua-New Guinea the apprenticeship system operates under the Apprenticeship Board. In 1966-67 there were 1,084 apprentices in training. Of these, 543 were classified as belonging to the building group, of whom 283 were with government departments and instrumentalities and 260 with private enterprise. Of 28 leading building firms surveyed by the Department of Labour 16 were found to be employing apprentices.

In the public sector the principal employer of apprentices has been the P.W.D. It will be recalled that this department employs a permanent workforce as well as substantial day labour force and therefore has the necessary tradesmen to provide apprenticeship training. The departments apprentices are trained in one of eight trades which include carpenter and joiner, plumbers, wood machinists, painters, diesel mechanics, welders, fitters and turners and draftsmen. An expatriate tradesman gives 'on the job training' which is complemented by correspondence study through the Department of Education and by a month's study at the Idubada Technical College, Port Moresby.

A major difficulty associated with the apprenticeship system is the lack of skilled tradesmen available for instruction work. In Australia a usual ratio of tradesmen to apprentices is two to one, but this is often difficult to maintain in New Guinea. One solution would be to build up a number of training centres with permanent staff offering continuous training courses. The Department of Public Works has already arranged a number of such courses for operators of plant and machinery. Another difficulty is to achieve the correct balance of theoretical to practical instruction. This seems to be a particularly difficult problem in New Guinea when many potential tradesmen lack formal education but possess, to a very high degree, inherent practical skills.

In respect to education many government officers and builders concerned with the management of young tradesmen emphasised that there is often an inverse relationship between the marks students obtain for theoretical subjects and their skill as practical tradesmen. It may be that in New Guinea many indigenous young men with high academic potential are being pushed into apprenticeship schemes for which they lack practical aptitudes. It could be that among this group there are some young men for whom a more prolonged period of academic-type education would be more appropriate as a means of fitting them for professional and management work. However, in present circumstances they may be shunted into trades for which they have neither the inherent aptitude nor the inclination to succeed. While this is a general consideration touching on the education and manpower training system as a whole, it could have a very real bearing on the long-run success of indigenous people in the building industry.

Ideally one would like to see the development of at least two tiers in the industry's educational ladder. One tier would be for apprentices in the trades and a second tier for building and management training at a more advanced level. The latter could begin as an apprenticeship system in clerical work as adopted by the Electricity Commission, and later might ease the shortage of office workers and administrative personnel. In the initial stages higher tertiary training for the industry is probably best provided at the new Higher Technical Institute in Lae. In the longer run courses in Architecture, Quantity Surveying and Building Science will be essential to the development of the building industry while locally trained civil engineering will have an important role in construction work.

16. Building materials and credit

Building materials normally represent at least half the total cost of the average building, while for construction projects materials represent about one third of total costs. In New Guinea, the need for durability makes the correct choice of materials of particular importance. The C.S.I.R.O. Division of Building Research has examined the deterioration of materials which arises from Papua New Guinea's varied climatic and geographical conditions (Moss, 1967). One is the effect of moisture, particularly on timber structures, in areas of high rainfall. Algae and Funga growth occur in extremely damp conditions and lead to the rapid deterioration of timber, asbestos cement sheeting and paints. Another common cause of deterioration is high exposure to solar radiation which leads to excessive expansion and contraction, chemical degradation and accelerated evaporation of many basic materials, including bitumens, plastics, rubber and cement mixes. Insect attacks by both subterranean and dry wood termites also make special treatment of woods essential. Other causes of deterioration include high winds leading to structural damage, particularly in coastal regions, earthquakes in New Guinea, New Britain and Bougainville and the corrosive atmosphere in places like Rabaul, arising from volcanic activity.

It is not possible in the space available to give a comprehensive assessment of the available material resources or their relation to the manufacture and supply of building materials. The interdependence of the timber and building industries will be obvious, but building does not provide as large a demand for sawn timber as might be expected. There are large forest resources currently exploited by some 50 sawmills, and in 1966-67 the value of timber production was over \$11.5m compared with \$6.9m two years previously. The main part of production was used locally but only a few houses (generally less than five per cent) are built with timber outer walls. Fibro-cement is most preferred because of its low cost of upkeep and ease of application, though because of breakage it is not as durable as bricks. Corrugated iron is widely used, less for dwellings than for larger buildings.

New Guinea still relies on imports for all its supplies of bagged cement, permanent external wall linings (other than timber weatherboards) sanitary ware, plaster boards and insulating materials together with structural steels and hardwares, glass louvres, bathroom and kitchen equipment and light fittings. The relative cost of local production compared with imports is of considerable importance to industrial development, and to building costs. Paint and nails receive protection through a fairly low level of import duty. The gains from import replacement are of two main types; the introduction of new technology and new skills and the better availability of local supplies compared with imports, which are often delayed or diverted. These advantages are sufficient to justify a moderate degree of protection to new industries, particularly if there is a possibility of

their becoming more efficient as the market expands and they achieve economies of scale.

Papua-New Guinea operates on a non-discriminating trade and tariff basis and the relative incidence of overseas freight rates is often the major factor in the choice of one as opposed to another overseas source. Whereas from Australia the cost of cargo is about \$30 a ton, from Japan it is about \$25, and from Europe about \$22. This overseas freight structure gives many European and Asian materials an immediate marketing advantage over Australian products. Moreover for some basic materials, notably bagged cement and some types of structural steel and glass, European and Japanese production costs and f.o.b. prices are also lower than Australia's. In the extreme case of Japanese cement this is delivered in New Guinea at \$10 per ton compared with Australian delivery prices of about \$30 per ton.

At present most cement is imported from Japan, with small amounts from Eastern Europe. Landed prices are so low that on the face of it the establishment of a local cement industry would seem impracticable, or at least costly in present circumstances. The use of cement has expanded greatly in the last five years from 21,000 tons in 1961-62 to 66,000 tons in 1966-67. Pre-cast concrete work has been used very extensively in the recent Army expansion programme, mainly in Port Moresby and Wewak.

There has been no local production of burnt clay bricks, except for a time from a small plant in Goroka. Recently experiments have been carried out in Be'on Corrective Institution near Madang, by Mr. J. Peterson, a ceramics expert seconded by I.L.O. These have shown that strong bricks can be produced from local clay, though using only a crude kiln and wood fuel. Using a larger double kiln fixed with waste sump oil some thousands of bricks a week are being produced and fire bricks to line the kilns have been produced from local clays. It is possible that these experiments will give brick production a new start, as at least four or five coastal towns and one or two inland ones, seem to offer a sufficient market for the output of a small kiln.

The more highly manufactured materials including hardware, metal products and structural steels, are usually available from Australia at prices competitive with other supplies. Apart from competitive prices and firmer delivery dates, Australian branded products, have the advantage of being made to British and Australian standard specifications, which accord with those of the works departments.

Overall considerable progress has been made in the local production or investigation of building materials. Alcock and Richards (1963:81) recommended the investigation of local production of nails and corrugated iron, which are now being locally manufactured, of lime which is being experimented with, and of cement and asbestos fibre products, which certainly have been investigated though not produced.

It would be difficult to overstate the influences of credit on sales of building materials. Because of the difficulty of operations and the lack of capital reserves many building companies rely substantially on long terms of credit of up to 90 days or over from their suppliers. For instance, many firms do not pay for timber supplied until they have 'built it in'. The need for long term credit is frequently associated with the necessity for builders to maintain substantial and costly stocks of materials -- often in isolated and remote areas. The main source of credit remains trading bank overdraft for materials and working capital while for machinery and equipment hire purchase is used extensively. Another cost consideration is the frequent and often justified complaint of damages and losses due to inadequate packaging and unloading facilities. Glass louvres have extremely high breakage rates (50 per cent on average) as do asbestos cement sheets and light metal goods which are particularly subject to warping and bending in transit and storage. As a result it is essential that orders be placed and stocks built up well in advance in order to ensure that the necessary supplies are available at the right time and place. The internal movement and handling of materials is further complicated and made costly by the rugged nature of the terrain and lack of adequate roads in many areas. Many bulky materials have to travel by expensive air transport which adds enormously to the cost of building expatriate-type dwellings in outlying areas. The cost of a house or other simple structure is often twice as high in the Highlands as in coastal locations. In the Western Highlands District the recent improvement of the Lae to Mt. Hagen Highway has already substantially reduced the cost of freight deliveries. An estimate by Mr. T.M. Crotty of the Department of Public Works suggests that the overall freight cost reduction deriving from the improvements in and the greater usage of this road would be about \$700,000 annually. There seems little doubt that the improvement of the Highlands Highway will lead to a more extensive use of highly manufactured building materials throughout the Western Highlands and Chimbu Districts. One example may be seen in the Goroka Hospital which is being built entirely of metal and concrete.

#### 17. Research needs and indigenous materials

It is desirable that the building industry make greater use of indigenous materials as a form of import saving and as a means of bringing local people more firmly into the activities of the industry. Mr. T.B. Brealey has also emphasised the advantage in production of indigenous materials close to their points of consumption (Brealey 1967:2). He emphasises the need to involve indigenous people at the cottage industry level and to attempt to provide materials and devise techniques suitable '...for the simpler structures, which the exigencies of the present state of the country's development demand.'

In 1964 in order to encourage these possibilities the P.W.D. instituted a programme of research and established a building research station (P.W.D.B.R.S.) This currently employs two architects, three technical officers and three indigenous artisans. The purposes of the station are wide-ranging but may be summarised as follows: to assess available resources and capacity to produce building materials; to instigate their manufacture preferably at village or family level in the first instance; to ensure inclusion of these materials in the works programme by devising suitable construction techniques; to improve the quality of traditional local building materials and adapt them to forms more suitable to universal usage; to establish documentation to ensure uniform quality and enable them to be included in contract work; to facilitate development of low-cost building techniques in conventional materials for urban areas where local resources have become depleted; to aid the development of simple cooking, latrine, laundry, and ablution facilities preferably capable of being manufactured locally; to train indigenous personnel as operatives and supervisors for these new processes and techniques to promote investigations into sociological aspects of indigenous living as they affect the design and standards of housing, hospitals, schools, etc; to appraise different types of traditional architecture, assess their structural efficiency, and investigate the possibility of including them in works programme projects.

Concerning the greater potential use of local resources, since 1964 schedules have been prepared for many locations covering such features as the type of materials and their possible use, their availability and costs and means of harvesting, transport and storage. Materials surveyed to date include: frame-work materials such as mangrove and other timber stumps, pit sawn timber bush poles, bamboo; flooring materials including limbon (split black palm), split bamboo, pit sawn timber; linings, sago matting, bamboo matting, pit-pit (wild sugar-cane) matting; roofing materials such as kunai grass thatch, sago and nipa palm leaf thatch, bamboo, timber shingles. Schedules have been prepared for the raw materials for locally manufactured building materials not in traditional use. These include soils suitable for making stabilised earth bricks, concrete aggregates, limestone for block making, and limestone for hydrated lime manufacture. Preparation of these schedules by the B.R.S. is a continuing process as there are hundred of isolated locations to be investigated, and the rapid development of New Guinea also brings about constant changes which in turn call for constant revision of schedules.

The leading question underlying all this work is whether an intermediate building technology between current village methods and high-cost methods based on largely imported materials and external standards can be established. If bush materials and other natural resources can be rendered durable, and their production could be speeded up by such aids as looms, portable saws, lime and brick kilns and prefabrication of simple components on an uncomplicated

building system, then building costs will come down, not only in the fringe areas of the towns but in isolated settlements. At present high transport costs and a shortage of development funds inhibit the construction of schools, council and mission buildings, and all the structures required round a patrol post. Strength, comfort, durability and a prestige greater than that accorded to bush materials, are the qualities required in low-cost building. In many localities the choice will be between building in bush materials or not at all.

As indicated above, most wall lining materials are imported. A traditional woven matting called selo, made from the skin of the mid-rib of the sago-palm frond is widely used in coastal locations. The P.W.D.B.R.S. has adopted a design for a simple hand-operated loom which originated in Bes mission in the Sepik. The loom is capable of producing eight sheets of sago matting - 8 feet by 4 feet - a day which is many times faster than hand-weaving. The cost is between 50¢ and a dollar a sheet, or a maximum of roughly 3 cents a square foot, which compares very favourably with imported walling. Galvanised iron is 9.4¢ a square foot; asbestos cement 9.6¢; hardboard 7.2¢. Even when used in double thickness sago sheets are cheaper. To meet the needs of low-cost building plans in parts of Papua, some thousands of sheets are required and the Administration is endeavouring to buy the production from a number of looms it has distributed (Wilson 1967:31).

Other important local products already in wide use include various types of stabilised soil and coronus bricks. The advantage of this type of 'natural' brick production is that a good quality product can be made using unskilled labour, minimum equipment and mainly local materials. They are made from a mixture of suitable soil or coronus (fossilised coral) mixed with cement in proportions ranging from eight parts soil to one part cement to 20 parts soil to one part cement, depending on soil characteristics. The bricks are compressed in a cheap hand-operated machine which can be worked by unskilled personnel. A team of good men can produce from 500 to 700 bricks per day, and costs vary from \$36 per thousand in inaccessible locations where transport costs make cement expensive to \$16 per thousand. The average cost is \$22 per thousand. Most bricks used so far have been made by inmates of corrective institutions, although local government councils and private indigenous individuals have engaged in brick manufacture. To date bricks have been made in 19 different locations and successful surveys for suitable material have been conducted in 57 locations. Because the use of bricks was being retarded by the general shortage of bricklayers, the P.W.D. made arrangements with councils to train prospective employees and tradesmen. Cement-stabilised bricks are generally not cheaper than cement blocks (made mechanically) in the larger coastal towns, as coronus or soil has generally to be carted some distance and urban wages are high compared with rural areas.

New Guinea has substantial deposits of limestone and thus a potential for lime production which could be used as a replacement for imported cement in the production of earth bricks, mortars, renderings and in building road surfaces. A kiln was set up by the P.W.D.B.R.S. at Kikori in the Gulf District and has shown that an indigenous labour force can produce some hundreds of tons of burnt lime, given a certain amount of training and supervision. The initial use of the lime was on the new Kikori airstrip. Unfortunately, the kiln has had to be closed, at least temporarily as no new market for burnt lime large enough to keep it in production has been established. However, future road construction may provide a market. It also seems likely that substantial resources of other types of building stones have not as yet been adequately assessed or exploited.

Other work of the B.R.S. included experiments to produce simple household facilities such as cheap stoves, showers and latrines. Techniques of building have also been investigated. The simple system of prefabrication already described has been a major step forward as it is enabling semi-skilled workers to make parts and erect a simple building. All parts are of the same dimensions corresponding to those of the sago sheets - 8 by 4 feet. Using this type of construction and the household facilities mentioned above has made it possible to build Sebama-type houses at half the cost of similar buildings erected by conventional methods. It is probable that low-cost housing will be built to this plan in future in most districts where the required materials are available.

As most bush materials are short-lived, because of insect and fungal attack and most have a high fire danger, methods of reducing flammability and decay would be valuable. Various chemical dips and applications are being tested. Here the C.S.I.R.O. Building Research Station in Port Moresby has undertaken tests on bamboo, which holds promise as a wide-spread material of use in many low-cost building applications.<sup>1</sup>

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1 For a comparative review of the topic see: C.D.W. 1966.

18. Retrospect and prospect, 1968

In this paper the role of the building and construction industry within the New Guinea economy has been outlined. During the early 1960's the value and extent of activity has expanded rapidly, a result of both increased development and defence spending. An overriding characteristic affecting the industry is the dominant place of government, both in the creation of demand and as an organiser of activity. The two government works departments undertake or are directly responsible for approximately two-thirds of all building and construction work. The significance for the territory's economy of the annual Commonwealth grant has been emphasised together with the changes in development planning flowing from the 1963 World Bank Mission Report. These include the movement towards greater co-ordination of planning activity arising from the strengthening of the system of central government and the appointment of an economic adviser to the Administrator. Other developments include the appointment of a transport co-ordinator to prepare an overall plan of transport needs, which promises to bring radical changes to decision-making about road construction and the creation and use of other transport facilities within the Territory. A third development arising from the World Bank Report has been the formation of a Housing Commission responsible for urban housing needs. Plainly there is a serious shortage of housing in the urban centres and an urgent need to find means of providing more low-cost housing for indigenous people, and experiments in this field are of particular social importance.

The main features of the private building and construction industry have been discussed. The industry consists largely of expatriate-owned companies some of which are branches of Australian and overseas groups. Problems include the ease of entry and exit of individual contractors, the extremely competitive nature of the public tendering and contract system and the uncertainty and diversity of work to be undertaken. Conditions normally preclude contractors from developing specialisms in particular types of work so as to have some respite and security from competitive pressures. There is a constant danger of 'overtrading' leading to financial instability and bankruptcy. Other features include the limited supply of good sub-contractors and the dependence of much of the industry on the limited number of expatriate tradesmen who are prepared and able to act as supervisors, often in outlying areas and difficult conditions. Whereas indigenous people are increasingly demonstrating an aptitude for training and work as tradesmen, as yet only a few have proved able to undertake responsible supervisory positions. There is an urgent need for an adequate apprenticeship and tertiary education system which will train more indigenous people to undertake supervisory and entrepreneurial activities. Finally

much of the industry is highly dependent on the provision of credit and the maintenance of adequate supplies of building materials by local merchants. There is a continuing and urgent case for research and experimentation in the manufacture and use of local building materials. However, the diversity and rapidly changing nature of local building requirements make it unlikely that the industry will be able to operate without substantial imports of building materials for many years to come.

Table 1  
National Income and the building industry  
 \$ m. (Year ended June)

	1961	1962	1963	1964	1965	1966
Gross monetary sector product at factor cost (a)	99.5	107.3	120.1	134.9	160.1	179.3
Building & construction	6.2	n.a.	n.a.	n.a.	11.2	n.a.

Source: Department of Territories, Compendium of Statistics for Papua-New Guinea, 1967.  
 Economic Development of Papua and New Guinea, Port Moresby, 1967.  
 (a) current prices.

Table 2

Planned expenditure in works programme, 1963-64 to 1968-69.

Items	₹'000					Partial expen-
	1963-64	1964-65	1965-66	1966-67	1967-68	diture forecast, 1968-69
<u>Architectural, amount</u>	11,503	10,625	10,548	11,881	13,000	7,928
% of total	67.6%	49.8%	44.3%	50.8%	54.1%	
% variation on base year	-	-7.7%	-8.2%	+3.2%	+13%	
<u>Engineering, amount</u>	4,484	8,446	9,592	11,444	11,000	8,868
% of total	26.3%	39.6%	40.3%	49%	45.8%	
% variation on base year	-	+88.8%	+113.9%	+155.2%	+145.3%	
<u>Grants in aid and loans, amount</u>	1,016	2,240	3,660	20	-	-
% of total	5.9%	10.5%	15.3%	.02%	-	-
<u>% variation on base year</u>	-	+120.4%	+260.2%	-	-	-
<u>Total</u>	17,003	21,332	23,800	23,345	24,000	16,796
% variation on base year	-	+25.4%	+39.9%	+37.2%	+41.1%	-1.3%

Source tables 2, 3, 4; Works programme, Government Printer.

Table 3  
Planned expenditure on architectural works, 1963-64 to 1968-69.  
 \$ '000

Items	1963-64	1964-65	1965-66	1966-67	1967-68	Partial expenditure forecast 1968-69
<u>Accommodation; amount</u>	2,472 <sup>1</sup>	2,845	3,758	5,442	7,500	4,165
% of total	21.4%	26.7%	35.6%	45.8%	57.6%	-
% variation on base year	-	+15%	+52%	+120%	+203.3%	-
<u>Offices; amount</u>	961	1,345	226	49	60	72
% of total	8.4%	12.6%	2.1%	0.4%	0.4%	-
% variation on base year	-	+38.5%	-76%	-95%	-93.9%	-
<u>Hospitals; amount</u>	1,234	503	332	803	1,023	988
% of total	10.7%	4.7%	3.1%	6.7%	7.8%	-
% variation on base year	-	-59.2%	-73%	-34.9%	-17%	-
<u>Schools; amount</u>	3,177	2,436	2,815 <sup>2</sup>	2,472 <sup>3</sup>	1,889 <sup>4</sup>	1,479
% of total	27.6%	22.9%	26.6%	20.8%	14.5%	-
% variation on base year	-	-23.3%	-11.4%	-22.2%	-40.6%	-
<u>Agriculture; amount</u>	543	526	527	464	446	233
% of total	4.7%	5.4%	4.9%	3.9%	3.4%	-
% variation on base year	-	-3.1%	-2.9%	-14.5%	-11.8%	-
<u>Police; amount</u>	324	332	509	831	526	305
% of total	2.8%	3.1%	4.8%	6.9%	4%	-
% variation on base year	-	+2.4%	+57%	+156.4%	+62.3%	-
<u>Higher Education; amount</u>	-	-	905	n.a.	142	-
% of total	-	-	8.5%	-	1%	-
% variation on base year	-	-	-	-	-84%	-

1.	Excludes indigenous accommodation.	1963/64	Totalled	\$ 1,054,148.
2.	" higher education	1965/66	"	\$ 904,800.
3.	" " " "	1966/67	"	\$ 850,000.
4.	" " " "	1967/68	"	\$ 142,000.

Table 4

Planned expenditure on engineering works, 1963-64 to 1968-69.

Items	£ '000					
	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69
<u>Roads and bridges; amount</u>	1,429	3,910	4,994	5,663	4,973	4,836
% of total	31.8%	46.1%	52%	49.4%	45.2%	-
% variation on base year	-	+173%	+244.4%	+296.4%	+248%	-
<u>Wharves &amp; beacons; amount</u>	384	639	850	817	711	1,944
% of total	8.5%	7.5%	8.8%	7.1%	6.4%	-
% variation on base year	-	+66.4%	+121.3%	+112.7%	+85.1%	-
<u>Surveys, investigations, and consultant services; amount</u>	557	527	1,060*	1,500*	1,700*	636
% of total	12.4%	6.2%	11%	13.1%	15.4%	-
% variation on base year	-	-5.3%	+90.3%	+169.5%	+205.2%	-
<u>Aerodromes; amount</u>	139	306	369	194	280	240
% of total	3%	3.6%	3.8%	1.6%	2.5%	-
% variation on base year	-	+120%	+165.4%	+39.5%	+101.4%	-
<u>Water Supply; amount</u>	605	946	1,000	847	725	300
% of total	13.4%	11.2%	10.4%	7.4%	6.5%	-
% variation on base year	-	+56.3%	+65.2%	+40%	+19.8%	-
<u>Sewerage and sanitation; amount</u>	314	744	416	597	471	315
% of total	7%	8.7%	4.3%	5.2%	4.2%	-
% variation on base year	-	+136.9%	+32.4%	+90.1%	+50%	-

\* Includes Consultants.

Table 5

Value of new buildings completed, classified by type of builder1961-62 to 1965-66

₹ '000

Items	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67
<u>Owner-builders; amount</u>	570	1,056	1,298	2,044	3,343	4,502
% of total	6%	13.5%	10.4%	12.3%	15.4%	15.1%
<u>Contractors; amount</u>	7,526	5,132	8,335	12,120	15,711	22,549
% of total	80.2%	65.9%	67.2%	73.3%	72.7%	75.5%
<u>Day labour; amount</u>	1,302	1,599	2,767	2,353	2,530	2,776
% of total	13.7%	20.5%	22.3%	14%	11.7%	9%
<u>Total amount</u>	9,499	7,787	12,400	16,517	21,583	29,827
% variation on base year	-	-18%	+30.5%	+73.8%	+127.2%	+467%

Source: Tables 5,6,7,8,11,14 and 15; Quarterly Bulletin of building statistics, Nos 1-15, T.P.N.G.

Table 6

Value of new houses, flats, other buildings completed, 1961-62 to 1966-67

Items	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67
<u>Houses &amp; flats; total</u>	4,142	3,596	4,435	5,663	9,219	15,405
Government	3,457	2,820	3,530	3,773	6,148	9,975
private	667	776	905	1,890	3,071	5,428
% of all buildings	43.6%	46.1%	35.7%	34.2%	42.7%	51.8%
<u>Other buildings; total</u>	5,356	4,191	7,964	10,854	12,365	14,421
Government	4,132	2,723	6,138	7,952	7,776	9,082
private	1,224	1,468	1,826	2,902	4,589	5,341
% of all buildings	56.3%	53.8%	64.2%	65.7%	57.2%	48.2%
<u>All buildings; total</u>	9,498	7,787	12,399	16,517	21,584	29,826
Government	7,607	5,543	9,688	11,725	13,924	19,057
private	1,891	2,244	2,731	4,792	7,659	10,769

Table 7

Value of additions and alterations to buildings 1961-62 to 1966-67

Items	£ '000					
	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67
Houses and flats	81	122	152	181	323	139
Other buildings	267	204	217	286	282	211
<u>Total</u>	348	326	369	467	605	350

Table 8  
C.D.W., expenditure in Papua-New Guinea, 1957-67, \$m.

Expenditure on behalf of	Administration	Other than Administration	Total
1957-58	6,648	1,278	7,926
1958-59	5,460	1,580	7,040
1959-60	6,850	1,374	8,224
1960-61	7,567	1,850	9,417
1961-62	7,617	2,490	10,107
1962-63	9,790	2,140	11,930
1963-64	11,488	2,846	14,334
1964-65	13,282	4,712	17,994
1965-66	13,681	*15,536	29,217
1966-67 Estimates	16,145	*22,955	39,100

\* Includes Army Expansion Expenditure

Source: Tables 8 and 9 Standing Committee on Public Accounts 1966, Fourth Report, House of Assembly.

Table 9

Expenditures; P.W.D., 1955-67 (selected years)

1955-56	Maintenance	1,094,000
	Works and services	1,023,200
	Total	2,117,200
1959-60	Architectural	2,497,158
	Engineering	742,510
	Maintenance	2,707,846
	Total	5,947,192
1964-65	Architectural	5,720,836
	Engineering	3,683,128
	Maintenance	6,205,066
	Total	15,608,580
1966-67	<b>ESTIMATES</b>	
	Salaries and administrative	3,493,000
	Maintenance	6,381,000
	Capital works and services	12,291,700
	Total	22,165,700

Table 10

Construction material of completed new houses and flats, 1962-63 to 1966-67

Material of Outer Wall	Number of houses & flats				
	1962-63	1963-64	1964-65	1965-66	1966-67
<u>Houses - Total</u>	502	561	631	1052	1,785
Brick	9	34	37	37	53
Cement brick	38	11	19	21	66
Timber	91	53	24	48	42
Asbestos cement	355	413	528	786	1,086
Other	9	40	23	160	538
<u>Flats - Total</u>	15	26	204	308	456
<u>Houses and flats - Total</u>	517	587	835	1360	2,241

Table 11

Indigenous workers in building and construction industry: 1960-1966

Sector of work force	1960	1961	1962	1963	1964	1965	1966
Private building and construction				2031	2108	3098	5913
% of total indigenous workforce				2.6%	2.6%	3.3%	6.0%
Government building and construction				3303	4350	6667	6060
% of total indigenous workforce				4.2%	5.4%	7.2%	6.2%
Sub-total	3768	4151	4455	5334	6458	9765	11973
% of total indigenous employment	5.1%	5.4%	5.8%	6.9%	8%	10.6%	12.6%
Total indigenous employment	72971	75921	76365	76816	80269	91753	94191

Source: Labour Information Bulletin, Nos. 1-4 Department of Labour, T.P.N.G., 1964-1967, and Industrial Review, Vol. I No. 2, 1963, p. 44.

Table 12

Weekly wage rates; indigenous tradesmen commonly employed in building and construction industry, 1966-67

Occupation	\$ \$4.00	4.01 to 5.00	5.01 to 6.00	6.01 to 7.00	7.01 to 8.00	8.01 to 9.00	9.01 to 10.00	10.01 to 11.00	11.01 to 13.50	13.51 to 15.50	
Bricklayer	3	1	6	18	18	15	18	7	24	1	
Carpenter	56	221	134	226	135	285	215	193	440	441	
Drainer	-	-	-	-	-	-	3	1	1	-	
Electrician	1	4	3	32	7	23	15	22	26	18	
Heavy Plant Operator	4	10	9	10	7	36	27	11	30	29	
Joiner	-	1	2	6	4	11	5	1	10	-	
Labourer (General)	3940	5688	835	5562	2519	840	293	210	200	99	
Mechanical Equip.Operator	6	63	37	32	12	29	17	10	30	6	
Painter	4	9	4	40	80	117	47	85	130	111	
Plasterer	-	-	-	-	-	5	3	-	3	15	
Plumber	1	9	4	39	32	77	37	24	65	45	
Occupation	15.51 to 17.50	17.51 to 19.50	19.51 to 21.50	21.51 to 23.50	23.51 to 25.50	25.51 to 27.50	27.51 to 29.50	29.51 to 31.50	31.51 to 33.50	33.51 to 35.50	Total
Bricklayers	-	3	1	1	-	-	-	1	-	-	117
Carpenter	185	156	251	113	98	34	14	20	7	18	3212
Drainer	2	-	-	-	-	-	-	-	-	-	7
Electrician	4	8	5	1	2	1	1	1	-	-	176
Heavy Plant Operator	13	17	25	8	8	-	3	3	4	11	265
Joiner	-	1	-	-	2	-	-	-	-	-	43
Labourer (General)	57	5	-	1	-	-	1	-	-	-	20250
Mechanical Equip.Operator	10	5	7	1	2	1	-	-	1	-	269
Painter	48	28	38	20	9	9	-	3	1	1	784
Plasterer	-	-	1	-	-	-	-	-	-	-	27
Plumber	35	45	38	12	17	1	3	1	-	1	486

Source: Labour Information Bulletin, No.4 March 1967. Department of Labour.

Table 13

Private building employment: employers and employees by status & race

Status and Racial Origin	June					
	1962	1963	1964	1965	1966	1967
<u>Contractors - Total</u>	37	122	38	55	57	65
European	34	57	37	51	58	59
Asian	1	8	1	4	5	6
Mixed race	-	-	-	-	-	-
Indigenous	2	57	-	-	-	-
<u>Sub-contractors - Total</u>	92	72	90	87	137	136
European	52	32	43	55	101	119
Asian	2	1	-	1	-	-
Mixed race	-	-	-	-	-	2
Indigenous	38	39	47	31	36	15
<u>Wage earners (working for contractors)-Total</u>	1534	2009	3769	5175	7907	8324
European	216	239	504	548	901	970
Asian	11	15	11	12	15	18
Mixed race	16	29	51	49	87	171
Indigenous	1291	1726	3203	4566	6904	7165
<u>Wage earners (working for sub-contractors)-Total</u>	686	397	487	628	608	1427
European	99	34	63	68	59	140
Asian	12	-	-	1	-	-
Mixed race	15	3	-	-	5	79
Indigenous	560	360	424	559	544	1208
<u>Total</u>	2349	2600	4384	5945	8715	9952
European	401	362	647	722	119	1288
Asian	26	24	12	18	20	24
Mixed race	31	32	51	49	92	252
Indigenous	1891	2182	3674	5156	7484	8388

Source: Quarterly bulletin of building statistics, Nos. 3-15, T.P.N.G.

Table 14

Building Employment: No. of persons engaged on Building classified by occupation and race, June, 1967

Trade	European	Asian	Mixed race	Indigenous	Total
Carpenters	664	13	27	2,805	3,509
Bricklayers	29	-	3	161	193
Painters	111	-	-	919	1,030
Electricians	150	-	3	221	374
Plumbers	155	2	8	538	703
Labourers	15	1	89	2,836	2,941
Other	189	1	2	437	629
<u>Total</u>	<u>1,297</u>	<u>17</u>	<u>135</u>	<u>7,951</u>	<u>9,400</u>

Table 15

Private sector employment in building and construction, July 1967.

Male		<u>Wage and salary earners</u>	
Male	Female	Total	
7,664	81	7,745	
Other Workers (a)		Total	
Male	Female	Total	
125	6	131	
All Workers		Total	
7,789	87	7,876	
Indigenous		Non-Indigenous	Total
6,810	1,066	7,876	
<u>No. of enterprises</u>		<u>Wages, salaries paid</u>	
193		\$8,157,000	

(a) Includes working proprietors, unpaid partners etc.,  
 Source: Census of employers, July 1967, preliminary bulletin, Bureau of Statistics.

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