

APPLICATION OF APPROPRIATE TECHNOLOGY TO OUTSTATION DEVELOPMENT THROUGHOUT CAPE YORK PENINSULA

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Abstract: *This paper is based upon work undertaken for the ATSIC Peninsula Regional Council during a feasibility assessment of an Appropriate Technology Facility to serve Cape York Peninsula. The study was undertaken over a six month period, from October 1993 to March 1994. In the context of recent land legislation initiatives in Queensland and the accelerating momentum of the outstation movement, a significant need has grown for technology which is appropriate to outstation living. The paper demonstrates that in order to address the delivery of such technology it is necessary to adopt a broader than usual view, beyond scientific and economic factors to the human dimensions of self determination and sustainable development.*

A Rationale of Appropriate Technology

Appropriate technology is defined here as *tailoring technology to fit the social and environmental context prevailing in a particular location and point of time*. Schumacher described appropriate technology as “technology with a human face” and a tool for people to use or reject within a community controlled process of self determination and sustainable development.

The focus of the design process is on the human outcomes of the relationship between people, materials and their environment. These three elements are explored in a holistic way for solutions to perceived human needs and problems. The major dynamic of this relationship is technology.

The deliberate focus on people outcomes of the technical problem solving demands a strong commitment to community development and planning principles, and especially to community consultation, negotiation and feedback with the concerned client group. It also requires a particular recognition of the role and affiliation of women and technology.

The most common perception of appropriate technology is related to the final product or artefacts, such as pit toilets, and hand operated washing machines. However, appropriate technology is more concerned with the design and delivery process as it is with the actual technical artefact utilised. A participatory process is essential in order to foster beneficiary ownership and control of the technological intervention. The actual product or technology utilised is secondary to this and evolves from this process.

Due to the diversity of peoples needs and aspirations, this participatory process is similarly diverse and unpredictable. It follows that appropriate technology is not generally amenable to standardisation. The wholesale introduction of previously developed appropriate technology artefacts without due regard to local factors may therefore prove to be inappropriate.

More Specifically, an Appropriate Technology is one which, in general, meets the following criteria.

- . It is a technology that best suits the needs and lifestyles of the people using it
- . The choice and design of technology should involve the beneficiaries to the greatest extent possible and thereby foster ownership and community control
- . The manufacture or installation of the technology should be local based, capitalising on the local skills, ingenuity and materials.
- . The technology should enable local artisans to earn a living and increase their potential for income generation
- . The cost to install, operate and maintain the technology should be within the economic means of a community
- . It should fit in with, and be adapted to, the local social and cultural environment.
- . It should be non-violent to the natural environment and ecosystem.
- . The use of appropriate technology should result in self respect and increased self-reliance.

The Setting and Context of Cape York Peninsula

Cape York Peninsula is characterised by considerable physical and social diversity. The largest proportion of the Peninsula consists of level and undulating plains which are prone to inundation during the wet season. Along the east coast runs an axis of high ranges which form part of the Great Dividing Range.

The climate is typical of tropical northern Australia with alternating wet and dry seasons and with 95% of the rain falling during the wet. Average rainfall varies from 900 to 1750 mm according to location. Thermal contrasts are less distinct between seasons, ranging over the Cape from a mean daily maximum of 32°C to 36°C in January and a mean daily minimum of 16°C to 21°C in July.

Cape York Peninsula is a sparsely settled area with a population of approximately 10,000. For such a low population, there is considerable social diversity between different social groups. This is mainly the result of the lack of interaction between population centres due to the large distances involved and the difficulties of access typical over the region.

Over half of the people of the Peninsula are of Aboriginal or Torres Strait Islander descent. Most Aboriginal and Torres Strait Islander people live in discrete established townships within locally controlled DOGIT or leasehold areas, most of which were originally established as mission sites, from 1880 to 1920. Over the last ten years, people have slowly begun to move away from these townships and to establish discrete outstations on their homelands. The current number of outstations is summarised below.

Current Aboriginal land legislation issues throughout the Peninsula have two separate grounds in law. The first at a State Government level is based upon the Queensland Aboriginal Land Act, 1991. The second is embroiled in the High Court's decision in the Mabo case and the ensuing Commonwealth legislation on native title. There are many layers of uncertainty associated with this legislation, which has led to considerable confusion amongst Aboriginal groups concerning security of tenure over homelands. Many of the outstation groups expressed some uncertainty to the preferred location for outstation development in anticipation of current and pending land claims. This was exacerbated by the possible choices afforded by marriage and alternative family lines with separate traditional and historical affiliations.

Remote Outstations (well isolated)	31	40%
Rural Outstations (close to resource centre)	25	33%
Cattle Stations (ATSIC property purchases)	3	4%
Planned or minor establishment only	18	23%
Total	77	100%

The Government response to outstation development (and development generally) throughout the Peninsula is still very much at an initial policy level. A consultancy is currently underway to prepare The Cape York Peninsula Outstation Strategy, including the feasibility of outstation resource centres. Another related State Government initiative is the Cape York Planning Land Use Study which is focusing upon broader regional development and land use.

As has been proved elsewhere, the ability of outstation groups to afford the capital and recurrent costs associated with outstation development is extremely limited. This is exacerbated by the comparatively small amount of Government funding currently available for outstation support. For the financial year 1993/94, the level of support was approximately \$1.5 Million spread over an estimated 40 outstations, excluding CDEP contributions. It is likely that the long term sustainability of outstations will be dependent upon the ability of outstation groups to undertake maintenance themselves within their existing resources and to supplement their income through enterprise development.

Technology Choice for Outstation Groups

Outstation groups throughout the Peninsula are faced with a diverse range of technical choice associated with the development of their outstations. The following discussion addresses this choice and explores the advantages and disadvantages of different technical solutions.

The following general factors are considered to be pertinent to the context of outstation technology. Further analysis is then divided into seven separate components: access and transportation; communication; water; shelter; sanitation; power and waste disposal.

- . In the context of available remote area technology, the current level of technology on outstations throughout the Peninsula may be considered as "low", and represents what outstation groups have been able to achieve with limited resources and technical support. This is related to the early stage of outstation development typical for the

Peninsula and Queensland generally. There were many examples of shallow water wells with simple bucket & rope lifting mechanisms and simple bush constructions for shelter.

- . Most informants did not have unrealistic expectations for technology and outstation development. There was a general recognition that outstation living entails a separate lifestyle to that of township living and that different levels of servicing apply. If comparisons are drawn with the more established homeland movement in the Northern Territory, this level of expectation may increase with time. The technical exit points in such a continuum of outstation development are difficult to define. If limitless funding is permitted to keep up with technological advancement, it is already feasible to live in the remotest parts of Australia with all of the comforts of a coastal city. The limitations to the pursuit of national standards of infrastructure are rarely technological, but rather economic.
- . As previously discussed, planned and possible land claims throughout Cape York Peninsula are likely to impact upon the ultimate location of outstations and associated occupancy levels. This will affect some outstation groups more than others. Where uncertainty prevails, technology and infrastructure should be as temporary or mobile as practical.
- . It was also found that outstation residents, especially young people, are highly mobile between the outstations and other communities. Occupancy levels are highly variable and difficult to predict in the first instance. The design of technology needs to adaptive to changes in occupancy. Where appropriate, staged developments must allow for increased occupancy with time which may, or may not, be realised.
- . Outstations are generally unoccupied for a period of up to 3 months during the wet. Technology choice must allow for this period of in-occupancy and subsequent absence of user presence and care. Security against theft and difficulties relating to inundation, storms, and flooding during this period must also be addressed.
- . Although cultural considerations apply, the feasibility of infrastructure and technology to outstations is very much related to selection of the location of an outstation. This is particularly pertinent to water supply, access and flooding. During the early stages of a planned move, it is valuable for people to seek appropriate advice with outstation location.
- . It is critical that technology choice minimise operation and maintenance costs. In light of the absence of supporting outstation organisations and the lack of recurrent funding, maintenance and operation of technology at the outstation level by outstation groups is crucial. This is exacerbated by the loss of access to outstations for external servicing during the wet. Technology needs to be appropriate to the skills levels and competencies of outstation groups with complimentary technical training as necessary.

Access and Transportation

The most important technical decision facing outstation groups was found to be related to access and transportation. Outstations are inherently remote. Outstation living is not practical unless there is the means to travel between the outstation and the nearest service centre for services and family and kinship obligations.

The standard technical solution to improved access is the construction of a rough bush track and the purchase of a 'Toyota' 4wd. Of those outstations that have received funding, the purchase of a 4wd generally preceded any consideration for other aspects of outstation development.

Although the convenience afforded by a road access are substantial, the complexity of the relationship between roads and vehicles must be considered. Roads create the demand for vehicles. Vehicles damage roads. Poor roads damage vehicles and the maintenance and recurrent cost cycle is never-ending.

The standard of outstation track construction is usually low with only minor attention to drainage works. Such roads are prone to erosion and quickly deteriorate with time. The existing shire and community councils would require additional funding to undertake adequate maintenance and upgrading of outstation tracks. The recurrent cost difficulties of maintaining 4wd vehicles are already well known.

Improved road access may also attract unwanted tourism, primarily for the purposes of fishing coastal estuaries. Uncontrolled access to such remote areas can place pressure upon the environment of the homeland. Certain outstations are vacated for periods of time during the year and already there are reports of essential equipment (especially radios and solar panels) being stolen.

Road and vehicle access is not the only option available. For a large proportion of the Peninsula, road access is not possible for between two to five months over the wet. During this time, air access and sea access along the coast are much more reliable and usually "friendlier" to the environment.

An informative account of the inter-relationship between transport, mobility and development in the Aurukun Region has been undertaken on behalf of the Man Thayan Association (Lawrence, 1992). Aurukun Community Incorporated (ACI), which supports the outstations in the vicinity of Aurukun, has adopted a policy of supplying tractors to outstation groups. These are employed for a variety of tasks around each outstation and the trailers provide personal transport for family groups. Although they travel at slow speeds and are not suited for travel over long distance, these vehicles are very appropriate for the poor road conditions over which they travel.

The ACI position recognises that an influx of 4wds would be economically inefficient since their use would be limited to the dry and because of the high associated maintenance costs. There would also be an inclination to travel farther afield. The current system of tractors limits mobility to the immediate environs of the outstation and for the occasional trip into town. Although 4wds are still clearly desired by certain groups from Aurukun, it is clear that the economics and realities of outstation living in the area would mitigate against their wholesale introduction.

ACI also operate an extensive air service to outstations. Many outstations have two airstrips; one constructed of sand or shell for the wet season and the other on black soil for the dry season. With the exception of extreme weather conditions, air access is possible all year round. The high costs involved with aircraft operation are not prohibitive in comparison with the alternative costs of maintaining a regional road network and 4wd vehicles. On the downside, the choice afforded to outstation residents of when to travel is dependent upon scheduling and availability of flights, which is not as convenient as alternative land or sea based vehicles.

Given the nature of the typically riverine coastline and the problems of land transport, an important and under-utilised option for coastal outstations is access through motorised dinghies and supply barges. In addition to regional access, dinghies can locally provide for fishing and hunting expeditions along the coast and rivers. The maintenance problems of outboard motors are also easier to manage than for land based vehicles. With the exception of extreme weather conditions, they can also provide almost year round access.

It is not suggested that roads and 4wd vehicles are not a viable means of access, but rather that there are implications of this choice and that there are other options for consideration. Measuring the complexity, rather than the simplicity, of access and transportation is a sensible means for outstation groups to control the development of their homelands.

Communication

An essential component of remote outstation living is the ease of communication with the outside world, especially in the event of a medical emergency. The two options for communication, other than in person, are radio and telephone.

High frequency (HF) radios are well suited for remote locations due to their greater range. Although they can be easily be fitted into vehicles, it is important that there is also a fixed radio at the outstation site for medical emergencies which occur when the vehicle is away. A simple means of power to such a fixed radio is through a deep cycle battery and a small solar panel.

The alternative to a HF radio is a VHF or UHF radio, which have a much lower range, but are cheaper to purchase and replace and use less power. Where outstations are close to central administrative hub, VHF or UHF radios may be the better choice. The range of a network of VHF or UHF radios can be approved considerably through the construction of a repeater tower. Such a tower, however, is vulnerable to lightning strikes and damage during cyclones and can become the weak link.

Most informants preferred the telephone as a means of communication. Telecom will provide a telephone service to any remote outstation site on application. In some locations this may require substantial capital works so the time from application to installation can be over two years. The cost to the consumer is in the order of \$1500 which is negligible in comparison to the cost incurred by Telecom. It is also less than the cost of installing a new HF radio.

The advantages of connection into the international telephone network are obviously substantial. The convenience of calling friends and family from a remote outback outstation to a major city thousands of kilometres away is a testimony of modern tele-communications throughout Australia. Beyond the glitter of the tele-communication industry, there are however a number of complexities that must be addressed. Due to the remoteness of some installations, Telecom are not always able to respond quickly to service faults and the reliability of service can be poor. The user costs of telephones in remote areas are high since most calls are on STD rates. This adds to the other running costs of an outstation which are already high in comparison to the combined income of outstation groups. Even when the money is available, payment of telephone bills requires either a cheque account or an inconvenient trip into the nearest service centre. It is not surprising that Telecom can cite many examples of disconnected services in such remote locations.

Radios should not be discounted as an obsolete technology in comparison to the telephone. A telephone conversation is limited between two individuals. Radios permit all within range to listen in and are a useful means of communicating en masse over a number of outstations. In the Northern Territory where common radio usage has largely been replaced by telephones, it has been commented that "the bush has gone quiet now". They are also easily relocated in comparison to fixed telephone installations. With the exception of the licensing fee required by the Department of Communications, there are no virtually user costs. Maintenance and repairs can be managed on the basis of exchanging units with a centralised maintenance operation. Outstation groups can have a level of involvement with the operation and maintenance.

That is not to say that telephones are not a viable choice for communication. But it should not be assumed that the "higher" technology of telephones is best in all cases. In certain situations the utilisation of radios may be a more appropriate alternative.

Water Supply

The viability of any outstation development is dependent upon the availability of a plentiful and clean water supply. Although the Cape York Peninsula receives a comparatively high annual rainfall, 95% of this falls during the wet season. Due to high temperatures and evaporation rates, water shortages and dry conditions are typical towards the end of the dry season.

Clean drinking water can be easily obtained through rainwater harvesting and protected storage. The most common means is through the use of roof rainwater collection tanks. This would only be possible for the small percentage of outstations which have proper shelters with roof and guttering. The storage capacity of such systems is limited by the size of the roof catchment and may be sufficient for drinking purposes only.

Surface water storages through constructed dams and river systems can supply water according to their storage capacity. Depending upon the soils in the area, this water can be very turbid. Otherwise any surface water storage is prone to bacteriological contamination and would require disinfection through boiling or through the installation of disinfection equipment. It is also possible to design dual reticulation systems which separate potable rainwater for drinking purposes and surface water for washing and other domestic purposes.

Groundwater can be a plentiful and clean source of supply. Along most of the west coast there is a shallow water table which is easily sourced through shallow wells. Along the east coast and inland areas, the availability of groundwater is more unreliable and subject to local hydro-geological characteristics. Since groundwater is usually safe from bacteriological contamination, its utilisation is preferable to surface sources providing that the taste difference is acceptable to users.

Toilets and ablution facilities must be carefully sited to avoid contamination of groundwater resources, especially when shallow wells are utilised. Siting must allow for the depth of the water table and the direction of groundwater flow.

The majority of lifting mechanisms observed were petrol driven pumps. In some instances, water lifting was undertaken by hand with a bucket and rope. A more hygienic alternative to this would be the installation of a simple handpump.

There is an unrealised potential for utilisation of solar and wind driven pumping systems. The Peninsula is a relatively windy area, especially close to the coast, and windmills are commonly used for pastoral purposes. Windmills tend to be prone to mechanical problems, and consideration for their use must allow for maintenance and access for service personnel if necessary. The higher capital cost of these systems must be balanced against the reduced running and maintenance costs in comparison to petrol driven pumps.

Shelter

The majority of outstation shelters observed during the investigation were simple bush constructions of timber, corrugated iron and tarpaulins. These constructions represent what outstation groups have been able to achieve unassisted and within their existing means. The exception to this was a few more substantial outstation shelters of block and steel frame construction throughout Aurukun Shire. Aurukun is currently planning to construct more outstation shelters during 1994.

There is no reason why a properly constructed bush shelter cannot adequately service the needs of outstation groups, especially if occupation is only intermittent. Indeed many informants were more concerned about tenure, access, water and power than improved shelter. It is likely that shelter will become a greater priority to these people as the outstation development proceeds, as is beginning to occur throughout the Aurukun lands.

In light of the uncertainty surrounding tenure throughout the Peninsula, the location of some present and proposed outstations is tenuous. Where there is the possibility of the future relocation or closure of an outstation, it is sensible that the type of shelter be as temporary or mobile as possible. In such cases, less complicated bush constructions may well be the most appropriate interim solution.

A drawback of such constructions is their structural ability to withstand high winds and cyclonic conditions. They are however easily rebuilt in comparison to more permanent constructions.

With more secure and established outstations, construction of more permanent shelters and housing may be appropriate. There is much that has been researched and written on the architecture of outstation shelter design, including the UPK Report (Nganampa Health Council, 1987). Some examples of the specific factors for design and consultation include :-

- . heat control through choice of materials, insulation, structure orientation, awnings, breeze collection, shade structures, etc.
- . consideration to spatial arrangement of greater living area outside house structure
- . protection against termites, bushfires and cyclones
- . allowance for the full range of occupancy levels, from peak periods of visitor influx to periods of total in-occupancy, and in particular with respect to design of the toilet and ablution facilities.
- . special features which allow for inundation during the wet season and associated flooding, loss of access and extended period of in-occupancy.

design features which minimise the health problems associated with dogs

This available information is intended to guide and facilitate a consultative process rather than provide a presupposed formula for shelter design. It is largely based upon research undertaken in the arid environments of Northern Territory and Western Australia. The unique climatic, environmental and social conditions of Cape York Peninsula will require a somewhat different approach and the testing and re-thinking of the lessons learnt elsewhere.

Sanitation

The observed toilets on existing outstations consisted of simple earth closets with make-shift enclosures. The excavated pit below these toilets was not ventilated and were generally only the depth of a 44 gallon drum. There are a number of low cost solutions to upgrade such toilets into well ventilated hygienic facilities.

The Ventilated Improved Pit (VIP) latrine was developed by the World Bank in Africa and is widely accepted as being the most sanitary design for a pit latrine. The design reduces the presence of smells and flies and is otherwise more "user friendly". Pit latrines may not be suitable if the outstation water supply is sourced from a shallow water table. They also require special construction details for certain soil conditions and when intrusion of surface water during inundation is possible.

Other toilet options with their own specific advantages and disadvantages include composting and chemical toilets. The option of a conventional flush toilet and waterborne septic tank system is ideally suited to full-scale housing construction, where toilets and ablution facilities are located within a closed structure. Septic systems are a costly solution and are dependent upon a reticulated and abundant water supply. They also frequently cause maintenance difficulties with the overloading and clogging of absorption trenches and the need for periodic emptying and desludging of the septic holding tank.

The outstations visited also displayed a variety of innovative solutions for household kitchen and ablutions facilities. The most important design element of these facilities, from a public health perspective, is the drainage and disposal of wastewater. The commonly adapted method of absorption into the ground requires special consideration of the likely occupancy level and the permeability of the insitu soils. This can be complicated by inundation and flooding during the wet season.

There is the potential to re-utilise this household wastewater through irrigation of household gardens, although there are public health regulations which would need to be considered to determine their relevance to outstation situations. The advantage of this approach is the reuse and linkage with the quantity of domestic consumption.

All of the outstations visited used a simple excavated pit for disposal of refuse. When filled the pit is generally covered and another dug. The Department of Queensland Health require that the location of the pit be well clear of the outstation camp and above known flood levels. It is also a requirement that the refuse be burnt intermittently to reduce the incidence of scavengers and vermin or covered regularly by backfilling.

Fuel and Power

All outstations visited during the course of the study utilised diesel or petrol generators. Such generators have a low initial capital cost, give a reliable supply on demand and repairs can usually be undertaken locally. On the downside, they are costly to run and maintain, make considerable noise, require frequent maintenance and need a storage of fuel.

The operating efficiency of a generator is reduced if it is not operated within its efficient range. There were many examples of generator sets running with a small load of some few lights only. This practice wastes fuel and will reduce the life of the generator unit. It is possible to connect a generator to charge a series of batteries which in turn supply the power as required. The generator is controlled to stop and start in response to the charge of the batteries and is operated close to its efficient duty. Although there are cost savings with reduced fuel consumption and extended life of the generator, this arrangement is more expensive to set up and introduces more maintenance costs associated with the batteries and their special storage requirements.

Other options for domestic power generation include solar photovoltaic cells, wind turbines and to a lesser extent, micro-hydro systems. Most such renewable energy systems require substantial capital investment up front. Although running costs are very small in comparison to a generator, maintenance usually requires specialised technical support which may not be available locally. Their utilisation in remote outstations requires careful consideration. Outstation groups need to be informed of the lifestyle requirements of living with renewable energy systems. In some instances, diesel generation may prove on balance to be the more appropriate solution.

The use of solar photovoltaic cells for generation of electricity is relatively untried throughout the Peninsula and has considerable potential for exploitation. It is particularly suited to water pumping systems. The water storage tank permits the intermittent operation of the pump in accordance with daylight hours, without the use of problematic batteries. Other examples of potential use include powering radio sets and stand alone night lights.

Designing for solar requires allowance for the overcast conditions. In certain areas along the east coast where overcast conditions are frequent, solar photovoltaic cells may not be economic. As solar photovoltaic panels are often stolen, design must also allow for secure fastening or mounting on high poles.

Solar radiated energy, in its simpler sense, is also well suited to hot water heating through roof-top solar collectors and can also be concentrated for cooking purposes. Burning of wood in open fire places and wood stoves is an alternative for cooking and heating, as long as sufficient and suitable timber is available. Simple devices such as chip heaters can also be installed for heating hot water.

More Diversity for More Certainty

The above discussion demonstrates that outstation groups are faced with a diverse range of technical choice and associated implications. Measuring the complexity, rather than the simplicity of technology choice is a sensible means for outstation groups to control development of their homelands. A design process is fundamental to appropriate technology and permits outstation groups to work through this complexity and to choose the technology which most suits their purposes.

In order to consider the application of appropriate technology, it is essential to grasp the rich and diverse forms of lifestyles which typify Aboriginal and Torres Strait Islander people throughout Australia. This diversity of living is accompanied by an equally diverse range of Aboriginal and Torres Strait Islander people's aspirations for development. And for the multiplicity of development scenarios, there is a similarly diverse range of technical problems and solutions for people to address.

Furthermore, the dynamic of Aboriginal and Torres Strait Islander people and their development is very much a moving, evolving, multi-faceted thing. Solutions that are appropriate for one year, are inappropriate the next.

To Non-Aboriginal service providers, this complex ever-changing diversity is very difficult to grasp. The general Non-Aboriginal bureaucratic perspective of rationality and accountability is rooted to strictly functional terms, and the classification, calculation and manipulation of variables. Aboriginal and Torres Strait Islander affairs has increasingly become "control-oriented" in a futile effort by Government to reduce the level of uncertainty that accompanies any infrastructure project. This disenfranchises people from the technology around them and further increases the dependency on outside government support. It is futile because increased control-orientation leads inevitably to a denial of reality and greater, not lesser uncertainty.

The only sensible means to find more *certainty* is through the acceptance of this *diversity*. Aboriginal and Torres Strait Islander people, by acting themselves upon their diverse range of values and interests, seek to construct their own world. Self-determination is the *process* of facilitating people's assessment of their opportunities for development and technology can become a tool for people to use during this process, or reject, as necessary. This requires a more "process orientated" approach and a greater focus upon the diversity and the human dimension to the problem.

It is impossible to avoid complexity in response of this. The problem does not lend itself to reductionism or standardisation of presupposed solutions. Different solutions have to be researched and developed for different applications. Known technical solutions must be retested with time. This requires a more intensive methodology than is necessary for the commonly practiced "control-oriented" method of delivery.

In the real world of government conditionality and financial accountability, it is also important to acknowledge the necessity for process outcomes, milestones and timetables. A "process-oriented" approach is not incompatible with this government conditionality and accountability, but a commitment to a development process requires a more structured flexibility with project management, and sometimes more time and money. Never the less, it is still possible to achieve outcomes sufficient for accountability purposes.

Several references are pertinent to this discussion, including "Community Development Planning and Aboriginal Community Control" (Lea and Wolfe, 1993) and "Development In Practice - Paved With Good Intentions" (Porter, 1991).

Conclusion

It has been demonstrated that outstation groups throughout Cape York Peninsula are faced with a diverse range of technical choice associated with the development of their outstation. It has also been shown that the process of technical delivery has broader implications for the sustainable development of outstations and the self-determination of outstation groups.

The intended corollary of this paper is that measurement of the complexity, rather than the simplicity, is the only sensible means to obtain lasting sustainable technical solutions in Aboriginal and Torres Strait Islander outstations and communities. Technical delivery must become more “process orientated”, accept the uncertainty, welcome the diversity, and face up to the realities.

Consistent with this, it is not possible to offer simple prescriptive solutions. The problem is a moving, evolving, multi-faceted thing and is relative to specific social and environmental locations. The human focus of appropriate technology utilises a location specific process which can work through this diversity and complexity and thereby support, rather than impede, the self determination of outstation groups.

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