

# Innovative transport options for enhancing liveability in Australia's rangelands

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This article presents a range of potential adaptations and innovations and aims at informing about the future transport systems in the rangelands according to different factors of demographic, economic, climatic, and technological changes by 2050 (Table 1).

Adaptation strategies cover a range of technological, behavioural and operational dimensions. While locally, more services will be delivered remotely via cost-effective advanced telecommunication systems opening new opportunities for managing community development projects and increasing economic participation, transport systems will still need to adapt to new types of challenges such as a pressure on resources, a more mobile aging population and more frequent extreme climatic events (Zander, Taylor et al. 2012; Memmott, Reser et al. 2013). An effective way to respond to increasing fuel and resource costs will be to reduce transport demands in very remote locations by providing appropriate funding for new technologies such as IT, robotics and biotechnologies allowing greater on-site access to goods and services and cross-cultural programs to retain and skill a remote workforce.

Documenting and designing positive learning materials and strategies for everyday transport needs in very remote communities could be based on the current knowledge in off-the-road driving, fuel economy, vehicle occupancy maximisation, with associated vehicle pooling practices, and unconventional on-the-go-repairs (Spandonide 2014).

Operational models will change as well. Advanced technologies of vehicle pooling, IT and travelling management, and a coordinating transport regulatory authority could considerably decrease transport costs for the service delivery industry (Spandonide 2014). Appropriate dynamic door-to-door public transport services will need to be developed by integrating the existing public transport operators. There is also an opportunity to create a more appropriate public transport policy framework with suitable concession fares over long-distance travelling.

In 2050 the transport experience in itself will be significantly transformed through the use of new technologies, with the ability to increase the functionality of transport systems - business and recreational trips will be characterised by the activities carried out during the transport task as much as by the services and goods accessed at destination (purpose of the trip) - as it will be possible to communicate and exchange more efficiently on-board of connected driverless vehicles.

In Australia, driverless, connected, intelligent, integrated, ultra-efficient vehicles including drones and efficient air transport will redefine transport activities (Goller 2011). Transport safety is expected to improve with auto-maintenance systems, and improved access to parts through 3D printing technologies (McKenzie 2013). Electric vehicles will be dominant.

However the degree and the rate of penetration in the rangelands will depend on the availability of recharge infrastructures and affordable long-distance electric off-the-road vehicles on the market.

Finally, long-range electric vehicles with extra battery capacity might be used in an integrated way with other energy utilities (Diesendorf, Lamb et al. 2010) offering a more affordable and reliable off-the-grid energy resource ultimately increasing business and community resiliencies (Went, Newman et al. 2008). The co-benefits of such decentralised energy systems are particularly evident when

Table 1 Potential transport futures in the rangelands

	Large remote agglomerations	Very remote localities	Transport futures
Demographic change	Strong population growth and aging, increase in migration flux both domestic and international encouraged by a potential movement of re-ruralisation (Garnaut, Connell et al. 2001; Beer, Tually et al. 2013).	The current situation of extremely low densities will be maintained with under-critical-mass threshold for mainstream Australian style of governance and regional planning (Smoker 2011).	An increased aging of the population imply escalating costs in health services and more vulnerable very remote settlements with strong temporary migrations due to climatic factors (Australian Government 2010).
Economic change	The tourism industry booms with a strong demand from South-Eastern Asian countries. Export-focus markets for resource rich regions (Pittock 2011).	The service delivery, resource, and tourism industries dominate. Opportunities are available at specific locations for new forms of regional management (Altman 2010).	Strong economic exchanges with South-Eastern Asian countries. Despite a greatly improved access to goods and services there is a global pressure on resources (Cribb 2013).
Climatic change	Climate change affects remote Australia in different ways. While the Top End regions face higher rainfall, sea level rises, more frequent and intense floods, Desert Australia experiences higher average temperatures (Whetton 2011).		More outages of service deliveries and more costly alternative transport for emergency services for remote communities.
Technological change	Advanced IT, telecommunication biotechnologies and robotic technologies will change the way goods and services are accessed and delivered (Siemens 2011; McKenzie 2013). For transport systems, hybrid and electric vehicles will dominate the market.		Seamless exchange of goods, services and resources (Gallup Organisation 2011; Siemens 2011).
Transport futures	The passenger and freight transport demand is multiplied by three (Goller 2011).	Small remote and very remote areas experience high fuel prices and average fuel consumption (Graham, Reedman et al. 2008). Average vehicle occupancy rates divided by two or three.	Rapid, flexible and affordable transports, with new infrastructures at a national standard level (integrating driverless and fast recharging technologies) (Department of Infrastructure and Regional Development 2014).

considering the specific transport needs of a large number of Aboriginal and Torres Strait Islander people living in the rangelands (Dockery and Colquhoun 2012): a versatile and well-integrated energy system would positively contribute to maintain and meet cultural obligations and livelihood aspirations implying regular travels over long distances and in relatively isolated areas.

This study provides some useful information for transport planning in the rangelands at a strategic level: the main conclusion is that supporting the acquisition and operation of affordable, robust, easy-to-maintain, and fuel-efficient vehicles, combined with improved public transport operations including a specific access for people with low mobility is a viable answer to the current situation of severe transport disadvantage for a large number of Aboriginal and Torres Strait Islander people living in the rangelands (Currie, Stanley et al. 2007; Raicu, Taylor et al. 2011).

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