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In view of recent discussions at City of Adelaide Development
Committee Meetings appropos of the future of tall buildings in
city centres, it is felt that the attached paper by Mr George
Clarke on this subject may be of interest to Members.

"THE ECONOMICS OF TALL BUILDINGS"

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THE ECONOMICS OF TALL BUILDINGS

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SYNOPSIS

We here attempt :- (a) to identify the historic cultural and economic determinants of the tallness of tall buildings; (b) to review the degree of relevance of past and present determinants in the light of our own speciality, ie. of urban planning, which is herein defined as the identification of a community's environmental needs and demands, the adoption of developmental objectives and policies, and attempts to self-consciously plan and control urban systems in the pursuit of those objectives and in accord with those policies; and (c) to speculate on the relevance of tall buildings in possible future urban systems.

(a) Historic Cultural and Economic Determinants

The tallness of buildings tends to vary directly with the relevant degree of agglomeration of social, economic and/or cultural activities in space. This is obviously true of Cathedral Cities and downtown Manhattan but less so of some Middle Eastern cities or of London, Amsterdam or Geneva.

The tallest single structure in a community, whether pyramid, Cathedral, fortress, town hall, private or government office tower, proclaims the de jure or de facto economic, social or cultural dominance of the particular ruler, priesthood, bureaucracy or institution for which the structure was built. Historically, tallness proclaims the existence of power. Conversely, the use of such power can command the resources of capital, land, labour, entrepreneurial and technological skills to produce tallness.

The technological and managerial revolutions of recent centuries have produced modern megalopolises, the central business districts of which are the nerve centres of activity systems of increasing complexity and interdependence. Nineteenth and early twentieth century revolutions in metropolitan and regional horizontal transport, both public transport and radial arterial road systems, made modern megalopolises, and their characteristic central business districts, possible.

The tall office building appears to have originated in the 1890's in Chicago, as that city achieved economic dominance over the American mid-west and west. New structural technologies and sophisticated vertical public transport systems, together with the evolution of real estate as an investment mechanism, made it possible. It originated in the United States as a pragmatic application of economics and technology. It was taken up by European architects and their clients, often motivated by the aesthetic excitement of tallness as well as by its functional advantages.

(b) Review of Past and Present Determinants

Tall buildings, clustered at points of maximum regional accessibility, usually defined as central business districts, have produced high efficiency in person-to-person contact, as well as prestige in the highly visible power of an organisation to locate at a strategic site. The erection of a tall, large building creates or reinforces the strategic centrality of the site on which it sits. These factors have produced high returns from the development of sites which themselves rapidly appreciate in value. This cycle then attracts more investment in ever taller structures.

The concentration of high buildings has been accelerated by increasing efficiencies of vertical public transport, declining effectiveness of all forms of horizontal public transport, and by the increasing barriers to pedestrian movement within city centres. It becomes quicker and more pleasant to move in elevators than to move a greater distance horizontally. This has led to vertical "city-within-a city" projects such as the John Hancock tower in Chicago.

Recently, in Sydney and Melbourne, the flow of investment by relative amateurs into tall office buildings, particularly in fringe locations, has produced an over-supply of badly-located tall buildings. Popular disgust with environmental degradation is now beginning to inhibit the uncontrolled location of tall buildings in urban areas. Whereas, twenty years ago, the announcement of a tall building project was acclaimed by the public as an exciting addition to the cityscape and to city life, we are currently experiencing a backlash or counter-cyclic swing of opinion against such projects. Governments and their Planning Authorities are being forced to impose increasingly strict controls.

(c) Speculation on Relevance of Tall Buildings in the Future

Rather than attempt to predict or prescribe at this historical juncture, we can only speculate on the future of the tall building, which is bound up with the future of the city as a whole. The city can be seen as an enormous communication network in which information-flow is becoming a more and more influential and dynamic element.

High rise buildings are an expression of need for face-to-face communication - they are a vehicle of close, organised exchange of information - they are an expression of the traditional necessity for CONCENTRATION of business activity and decision making in urban life.

However, improvements and advances in communications technology and horizontal transportation could significantly reduce this need, with profound implications for future city form and function. These advances appear potentially to increase the practicality of DECONCENTRATION throughout widespread urban regions - leading to the dispersal of some traditional CBD functions and consequently less demand for such intensive forms of land-use as the tall building. Nevertheless, radical new forms of communications technology, such as videophones, cable television, facsimile transmission and the rest, require intensive capitalisation. Organisations wanting to make most economic use of these capital-intensive innovations may still need to cluster tightly in and around the central locations of the new heavy equipment and expensive installations.

Thus, both traditional and new forces of centralisation are leading towards more concentrated super-city centres with more and more intensive use of traditional urban cores expressed in higher and higher buildings. Concurrently, forces of decentralisation are leading towards looser regional complexes with more relatively independent and integrated regional sub-centres around which, nevertheless, high rise buildings could crystalize. Some of the new decentralised regional sub-centres might take the form of single mega-structures which, however, due to low unit land costs, and the high unit costs of tall buildings, are more likely to emphasise the horizontal, rather than the vertical, dimension.

INTRODUCTION

The Organising Committee of this 1973 Conference on the Planning and Design of Tall Buildings has asked us to provide some background perspective to the more detailed technical and engineering-oriented Conference papers, by attempting to explore the "economic raison d'etre of tall buildings" from the point of view of the urban planner who is concerned with the wider social and environmental aspects of urban and regional development.

This paper, therefore, is deliberately intended to be generalist, broad-ranging and discursive. The urban planner's perspective of particular building types must be as all-embracing and inclusive as possible.

Our discussion, therefore, tries to focus on the socio-economic context of the tall building. The "city" is seen as an historically evolving urban system, comprised on many inter-acting spatial sub-systems of both "economic" and "non-economic" activities, and of many different existing and emerging modes of movement and communication between these activities.

HISTORIC CULTURAL AND ECONOMIC DETERMINANTS OF TALLNESS IN BUILDINGS

Economics is well defined as being concerned with the allocation of scarce resources among competing ends. The economic feasibility of tallness in buildings, therefore, is a direct function of two factors: firstly, the available volume of resources of men, money and materials; and second, the values or priorities ascribed at any particular time by particular ends, objectives or purposes.

When we consider the economics of tall buildings, the traditionally defined economic elements of production - land, labour and capital - can be interpreted as including entrepreneurship, creativity or imagination, without which neither pyramid, cathedral or World Trade Centre would have been attempted. They must also be interpreted as including consideration of available technology - particularly in structure, life-support services and in vertical transport.

The "ends" to which land, labour and capital, including entrepreneurship and technology, are directed, vary dramatically from time to time and from place to place in accord with social mores, cultural values, resulting political attitudes and decisions, and the particular mechanics of local capital investment, interest rates, market controls and incentives such as the depreciation allowances available in the U.S.A.

We are all familiar with the methodology and current rules of thumb of conventional "economic feasibility" studies for particular building development projects within the current conventions of particular cities, of current technology, of particular market-oriented "ends" or values, and of particular capital investment and market expectations, controls and incentives.

However, the economic *raison d'etre* of tall buildings has only in recent decades, and then only in free market economies, become entirely a matter for determination in accordance with the criteria of the market place as interpreted by the investor or developer.

It is apparent that the economic evaluation of tall buildings has meant very different things in previous historical contexts to what it is generally taken to mean by building economists, engineers, architects, developers and investors today. It is also apparent that increasingly in the future, such economic evaluation will mean something radically different again. It also seems that, in the light of public reaction to the boom in tall building over the past twenty years, the shock of future changes in the meaning of the words "economic *raison d'être*" is already being felt by pretty well everyone in the building industry.

Few of us have any experience, let alone skill, in the carrying out of "economic feasibility" or "cost-benefit" studies at the physically much larger and socially more complex scale of an urban sub-system or system, such as a Central Business District as a whole, a metropolitan region, or in terms of a national urban development strategy which might aim to discourage the growth of existing CBDs, and encourage new city "growth centres". Thus, as with most urban phenomena, the economic *raison d'être* of tall buildings becomes a problem of more exquisite complexity the more one grapples with it. The mammoth nature of such large scale cost-benefit studies and the often inconclusive nature of their results, is exemplified by the many volumes of the cost-benefit studies for the Third London Airport. It is not surprising that we have so far made such little progress in these fields, most particularly because the social and cultural values and criteria we try to assess and to quantify for use in such studies, differ between conflicting interest groups and even then, tend to change from year to year, if not indeed from moment to moment.

There are, however, certain basic and ongoing criteria which seem to determine the tallness of buildings. It is difficult to see these criteria changing very much in the future. For example, the tallness of buildings tends to vary directly with the degree of spatial agglomeration of social, business or cultural activities. Where activities have needed to concentrate in space, to serve as religious centres, administrative or trade centres, transportation or information interchanges, or for purposes of concentrated defense, then historically, previous cultures have developed tall pyramids, cathedrals, town halls, guild halls, castles, walled hilltop cities, and even private in-town family fortresses such as those of San Gimignano. The modern tall office building is simply the latest expression of this criterion. Concentration produces land scarcity, high land values. The most "economic" direction of expansion is upward.

A second seemingly constant determinant of tallness in buildings is the need or desire to symbolise prestige and/or power. This age-old determinant is still with us: witness the still frequent advertisements of space available in a "prestige office tower". The tallest single structure in a community, whether pyramid, Cathedral, minaret, fortress, town hall, guild hall, factory chimney, private or governmental office tower,

statue of Stalin or Lenin, or rocket launching tower, proclaims the de jure or de facto economic, social or cultural dominance of the particular ruler, priesthood, bureaucracy of institution for or by which the structure was built. Historically, tallness has been a symbolic expression of the aspirations of societies, in their various manifestations - cosmological, religious and materialist. Tallness also proclaims the existence of real power, because only by the use of power can resources of capital, land, labour, entrepreneurial and technological skills be marshalled to produce tallness.

Thus, in a city which has passed through many centuries of cultural change, we can trace the history of power relationships in the community over time simply by visual inspection. A typical example would be the overshadowing of St. Patrick's Cathedral by Rockefeller Centre. In recent times, we have seen individual financial institutions and government authorities vie with one another for the prestige of having their name attached to the tallest building in a city. The proposed addition to the Empire State Building, to vie with the height of newer buildings, is another example. The dominant importance of communications systems, allied with the upsurge of tourism and entertainment in our economy, has given us telecommunications towers, often with observation decks or revolving restaurants on top. These extend and modify the tradition of the obelisk, Stonehenge, Nelson's tower and the Eiffel tower.

The "space race" again emphasises the human urge to reach height above the earth. Respect for tallness and height is built into our very language, which embodies such phrases as "from the lowliest to the highest" to express social distinctions.

THE DETERMINANTS OF TALLNESS IN TWENTIETH CENTURY URBANISATION

The nineteenth century metro-polis, or mother city, and its later form, the sprawling megalopolis or city region, have been produced by inter-related "industrial" and "managerial" revolutions. Large urban agglomerations grew as concentrations of secondary industry and also as concentrations of tertiary industry, service activities and occupations. In emerging "post-industrial" societies, the greatest single section of the workforce, or the section with the highest growth rate, is that of those people handling personal, corporate and governmental business interactions, processing paper, whose work can most simply be done in what we now call office buildings.

Modern "office" buildings have evolved to house this workforce, to facilitate face-to-face business interaction between people, and as paper-processing, or more accurately, information-processing factories.

Prior to this relatively recent twentieth century shift in the occupational structure of the workforce, the tallness of buildings was not directly related to the people-intensities of land use.

However high the towers of a Cathedral soared, its use by people was essentially confined to one level. Despite the early development of factories of more than 1 storey, manufacturing equipment and processes never lent themselves to multi-storey arrangements to any significant degree. It has only been the emergence of office work as a dominant mode of activity that high multi-storey buildings have been needed to provide really high-density land usage, really high on-site concentrations of people within relatively compact centres, and consequently, opportunities for the profitable renting of space in the upper stories of buildings.

Nineteenth and early twentieth century technological innovations in horizontal transport - the horse, steam and electric tram; the steam, electric and deisel train; the electric trolley and the deisel bus; the steam and deisel ferry; and ultimately, the motor vehicle - were applied to radial routes extending outwards from the traditional market and business centres of older cities.

At first, they were so efficient that while they created sub-urbs, they made it easy for all suburban residents to travel to the original mother city. It became the concentrated centre for all types of activity - manufacturing, wholesaling, retailing, entertainment, and all forms of business and governmental transactions, services and employment.

For as long as the horizontal radial transport modes continued to serve comfortably the demands made on them, the newly sprawling urban regions tended to remain mono-centric.

Central Business Districts expanded horizontally, invading and succeeding inner residential uses, and even grew outward radially along the transport routes.

Competition for space was, and remains, most intense at the points or relatively small precincts of maximum accessibility. Urban land became a marketable commodity like any other, with its value primarily set by its degree of accessibility to the maximum number of people, and by the bulk of floorspace which could be put to profitable use on a particular site.

The increasing specialisation and inter-dependence of commodity and money markets, business and government administration, forced the closer and closer concentration of such uses into the central cores of central business districts.

These types of uses were able to outbid others for space at the core of the CBD. They demanded the maximisation of face-to-face contact between participants. The best way to achieve this was to build high. Such uses were able to afford the costs of higher structures, and consequently, pressed into service the nascent technologies of steel structure, vertical transport

and mechanical and electrical services to provide the land use intensities they demanded.

Thus, central city buildings became higher and higher at the core, and central business districts spread further horizontally outwards from the core in buildings of gradually diminishing height.

But horizontally fixed-route metropolitan transport systems reached a plateau of technical effectiveness and ceased to improve. They were prisoners of their original capital investments, their basic technology, and their limited land corridors. They were unable to increase their capacities to service the swelling central city workforces and visitors.

The automobile liberated urban movement from radial lines, and enabled many activities gradually to disperse from the once omni-purpose central area. Telecommunication in various forms also began to reduce some of the needs for face-to-face contact in concentrated centres.

Manufacturing, wholesaling, retailing, entertainment and many types of personal services have, for decades now, gradually been leaving the old central areas. They are dispersing throughout the suburbs on land of lower value, in buildings of less height and lower unit cost. Nevertheless, there remain those headquarter functions requiring daily top-decision making which still rely upon the face-to-face contacts which can only be maximised in the traditional cores of central business districts. Competition for locations at the cores of our central business districts therefore remained strong, while the fringe area, or frame, of the typical CBD has been vacated by many subsidiary uses which have departed to the suburbs. A typical high density city core is now surrounded by a "grey area" frame of obsolete buildings and unintensive uses.

The alarming degeneration of all forms of horizontal urban transport, and the increasing obstacles to, and discomfort in, pedestrian movement within central business districts, are part of the "public squalor" into which our cities have fallen. It is no longer possible to walk easily from one end of an old extended CBD to the other. Intra-CBD forms of transport such as trams, buses or taxis, do not normally today make it easy to move quickly and conveniently around the full extent of the old, horizontally spread, CBD.

Thus, the remaining headquarter office functions of central business districts have tended, in some cities, to contract into one or more vertically concentrated nodal points, of maximum regional accessibility and maximum ease of local pedestrian movement.

The continuing growth of business establishments and of government bureaucracies has created a need for bigger and bigger single or integrated building complexes, of larger areas per floor. We have experienced a stage in the growth of individual establishments such that, while only the top decision makers need to be within close physical proximity, they cannot operate effectively without their second-echelons who, in turn, cannot operate effectively without close physical links to a multitude of departments and branches, each of which needs to have close

contact to a host of clerical and other service functions, mostly inside, but also to some extent, outside the parent organisation.

The "private affluence" of such mammoth organisations has harnessed the increasingly sophisticated technologies of vertical transport, building structure and mechanical services, to provide taller and taller structures of larger and larger areas per floor.

Within these climate-controlled private islands of affluence in the midst of city cores of rapidly increasing public squalor, it is quicker and more pleasant to move vertically in elevators than to move a far greater distance horizontally along congested city streets or footpaths.

As the public environment of streets and urban spaces continues to degenerate, government and private developers now often try to turn their backs to it. They aspire to create high density complexes which are cities-within-a-city, or else new mini-cities on new sites well served by regional transportation. These projects often create their own shopping malls, plazas, office, hotel, entertainment and residential components, and in some cases, their own internal transport systems. Typical examples have been Rockefeller Centre and the World Trade Centre in NYC; Watergate, DC; the Barbican, London; Australia Square in Sydney; and the John Hancock building in Chicago.

However, such individual projects, however good internally, are simply not enough to satisfy the increasingly world-wide public demand for the re-civilising of our central areas. Recently in Sydney and Melbourne, the flow of investment by relative amateurs into tall office buildings, particularly in fringe locations, has produced an over-supply of badly-located low-quality tall buildings in urban areas. Whereas, twenty years ago, the announcement of a tall building project was acclaimed by the public as an exciting addition to the cityscape and to city life, we are currently experiencing a backlash or counter-cyclic swing of opinion against such projects. This backlash is affecting the amalgamated site, integrated city-within-a-city complexes in many cases even more violently than the small "infill" projects.

The problems will not be solved, as some may still hope, simply by providing lots of wind-swept open plazas at the foot of even higher towers.

Much more drastic surgical excisions and transplants will be required. These will include:-

- * radical improvements to existing metropolitan transport systems;
- * radical innovations in intra-city people movement systems;
- * city wide, traffic free pedestrian networks, made up of the conversion of more streets like Martin Place in Sydney to pedestrian plazas combined with linked pedestrian arcades, overpasses and underpasses;

- * widened footpaths, and the conversion of some streets for the sole use of public transport and essential service and delivery vehicles;
- * the closing down of many private parking stations under central buildings and their replacement with parking stations on the fringe of city precincts, easily served from by-pass arterials or expressways, and linked across the central business district by new forms of intra-city public transport.

In brief, we must comprehend our metropolitan centres as wholistic systems, not as playgrounds for real-estate speculation, or as collections of individual, unrelated sites on which to display the virtuosity of architects, engineers and developers in producing elegant and astonishing monuments. We need to re-deploy our formidable human resources of skill in individual building, to the new tasks and challenges of the planning and design of cities as integrated systems.

SPECULATION ON THE FUTURE RELEVANCE OF TALL BUILDINGS IN URBAN SYSTEMS

If we can achieve the above-indicated kinds of radical changes in the public environment of our city centres, we can still permit some very tall buildings within very compact core precincts.

But we will have to face up to the necessity of limiting the spread of areas given over to tall high-density buildings, to those compact precincts which can be effectively provided with efficient and comfortable movement systems and other civilised amenities.

We cannot continue to allow tall high-density complexes, no matter how excitingly designed, to spread outwards from the compact core into those frame areas which in Sydney are represented by Woolloomooloo, Oxford Street, Ultimo, Pyrmont and Surry Hills. These areas house the lower-intensity, less profitable, supportive services and commercial and residential uses which are essential to the functioning of the city core itself. These frame areas need most careful conservation, rehabilitation and renewal for both old and new uses. Of these, residential uses must rank as among the most desirable, albeit the most difficult to achieve.

It is reasonable to assume that governments, faced with the exorbitant financial and social costs of continually increasing the capacity of radial metropolitan public transport services, will, in most cities throughout the world, put a limit upon the growth of their central business districts. This will first apply to those cities which are not major centres of national or international trade. It will only, with reluctance, be applied to the world's major centres of economic growth. But, ultimately, every city centre will have to be regarded as finite in workforce size, or as a closed system.

Further tertiary workforce growth will of necessity be deflected into a consellation of regional sub-centres, or to new cities, growth-poles or growth centres.

Meanwhile, the competition for, and the costs of, space in the older high-rise core clusters will continue to intensify. This will continue to force out those users less able or less willing to compete and to pay for such a location.

There will be two additional factors operating to reduce the pressure for space within the traditional core clusters of tall buildings.

One will be advances in communication technology, and the restructuring of organisations which have previously been locationally monolithic. Clerical, computing, drafting, filing, invoicing and other routine functions of an organisation will be shifted either to sub-regional centres within a 5, 10 or 25 mile radius, or to other smaller or newer cities hundreds of miles distant, without loss of efficiency to the key decision-making functions retained in the primate or mother-city cores.

Another factor will be the "turning off" or "dropping out" of significant sections of the workforce from the psychic overloads of a working life spent in large tall buildings in congested old-city cores. It is possible that many more such skilled persons will find it congenial and economic to work either from a home in the suburbs, or from a location in one of the new types of leisure-regions now proliferating around the world's climatically attractive coastlines.

There is only one certainty - the future will in many significant ways, be different from the present and the past. It may be that some kind of so-called "post industrial" society will emerge, which will reduce the workforce engaged in the management and direction of the world's affairs, and so reduce the numbers who need to concentrate daily in tall buildings in compact city cores.

The height, capitalisation and complexity of tall central core buildings will probably increase, but the number of them may not. Some future major city centres may be entirely contained within one gigantic vertical mega-structure, along the lines postulated in Frank Lloyd Wright's "Mile High" building.

Many of our smaller new city centres may be entirely contained within climate-controlled, perhaps even geodesic domed, megastructures of lesser height, in the character envisaged by the Disney "Experimental Prototype Community of Tomorrow" (EPCOT). Due to lower unit land costs, and the high unit costs of tall buildings, many such mega-structures are likely to emphasise the horizontal rather than the vertical dimension, as does the not entirely successful experimental prototype centre of Cumbernauld New Town in Scotland.

Improvements and innovations in communications technology and regional horizontal transportation systems, combined with structural changes in the world's economic systems, could increase the practicality of deconcentration of central place functions throughout smaller city centres spread widely throughout urban regions of continental dimensions.

Nevertheless, radical new forms of communications technology, such as videophones, cable television, facsimile transmission and the rest, require intensive capitalisation. Organisations wanting to make most economic use of these capital-intensive innovations may still need to cluster tightly in and around the central locations of the new heavy equipment and expensive installations. Such highly capitalised structures and equipment may need to be used by a workforce divided into shifts so as to gain 24 hours of usage every day.

Thus, both traditional and new forces of centralisation are leading towards more compact super-city centres with more and more intensive use of traditional urban cores expressed in higher and higher buildings. Concurrently, forces of decentralisation are leading towards looser regional complexes with more relatively independent and integrated regional sub-centres around which, nevertheless, high rise buildings could crystalize. Some of the new decentralised regional sub-centres might take the form of integrated mega-structures, some of which may be tall, and some horizontal in character.