Public Libraries in a Digital Culture

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Research Unit in Public Cultures, The University of Melbourne

in association with

State Library of Queensland

THE UNIVERSITY OF MELBOURNE

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Prepared by The Research Unit in Public Cultures
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The RUPC is an inter-disciplinary research institute that brings together scholars from across four faculties at the University of Melbourne, alongside industry partners. The RUPC focuses on transformations in public culture produced by new intersections of knowledge, media, space and mobility, within Australia and internationally. In contemporary society public culture is dynamic and shaped by multiple forms of media, people from diverse backgrounds, and numerous global networks. Working with key cultural agents, stakeholders in public institutions and leading commercial partners, our researchers are investigating the issues that are transforming public culture. By developing an integrated approach between theory and practice, researchers in the RUPC seek to identify new trends in the social uses of public spaces and frame the horizons of public expectations.

Author Bios

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Danielle Wyatt is a cultural researcher whose research sits at the intersection between the practices of artists and cultural producers, the workings of institutions and cultural policy, and theories of culture, place and belonging. Since the completion of her PhD in 2013, she has worked at the School of Culture and Communication as a Research Associate on a five-year Australian Research Council Linkage Project, Multiculturalism and Governance: Evaluating Arts Politics and Engaging Cultural Citizenship. Danielle has written reports and presented research for the Australia Council for the Arts, the City of Whittlesea, Arts Victoria and the Office of Multicultural Affairs and Citizenship.

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Executive Summary

Libraries have long been a foundation for a literate society, and thus an important platform for democratic participation. Digital technologies have radically transformed processes of storing and distributing information and human stories, such that the volume of online information now exceeds that in every physical library in the world. Consequently, libraries are adapting to support new forms of literacy and a new kind of public sphere emerging in the wake of a digital culture. For Queensland libraries, the effects of a digital culture are visible in statistics showing that membership figures remain steady even as the number of physical items circulated by libraries has declined (State Library of Queensland 2014b). Library participation is increasingly being driven by a wide range of 'non-traditional' services, resources and activities that now form an integral part of the library's institutional function.

It is also important to note that specialist, public, academic and private libraries all have different dynamics of evolution in the world of technological change. Our emphasis in this research is on the public library form.

Our research identifies two themes that encompass these wide-ranging developments of a new library infrastructure:

1. The digital divide:

- Libraries play a key role in providing access to digital devices and the Internet, and in fostering digital literacy at basic and more advanced levels.
- A significant minority of the Australian population does not have access to the Internet at home, or the capacity to afford mobile data, and so lack the ability to access information.
- Lack of digital access is highest in remote areas and among socially disadvantaged communities.
- Changes in the National Broadband Network (NBN) towards a Multi-Technology- Mix is likely to entrench uneven digital access, particularly in rural and remote areas.
- As a range of public functions shift online (banking, welfare services, education, social networks, cultural resources), digital access and digital literacy become the precondition of effective civic participation.
- State Library of Queensland should consider how it can better assist digital connectivity for public libraries, particularly in remote, rural and Indigenous communities. Actions recommended include exploration of partnerships with State or local government and/or technology providers to extend network services, and extension of Wi-Fi services into public space around libraries.

2. Libraries as producers of public culture:

- Libraries are becoming platforms that support a diverse range of activities and relationships across public, private and community sectors.
- In a resource-constrained environment, these partnerships are critical to accessing the technical and creative skills to deploy advanced digital resources.
- Libraries are becoming hybrid spaces that provide unique opportunities for integrating face-to-face publics with new activities supported by networked digital technologies.
- Locating digital resources in popular library spaces can promote their uptake. Where this is not possible, focussed event programming to drive public uptake is required.
- Gaming is a strong attractor for younger library users, and offers a range of affordances, including entertainment, education, social interaction and community-building.

- Collective activities such as makerspaces and gaming require creative strategies for managing library space and balancing the needs of diverse users.

Key Findings:

A) There is **strong demand for technological learning** in libraries, especially among seniors seeking basic skills and families with younger children. Functional digital literacy remains a vital library service, particularly for communities most impacted by the digital divide: remote communities, Indigenous communities, new migrants and the homeless. Libraries are also investing in a variety of creative literacy programs and facilities: coding workshops, media labs, design training and recording equipment. Libraries want users to be able to interact with and customize the technology they use. Cultivating these capacities requires a combination of social, technical and pedagogical skills. Libraries need to develop a new non-traditional skills base for library staff, but also, need to facilitate flexible arrangements for the outsourcing of skills to industry specialists, volunteers or partner organisations.

B) The **physical library environment** contributes greatly to user participation and uptake of digital services. New libraries' investments in versatile furnishings, amenities for mobile devices, diversified spaces for small group activities and external amenities supporting 24-hour free Wi-Fi are creating open and inviting places for diverse forms of user engagement. Older libraries are customizing their spaces with similar results, but are often not well positioned to design spaces that take advantage of external Wi-Fi or to program events outside library walls.

C) New initiatives are often targeted at non-traditional library users, yet program managers report **low levels of public awareness of the library's non-traditional services and programs.** While libraries collect a significant amount of user data, there are no systematic protocols for making use of this data to target under-represented communities, to deepen user engagement, or to encourage engagement across different library services. In addition there are no systematic protocols for communicating data to library users, or for circulation within the library network. While libra¬ries make good use of social media for marketing and branding, they have not taken advantage of the more interactive, targeted and customized communication that these platforms offer, forms of interaction which may both expand and deepen user engagement and awareness of the Library 2.0.

D) **The public library is a trusted 'third place'**

In a society where many opportunities for entertainment and education are driven by the market, libraries provide a genuinely inclusive environment where the social capital of diverse cultural groups and communities is fostered.

Introduction:

Libraries and the challenges of contemporary digital culture

ABOVE IMAGE: BRISBANE CITY LIBRARY ENTRANCE

ABOVE IMAGE: STATE LIBRARY OF QLD EXIT WITH WIFI ACCESS

Public libraries are redefining their role in the face of a rapidly changing digital culture. Expanded digital networks and Web 2.0 platforms have created new opportunities for greater citizen participation in civic and cultural life, articulated variously as participatory culture (Jenkins 2009), creative consumption (Hartley 2007) and the rise of the 'user' (Wright 2013). However, it is evident that desired dividends such as greater social engagement, enhanced cultural awareness and increased civic and political participation do not flow automatically from the mere technical connection to the network. The gap between technological capacity and social and political outcomes is crucially mediated by institutional strategies, approaches and practices.

In particular, the role of information and the importance of access to information has become more fundamental to contemporary conceptions of the public sphere. While many Australian households have now adopted digital technologies that support new modes of communication, access to information and services, this has only sharpened expectations that libraries will continue to play a critical role as a place for public learning and knowledge sharing.

Our fieldwork and interviews in the Queensland public library network demonstrated numerous impacts of digital culture. Most evident is the shift of users away from traditional 'literary' library services such as book borrowing towards a range of newer services based on computer and Internet access, including use of personal computers and mobile devices within libraries' free Wi-Fi networks. Libraries are also introducing new digital equipment such as 3D printers, design software and recording equipment, and large screens for gaming and watching videos, and are developing programming around these resources. In response to these emergent forms of use, libraries are also physically remodelling themselves by introducing more flexible furnishings, and removing bookshelves to create meeting spaces and accommodate co-working spaces.

These changes in programming, services and design are transforming the atmosphere of libraries from places intended primarily for individual, silent contemplation of print resources to more flexible spaces that house a wider spectrum of activities. These range from individual study and after-school homework clubs to contemporary forms of creative production such as coding or robotics workshops that may also generate considerable noise, buzz and social interaction. As well as experimenting with after hours and weekend programming so as to enable working parents to attend workshops with their children, the 24-hour availability of digital collections, online learning materials and a presence on social media, means that library services have effectively expanded beyond both the institution's opening hours and physical boundaries.

The combined effect of these changes means that libraries in a digital culture can be considered as a platform, simultaneously tightly formatted and partially unbounded. They are hubs or centres where people come to access resources and interact with others within a specific time and place, yet also act as catalysts or conduits capable of connecting diverse social groups and organizations, and linking different creative and community practices. Libraries can thus be understood as vital public sites within larger creative ecologies or networks (Gibson and O'Regan 2002; O'Regan et al 2004;O'Connor 2009; Hartley 2005). For policy makers, managers and library administrators, this new context requires shifting from a static understanding of the institution as comprising a relatively stable set of services and impacts, to seeing the library as a dynamic and relational process, where its success is increasingly a function of how it engages with a diverse range of other institutions, communities and stakeholders.

Libraries around the world are aware that digital technologies are critical to their future. The Next Horizon: Vision 2017 for Queensland public libraries (SLQ 2013: 6) emphasises the need for libraries to be "technology trendsetters", a phrase that encompasses dimensions of access, skills and leadership, and demand commitment to partnerships, community engagement and new forms of co-creation. For Rowena Wilmott At Logan, digital technology is what has enabled libraries to survive and to remain relevant.

'I think if we hadn't moved with all of that sort of technology, if we weren't offering Wi-Fi, if we weren't offering iPad classes, I think we would have slid into the irrelevant pile … I think [these technologies] have kept us alive.'

'You can't exist the way that libraries have existed for years and years now…there has to be recognition that there's different services needed.'

IMAGES L-R: BRISBANE CITY LIBRARY EXIT; STATE LIBRARY OF QLD EXIT; STATE LIBRARY OF QLD BUILDING.

The new context raises key challenges in terms of skills and resources required by libraries, as well as understanding and planning for future community needs. As libraries expand their range of services, they have to balance the need to continue to provide traditional services such as book borrowing and reference services, with the desire to provide digital platforms and physical spaces that support new forms of access, connectivity and community creation.

The changing demands upon library services also necessitate the development of a new skills base for staff. Libraries increasingly need staff with both a technical knowledge of media, software and new technology, and social knowledge of how to maximise diverse users' engagement with this technology in relation to the library's other facilities. We emphasize that such skills are not only those that can be appropriated in short-term training, as already accounted for in the Vision 2017 Learning Strategy (SLQ 2013). The success of new programs depends to some extent on a new type of staff member who combines the skills of a creative producer and the technical facility with archives that has been the historical role of the librarian. Not every library is in a position to fund, attract, and retain such staff.

Concomitantly, the new digital context is also generating new forms of disadvantage, and therefore new kinds of institutional responsibility. As public institutions with a mandate to 'uphold civic values of access, diversity, equity and a culture of inclusion' (SLQ, 2013: 2), libraries' futures are undeniably shaped by the claims of new actors entering the public realm. Libraries are strongly impacted by social shifts brought about through changing migration patterns, economic insecurity and the ongoing recognition of marginalisation that prevents many constituencies (including the disability sector, the homeless, and Indigenous communities) to fully participate in public culture. How can libraries help to ensure broad access to digital infrastructure and the development of skills to participate in digital culture?

In addition to broadening their user base, libraries face a challenge in expanding their constituents' use of their services. How do libraries encourage the uptake of new technologies beyond a service demand model in which they supply the services and resources that users already know how to use? How do they encourage more critical and creative use of digital technologies, and develop capacities crucial to fully participating in a digital public sphere and a digital economy?

ABOVE IMAGE: CABOOLTURE LIBRARY. IMAGE COURTESY OF STATE LIBRARY OF QUEENSLAND. PHOTO BY KILN.

Research Methodology

Literature review

The review surveys current literature addressing how public libraries in Australia and overseas are responding to a shifting digital ICT landscape. It concentrates primarily on academic literature from the fields of library and information technology studies, with a few sources from professional publications and reports. The literature surveyed draws from North American, British, Scandinavian and Australian research, and includes a particular focus on libraries in Australian Indigenous communities. The contrast between metropolitan, suburban, rural, remote and traditional contexts was intended to reflect the breadth of the Queensland library network and the different challenges and opportunities arising from its diverse settings and constituencies.

The literature surveyed here includes historical studies, ethnographic case studies, practitioner guides, interview transcripts, policy analyses, practice-led research, empirical studies, reports and theoretical research. This variety in approach, scale, and method suggests the complex ways digital technologies are impacting upon the library as an institution. Such multifaceted forms of enquiry are necessary to gain purchase on how this new era is manifesting in everyday lived experiences, the institutional and managerial challenges it raises, and its broader sociocultural and political significance. Additionally, an overview of Queensland's network infrastructure is based upon a number of policy documents, government and corporate reports and governmental data.

Ethnographic fieldwork

The ethnographic research involved one week of fieldwork carried out between Monday 3 August and Monday 10 August 2015. The Queensland fieldwork was conducted by Danielle Wyatt, and included five interviews with library staff and ten site observations at contrasting locations across Queensland. Due to library operational requirements staff are anonymous and all uncited quotations are from these interviews. Transcripts are available from the report authors for verification. An additional email interview was conducted in Melbourne by Danny Butt with Tony Brown (Public Affairs Manager, Corporate, NBN Co).

Interviews were conducted as semi-structured conversations, giving the interviewees space to expand upon issues that were important to them, or to bring up ideas and observations that we had not anticipated in our questions. All of the interview subjects were very generous with their time. Most spoke to us for over an hour, generating transcripts between 20 and 30 pages in length. These discussions with experienced professionals with a deep knowledge of their field have elicited valuable and unique data. This data both complements and expands upon the available literature on the relationship between public libraries and digital technologies. It contributes to painting a rich portrait of how library staff are managing this relationship and will help the researchers sketch out what might be possible for libraries in the future.

Sites were selected in order to examine the digital infrastructure, technological resources, community needs and library practices across contrasting social and geographic contexts in Queensland's library network. Highly resourced metropolitan libraries like SLQ and Brisbane Square Library were contrasted with more suburban libraries in Logan and the Gold Coast, and these sites were compared with the suburban and inner-city libraries of a regional centre such as Townsville. Ngulaig Meta was selected to examine the extent of digital infrastructure and library use in a remote location such as Thursday Island.

This selection of library sites covers a range of new and older libraries in order to examine how digital technologies are impacting upon library design and architecture. Helensvale and Upper Coomera libraries are less than three years old and The Edge opened in 2010. These libraries can be contrasted with a smaller, older library like Hyperdome Library in Logan, or Aitkenvale Library, built in the 1970s but now significantly refurbished.

It was also particularly useful to compare two or more libraries within the same city. For example, though geographically proximate, SLQ and the Brisbane Square Library have very different atmospheres and very different patterns of use. This contrast relates to not only the spatial arrangement and location of each library, but also about the differences between users. Library users on the CBD side of the river visit the library for short periods between work hours, while users on the cultural precinct side of the river spend dedicated and prolonged time in the library space. These different cultures of use demonstrate the way in which the same technologies and infrastructure (Wi-Fi, screens, Internet terminals, powerpoints for mobile devices) can support and shape different behaviours.

Although the tight timeframe for this project did not allow for research into one of Queensland's Indigenous Knowledge Centres, fieldwork at Thursday Island gave some insights into the particular needs and practices of Indigenous library users in remote communities.

Observation Sites

Brisbane (State Library of Queensland, The Edge and Brisbane City Library);

Logan (Logan City Library, Hyperdome Library);

Gold Coast (Helensvale Library, Upper Coomera Library);

Townsville (Aitkenvale Library, Flinders Street Library);

Thursday Island (Ngulaig Meta).

The Digital Divide:

Access, connectivity and digital literacy

The term 'digital divide' evolved out of a 1995 American government study of Internet adoption and use across the United States (Jaeger et al 2012). It initially incorporated varying degrees of access to hardware, software and other digital infrastructure, but has subsequently come to also focus on capacity to use these technologies— on digital literacy (Jaeger et al 2012; Thompson et al 2014). For Jaeger et al, the digital divide means that the roll-out of digital technologies have compounded existing forms of socio-economic inequality. An 'explosion of personal technology' has exacerbated the disadvantage of some U.S. citizens due in part to the prohibitive costs of owning these devices. For Watkins (cited in Jaeger et al 2012, 2), the digital divide is experienced less as a problem of access, and more in terms of digital literacy:

> I think about 15 years ago when we used the term digital divide, we were talking largely about the question or the concern around access to technology. Fast forward about 10 or 15 years later to 2011, and now when we talk about it I think it's less about access to technology and more about participation.

The abundant literature around this issue and the many institutional programs addressing digital literacy reflect this awareness that having access to technology and the skills and knowledge to use it effectively are now fundamental to participating in society as a citizen (Thompson et al 2014). In the Digital Literacy Forum hosted by SLQ in 2015, John Gray from the Digital Economy and Policy Unit of the Department of Science, Information Technology and Innovation, framed the government's prioritization of digital literacy in economic terms: jobs are advertised online and employees need to navigate these sites, build profiles and access employment networks through the Internet; maintaining a job requires the ability to use mobile devices and to navigate oneself around a digital space (Gray 2015).

As government services increasingly migrate online, the level of disadvantage in not being able to access digital resources is accentuated.

In the discussion below, we first consider issues of access to devices and networks, and then issues relating to digital literacy – from fundamental skills to achieve functionality in a digital culture, to the more advanced uses that might support a critical digital literacy.

Libraries and Digital Access

Libraries are seen as vital sites for bridging the digital divide (Kinny 2010). They are frequently the only spaces providing free public access to digital resources – computer terminals, broadband, Wi-Fi and software – as well as offering the education and training necessary to navigate them. Jaeger et al (2012) provide a range of statistics revealing the role libraries in the United States play in providing access to disadvantaged populations. Almost all US public libraries offer free Internet access. Of these, 64.5 per cent are the only providers of free Internet for their communities (Jaeger et al 2012, 11-12).

Sweeney's State of a Nation Report (2014) found that 77 per cent of the Australian population have a smart phone and 81 per cent have broadband at home. Despite these relatively high figures, this means around a fifth of all households in Australia did not have access to the Internet via a broadband connection (ABS, 2014).[1] Moreover, only 57 per cent of low socio-economic households have access to the Internet (ABS 2014).[2]

[1] The most recent ABS figure is 23%. The ABS uses an encompassing definition of broadband as any Internet service that is not dial-up access, rather than a definition based on specific download or upload speed.
[2] Defined as households with annual income less than $40 000.

ABOVE IMAGE: UPPER COOMERA LIBRARY FOYER

In addition, the affordability of digital access in Australia is relatively low: Australia ranks 49th in world rankings for digital affordability (Digital Australia 2014).

For these reasons, libraries in Australia are still fulfilling a vital function of providing disadvantaged sectors of the population with basic access to computing and the Internet. The Australian Library and Information Association (ALIA, 2013: 3) describes 'Internet access as a core public library service'. The Australian Public Libraries Statistical Report (State Library of Queensland 2014a, 5) states that in 2012-13, 'there were 10,255 public access Internet terminals provided within Australian public libraries, rising by 18.5% since 2008-09'. More than 70% of public libraries provide Wi-Fi in the library. (ALIA 2013: 3) However, at least a quarter of the 820 public library service points surveyed by ALIA in 2011 did not offer this service at all (2013, 7), while most others restricted access to opening hours only (2013: 2). Cost and IT technical issues were the primary reasons given for restricted services.

- **Public access to networked computers is still important for a significant sector of the Australian community who lack a household connection**

- **Internet access is an attractor that brings new and repeat users to the library.**

These two points apply particularly in areas where there is less home-based Internet access. For instance, on Thursday Island only a few locals have Internet access at home. While many own mobile phones, few have smart phones. In this context, most respondents emphasised Internet access as a key resource that brings non-users to the library, particularly free Wi-Fi, and personal computers for public access.

Some of our respondents were surprised that the demand for public Internet terminals has not diminished. 'We've actually surprisingly found that there's possibly more demand... I had my reservations about the number of public PCs, because we'd put 26 or 27 public PCs in. And I thought, 'Well, I don't actually know if we're of that world any more where we need banks and banks of PCs'. But they get filled pretty quickly – quite a lot.'

BELOW IMAGE: UPPER COOMERA LIBRARY TERMINALS

Providing digital resources in the library is an ongoing challenge, in the face of strong demand and falling budgets. ALIA (2013) report that over a third of the computer terminals in Australian libraries were more than three years old and would need to be replaced soon. In addition, library buildings often lack the spaces for adding additional terminals and infrastructure, or are poorly equipped with electrical outlets (Jaeger et al 2012; Norman 2012; Butland 2015). This compromises capacity to provide the kinds of services that patrons are seeking. 'We've had to just put in another 140 new power points. […] [P]robably a fairly common thing across libraries is people that bring in their own devices and they want to charge things while there. And they might be multi-tasking, so they might actually be actually using our public PCs, but they want to be able to charge their phone at the same time or, you know, download something to their Kindle while they're in the library spaces.'

Loanable or rentable tablets are becoming an increasingly important part of library digital literacy programmes targeting those without access to network devices in the home.[3] Tablets are preferable as lent equipment because their operating systems require less maintenance than computers, and can be more easily re-imaged to their factory settings in the case of failure. In some libraries small-scale, loanable iPad programs, initiated through State Library grants are deployed as a way of developing local content. In Logan, migrants and refugees who attended the library's English conversation circles were given iPads to tell their stories, with the assistance of library staff. At Helensvale, loanable iPads were also used as part of a visual story telling initiative, such as in the Suburban Snaps project that produces a 'record of the Gold Coast'.

In these instances, loan programs for mobile devices are conceived in terms of enabling users to develop specific content. In terms of digital literacy and access, there is a broader question about how users respond to a more open loan program, not tied to any particular creative output.

Connectivity and the New NBN Environment

ALIA (2013) report that library users place a high value on free access to the Internet in public libraries. However, many expressed frustrations with slow speeds, insufficient terminals and restrictions or limitations on Internet access and use. ALIA suggest that only just over one third (36%) of libraries have a broadband connection, with the rest of their sample 'using ADSL' (although in colloquial use ADSL is defined as broadband). At the time of the survey, half the respondents envisaged the NBN creating positive benefits in terms of faster Internet access, improved services and the opportunity to attract new users.

This optimism was based on the original NBN plan announced by the Rudd government in 2009, which aimed to connect 93% of Australian premises directly to fibre optic networks (FTTP). The remaining 7%, including most rural and remote areas, would be connected through a mix of fixed wireless and satellite. Key features of the original NBN included:

- single network provider (NBN Co) with a layered service model
- mandated minimum download and upload speeds for fixed broadband and satellite areas

The election of the Abbott government in September 2013 led to a reconsideration of the NBN policy. The Minister for Communication commissioned a number of reports, including the NBN Co Strategic Review (NBN Co 2013), the Vertigan Review (led by Dr Michael Vertigan which produced the NBN Market and Regulation Report) and the Broadband Availability report (Department of Communication 2014) which laid the basis for moving away from predominant reliance on a custom built FTTP network towards a 'Multi-Technology Mix' (MTM) strategy.

This plan retains the national scope and universal service focus of the original NBN, but seeks to achieve this through a mix of new and existing networks, including fixed broadband, mobile broadband and satellite broadband. 'Fixed broadband' includes:

- fibre optic networks, including FTTP and fibre to the node (FTTN) networks
- hybrid fibre coaxial (HFC) networks originally built for subscription cable television services
- asymmetric digital subscriber line (ADSL) technology using the existing copper access telephone network
- fixed wireless

Mobile broadband includes broadband delivered over 3G and 4G networks, while satellite comprises broadband services delivered via orbital satellites. The proposed mix of these different delivery systems, as well as possible alternatives, are considered in more detail in Annex A – Queensland's Network Infrastructure below.

Adoption of the MTM model has a number of key implications. Mandated download and upload speeds across the entire national fixed broadband network have been replaced by a plan to prioritize NBN roll-out in areas defined as having poor or inadequate quality of access (subject to cost and network design considerations). Areas defined as already having 'adequate' existing access will no longer be remediated by fibre optic networks.

The most significant outcome of this shift in policy is that Australia's digital divide will continue to be significantly shaped by the issue of connectivity. That is, the communications infrastructure underpinning digital access in Australia will remain unevenly distributed and of varying quality, differing from region to region, and even suburb to suburb. This is significant given the ongoing rapid growth in patterns of data use, largely driven by greater uptake of online video services.

[3] Docklands library in Melbourne now offers iPad loans via a vending machine (City of Melbourne, 2014: 5).

ABOVE IMAGE: IBIS LIBRARY, PUBLIC NOTICE BOARD

The Broadband Availability and Quality Report identified a significant proportion of premises unable to access any type of fixed line broadband service. Regional and remote areas are the most poorly serviced, with fewer digital services, and slower and less dependable connectivity (DOC 2014: 4).

> Overall the analysis found that there are areas of inadequate access to infrastructure across the country – approximately 1.4 million premises (13 per cent) are in areas where fewer than 40 per cent of premises can access a fixed broadband service. The premises in this category are typically located in regional or remotes areas of Australia, or in small pockets of poor service in metropolitan and outer metropolitan areas. (DOC, 2014: 3).

However, the mere fact of access to a broadband service does not necessarily ensure high quality, with less than one third of the country able to access peak download speeds. Australia currently ranks 44th in the world for Internet speed (NBNCo. 2015). In other words, even regions with some access to ADSL are often without high-speed broadband service. Inadequate access is generally concentrated in rural and remote regions.

> In each state or territory, broadband services are generally more available and of higher quality in metropolitan areas than in regional and remote areas. (DOC, 2014: 4)

This variability—particularly the uncertain level of service for remote and rural Australia—is reflected in the different experience of the sites we visited. At one extreme, NBN Fibre To The Premises provides 'almost infinite' connectivity to connected library branches. Our respondents noted that this capacity opens the door to thinking about services and activities in a new way:

> What you're effectively saying to people, and it's the case with the NBN here, is 'don't worry about speed and capacity'. It's almost infinite for what you're doing. So don't even consider that. […] You could see the lightbulb go on. I could suddenly do my music mixing from home, because those great big files I've got could – you know, I can upload them. So if I can do that from home, I can collaborate with that guy in Barcelona that I've been emailing.

In contrast, outside of the NBN unreliable network connectivity compromises the ability to run some digital programs, as well as to develop more ambitious plans:

> I mean, it's lovely to think about these sort of concepts, but we have, you know, occasional connection problems at libraries. So I'd be really cautious about going too far into spending a lot of council money without knowing that there's going to be the infrastructure to be able to facilitate it.

At the other extreme of the spectrum, on Thursday Island, the whole town frequently loses connection during monsoon time. (Rain fade is a known drawback of satellite-based services). In more remote islands in the Torres Strait, connectivity is not sufficient to use the Aurora library database.

- **The MTM NBN environment means that libraries need to consider how they can further support access to digital networks, particularly in rural and remote areas.**
- **Uneven digital capabilities compromise the ability of some communities to access and use rich digital resources such as video.**

Functional Digital Literacy

Stratified patterns of access and connectivity are mirrored in differential levels of digital literacy. Australia's Digital Pulse (Deloitte Access Economics, 2015: 39) commented on the results of the National Assessment Program testing students ICT literacy.

> In particular, the NAP results found that students' ICT literacy varied considerably across a number of demographics. Students attending schools in remote areas, and students with parents of lower occupational and educational status, were significantly more likely to have lower ICT literacy proficiency. This may be related to the frequency of computer use by students from different socioeconomic backgrounds. While almost every Australian student had access to a computer at home, the share of students who were frequent computer users at home was lower for students living in remote areas and those whose parents were unemployed or in unskilled occupations.

All our respondents reported continued demand for what might be called functional digital literacy services: '[W]e've run a whole suite of introduction to the Internet classes and those basic digital literacy skills. […] The basic introduction to the technology classes, there's still a waiting list, there's still a need for that, and probably always will be'. Programs to address digital literacy are targeted at age-groups from toddlers to mature users. 'Digital literacy is one of the core platforms of all of our programming. […] But what we would like to see, the extension of that, is the financial literacy programs that we run to have better uptake. I think poor digital literacy leads to poor financial literacy and vice versa'. A similar concern for functional digital literacy comes through in our respondents' descriptions of assisting Thursday Islanders to navigate the Internet in order to pay bills, lodge forms and access their Centrelink data. When an increasing number of transactions – government, financial, social and cultural – occur online, functional literacy becomes vital to administering one's public identity.

- **Digital literacy has become a precondition for civic participation**
- **Libraries play a vital and ongoing role in enabling functional digital literacy**

Creative and Critical Digital Literacy

Internet access has recently been enshrined as a communication right in a number of jurisdictions, and was the subject of a recent report for the United Nations Human Rights Commission (see UNHCR 2011). At the same time, it has been argued that a citizen's communication entitlement now comprises more than the right to 'access' to information that was at the heart of Article 19 of the Universal Declaration of Human Rights. As much as 'seeking' and 'receiving' information, communication entitlement as an element of digital citizenship encompasses the capacity to speak back — which is to say to produce digital content.

As John Gray (2015) indicated in his address at SLQ's Digital Literacy Forum, functional digital literacy has a predominantly economic rationale, linked to employment and economic growth. By contrast, what we are calling creative and critical digital literacy refers to the capacity to actively shape the world you inhabit. These kinds of capacities enable citizens to go beyond taking advantage of pre-existing structures and markets, and open up opportunities for a more participatory democracy and broader social involvement in the making of culture rather than cultural consumption. These capacities are the foundations of what it means to be a cultural citizen (Ong 1996 and 2006). How, then, does the library position itself in this new knowledge context, where its traditional role as cultural repository and archive needs to shift towards an expanded role as facilitator, co-producer and active initiator of cultural and knowledge practices?

Our respondents clearly see the library's role extending to providing access to new resources and training in new techniques. More advanced digital creation programs include 3D design workshops run in conjunction with a local volunteer, coding programs directed at 'tweens, and a program run in conjunction with ABC local 'where they teach people how to record their own stories and post those up on the local ABC website'. One popular example were the Robogals: 'So they're a group of students who are doing robotics at QUT and they're all females. So it was a great way for us to introduce the idea of robotics… If they see young women who are studying robotics, then it might get them inspired to think about science and engineering and robotics as well.' Digital Hub funding from the Department of Communications has enabled some libraries to employ a new fixed-term staff member 'to do more of the creative digital stuff, like movie making, digital photography, sound recording, 3D printing, 3D design, those kind of things, which are still in that digital realm, but in more of that creative or story-telling area. So that's, I guess, how structurally we changed a little internally, that we started off running programs that we didn't offer before because of that funding.'

These kinds of initiatives are indicative of the way that demands of digital literacy are likely to shift over time. As more people gain a range of digital skills, libraries need to reconceive their role so as to continue to activate users' expressive capacities through participatory engagement. This entails developing new programs, and finding the skill base to support them, as a number of our respondents observed: 'A lot of community spaces are excited by the idea [of maker-

spaces], but then, […] - you need to have people with a certain level of skill and commitment for maintaining that gear.' Expanded skills might be drawn from new appointments, such as the creative media specialists a number of library branches have employed, but, given resource constraints, are more likely to arise from partnerships. Our respondents discussed partnerships with other libraries, with media organizations such as the ABC, with universities, with community and third sector organizations, and with various branches of government. Respondents also noted that volunteers and staff interests can also play a significant role in providing needed skills:

> We have run a CoderDojo trial for a little while, but we found that we needed a lot more volunteers to be able to run that one. But we can see that there's a lot of demand out in the community for coding, in particular. […] In one of our libraries where we're just really fortunate, we've got a lot of staff there who have a lot of interest in things like Minecraft and gaming.

Without some form of training and facilitation, digital resources are less likely to be used. 3D printing is demanding to offer because it is not 'plug and play' but needs a level of guidance. He also notes that a room equipped with a creative suite of hardware and software has been underused. 'It gets used a little bit, but probably not as much need as we anticipated.' This experience, in a location where high-speed broadband is readily accessible, underlines the fact that cultivating creative literacy requires more than the right equipment and fast broadband.

This insight informs the approach of The Edge, 'a kind of R&D lab for libraries'. The Edge emphasizes the cultural dimensions of creative digital practice. Rather than acquiring equipment and 'selling it to punters', they have taken a community development approach which 'is about building that community of interests'. This has required attention to the right kind of staffing (skills base), sensitive management of the space (see Theme 2), as well as extensive community engagement.

The Edge see it as their responsibility to export their resources and intellectual property beyond the tech-literate 'middle class white kids' who are most attracted to their services. In addition to undertaking focussed outreach toward specific communities, The Edge are now documenting all their workshops so that they can be shared online. They are also producing kits containing all the materials and instructions to run workshops anywhere in Australia. '[O]ur long-term plan is for there to be like an open source marketplace for these ideas, not to be just feeding into the system top down, from us down to the communities, but, you know … a non-centralised kind of thing.'

This approach signals a shift from centralised, top-down directed training to cultivating a DIY mentality around how to learn. It is a shift that impacts both library users and library staff who want libraries to be more than places that provide solutions to users' problems or answer their questions. This emphasizes the potential for adopting action-based research methodologies: 'The answer to that question might

be that the library helps that person do a design thinking exercise to fully develop their idea or the answer. It might be a rapid prototyping exercise, it might be a connection to that start-up community.'

This broad vision of what creative digital literacy looks like must be developed in conjunction with communities and industries if it is to be successful. The Edge's kits program and Townsville's vision for developing a new library user culture are still in their infancy. What they point to, however is a more networked, more interactive and user-directed role for the library than is currently in place.

- **In a resource-constrained environment, these partnerships are critical to accessing the technical and creative skills to deploy advanced digital resources**
- **Partnerships can assist libraries to better engage under-served communities, and can guide community-driven applications for advanced technologies and communications infrastructure**
- **Uneven digital capabilities compromise the ability of some communities to access rich online resources such as video training components.**
- **Uneven digital capabilities compromise the ability of some communities to produce and circulate their own digital content.**

IMAGES CLOCKWISE FROM LEFT: IN THE READING NOOK, KURIL DHAGUN, STATE LIBRARY OF QLD. PHOTO BY JO-ANNE DRIESSENS; CABOOLTURE LIBRARY. IMAGE COURTESY OF STATE LIBRARY OF QLD. PHOTO BY KILN; SLQ'S INDIGENOUS KNOWLEDGE CENTRE ICT INTENSIVE WORKSHOP, CAIRNS, MAY 2013. PHOTO BY SARAH SCRAGG.

Digital Literacy & Indigenous Communities

Inequalities of access, connectivity and literacy that constitute the digital divide are particularly evident in literature on libraries in Indigenous contexts. Nakata et al (2007) conducted studies of Indigenous Knowledge Centres in the Northern Territory[4], in research which would benefit from being updated and extended geographically. As well as the challenges of technological access and lack of resources – computers, patchy Internet service, hardware – these studies emphasise lack of trained staff, and support to run and maintain technological infrastructure in remote and culturally complex communities. These resources and infrastructure are all the more important in communities with the lowest levels of home Internet access in the nation.

Indigenous Knowledge Centres are organised around very different principles of knowledge dissemination and use to the Western library model. Nakata et al (2007) and Pilot (2005) emphasize that they serve an important cultural function for Indigenous communities, with technology and connectivity playing a central role. The digitization of Indigenous materials is seen as a way of garnering institutional recognition of Indigenous knowledge and heritage, and having these materials available online encourages digital literacy. Conversely, internet access has been a catalyst for addressing low levels of English language literacy (Nakata et al 2007).

Ngulaig Meta[5] plans to develop more creative programs to address digital literacy on Thursday Island. Like any form of literacy, has a cultural basis: people need to see the value and relevance of online material to their everyday lives. However, the utility of these services is highly dependent upon the robustness and reliability of the technological and social infrastructure necessary to maintain and support them.[6] In this respect it is important to note that IKCs and libraries located on islands in the Torres Strait do not have a rates base from which to generate income, except for the Torres Shire Council. This fiscal constraint inhibits each Council's ability to fund community services including libraries and IKCs.

With only a single librarian operating in a small space with limited spatial and technological flexibility (see Theme 2), Ngulaig Meta is limited in what it can offer. IKCs in the Torres Strait are even more limited: some are open only intermittently: no IKC opens on weekends and many close for lunch or only open in the afternoon. Only three offer Wi-Fi (SLQ, Indigenous Knowledge Centres, website).

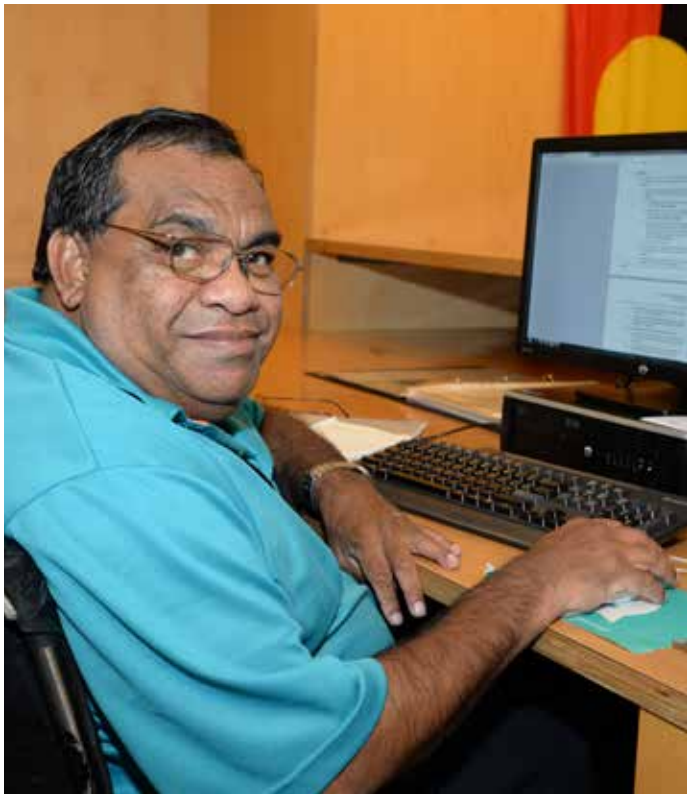


IMAGE ON RIGHT: COURTESY OF STATE LIBRARY OF QUEENSLAND. PHOTO BY JO-ANNE DRIESSENS.

Ngulaig Meta are not able to offer free Wifi and the literature on IKC's suggests that those in remote and regional areas most needing access to devices and networks are in fact facing the most uneven and constrained services: lack of computers, little or no connectivity, high connectivity costs, lack of free access to internet in the library.

- **Uneven access to digital resources is a clear constraint on the ability of Indigenous communities such as Thursday Island to benefit from the full range of services offered by the library network.**
- **The library needs to consider the potential for new strategies, including partnerships in order to help bridge the divide between urban and remote publics.**

[4] The term is Local Knowledge Centre in the Northern Territory.
[5] Ngulaig Meta is not an Indigenous Knowledge Centre.
[6] The studies by Nakata et al and Pilot are now almost a decade old and further research is necessary to establish how the Indigenous Knowledge Centres have evolved.
[7] IKCs are supported by SLQ but administered from Cairns Library.

Library as Producer of Public Culture

ABOVE IMAGE: STATE LIBRARY OF QUEENSLAND KNOWLEDGE WALK. IMAGE COURTESY OF STATE LIBRARY OF QUEENSLAND. PHOTO BY JON LINKINS.

During the 1990s, the dominant understanding of 'cyberspace' was that the virtual world formed a kind of parallel universe, disconnected from and operating under different laws to traditional social space. This understanding of the relation between digital and physical space as a dichotomy is continued by those such as Pomerantz and Marchionini (2007) who treat the digital and physical library as embodying different modes of being in place. Their forensic theoretical study argues that as digital technologies suffuse the library space and assume its core functions, physical libraries will adjust their role, by offering specialized materials not available online, as well as a space for social activity and collaboration (Pomerantz and Marchionini 2007, 527).[8]

While this approach goes some way to conceptualizing the relation between the digital and the physical, according to a model in which the digital replaces certain aspects of the physical, what it fails to recognize is the way that contemporary social encounters increasingly take place on what McCullough (2004) terms 'digital ground'. A range of more recent scholarship has emphasized the co-constitutive relation between digital technology and urban space (McQuire 2008; Shephard 2011; Foth et al 2011). In other words, social space is increasingly recognized as a hybrid space in which digital networks play a critical role not only in extending connectivity across time and space, but in mediating face-to-face social encounters. It is from this perspective that we strongly endorse the recognition in *The Next Horizon: Vision 2017 for Queensland Public Libraries* (SLQ 2013) of the library's joint role as a place of both social assembly and digital connectivity.

'We are a community meeting place. We're a place for you to engage with different types of technology.'

> The future of public libraries lies firmly in continuing to provide physical and virtual spaces for people to engage with learning, ideas, literature and most importantly, each other.
>
> The Next Horizon: Vision 2017 For Queensland Public Libraries.

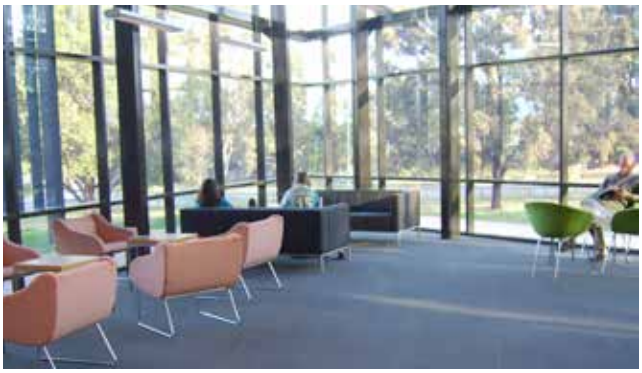
This broad understanding informs the approach of Bilandzic and Johnson (2013) and Bildanzic and Foth (2013) in considering the way digital technologies in libraries are producing hybrid spaces merging the digital and the physical. In their practice-led experiments conducted at The Edge in Brisbane they tested how ambient media applications augment the physical experience of being in the library by amplifying co-present users' sense of the user community around them. As background to their study, Bilandzic and Johnson (2013) proposed two distinct models for augmenting the permeability of physical space with digital technologies:

- **Commons 2.0** draws from design discourses and involves refashioning the library space to accommodate different modes of use. Bookshelves are replaced with couches, lounge areas and cafes. Furniture can be reconfigured and free Wi-Fi enables flexibility of use, from collaborative work to individual study to social interaction and serendipitous encounters between strangers (261).

- **The Participatory Library** adapts the technologies and sensibilities cultivated through social media to the library space. 'The discourse around such new library models fosters the evolution of the library's role away from being a "gatekeeper" of books towards being a facilitator for learning and knowledge' (261).[9]

These models underline the reciprocal impact digital technologies and physical space make upon each other. Changes to physical space can have just as much impact upon how people interact online as the online environment is having on physical library space. Far from dispersing the library as a situated place, digital technology has made the physical space of public libraries even more crucial to their appeal and utility.

This was evident in our research, as staff have sought to make libraries comfortable and attractive for a variety of different users. Furniture and diverse forms of seating have proliferated in public libraries — small desks for solitary work, lounges near window bays with low tables for digital devices, long desks for group work, couches for older users to read magazines, café-style tables and chairs for a small group to hover over a laptop or iPad. At new suburban libraries like Helensvale and Upper Coomera, at older libraries in Logan, at metropolitan libraries like Brisbane City Library and SLQ, the full variety of these spaces are occupied. Screens and digital devices are everywhere in these scenes, fully integrated with the library space, and are a primary reason for users taking up residence.



> Libraries offer hybrid spaces that provide unique opportunities for integrating community assembly with new activities supported by networked digital technologies.

[8] See also Aabø et al 2010.
[9] See also Bilandiz and Foth 2013; Bilandiz and Foth 2014.

Spatial Flexibility

In a digital culture, both technological affordances and user expectations are requiring libraries to invest in new, more flexible spaces. This is evident in the expansion and diversification of library spaces in new libraries like Helensvale with an auditorium, dedicated media lab, rehearsal studios, dance studios, meeting rooms as well as the 'traditional' library space for books, magazines and other borrowing materials. For Leo Clayton, these spaces make the library 'flexible enough to cope with a different audience and different needs'.

At Helensvale in particular, attractive and versatile external spaces, such as a spacious forecourt with amphitheatre seating, have allowed the library to engage with the public 'outside of the four walls of the library itself.' Soon after opening, the library ran Linking You Locally in which non-profit community groups from the area were invited to set up stalls outside the library, interwoven with bands and kids activities. More recently they ran The Big Green, a one-day event mostly held outdoors that promoted sustainable living. Leo Clayton reports that these sorts of events, combining community organisations, entertainment and the general public, routinely attract 500-600 people. They suggest how external amenity can be used to create a larger public around libraries, activating a public sphere deeply embedded in local communities yet attached to national debates like sustainability and the environment.

Our respondents noted that greater emphasis on running events and workshops demands different provisioning of interior library space:

> [W]e've had to purchase a lot more furniture. We've taken away reference sections basically, so that we can put in more lounges and comfortable chairs, so people can just sit down and plug in and use their own devices here.

Increasingly important are spaces that enable co-working and collaboration, whether for community groups, those running a small business or for students. 'They want to have a table where they can all plug in and, you know, use their devices together.' The Hyperdome also hosts a large screen available for collaborative work.

The new reliance on spatial flexibility is nowhere more evident than where it is on short supply, such as in less resourced libraries like Ngulaig Meta, which struggles to accommodate the different needs of its constituents in a single-room space in which noise and silence, collective activity and individual concentration cannot be easily accommodated at the same time. Ngulaig Meta has a large screen, and uses it to show local content such as photos from the annual Mabo Day celebration, but cannot screen a film without disturbing other borrowers. To run specialised workshops Ngulaig Meta would have to close the library to general users. The one small table and chairs are almost always occupied, and users—particularly students—often call to book the table for an afternoon.

The library space is being leased by Torres Shire Council from Thursday Island's local IBIS supermarket and is co-located in the same building. While proximity to the supermarket has attracted extra users, co-location brings some drawbacks. IBIS staff use the space as a thoroughfare to access the toilet or exit the building, disturbing the atmosphere of the space. Trade-offs are involved in having a space sponsored by, or co-located with, a local business. While these relationships can add value to both parties, they can lead to a loss of independence for libraries and an inability to control the use of their space.

However, even libraries with better space resources are increasingly faced with the need to make choices: expanding spaces for 'non traditional' library uses often means bookshelves and collections are being reduced, or resituated in less prominent locations. Hyperdome Library in Logan has cleared an entire floor of the library of books and turned it into the TLC Lounge.[10] Here, people can use the 3D printer, make music or browse ebooks on large, desk-mounted screens.

IMAGES FROM L-R: HELENSVALE LIBRARY FOYER; HELENSVALE LIBRARY MEDIA LAB

[8] TLC stands for Tech Learn Create.

Separation or integration?

Our site observations confirm that the arrangement of library spaces has a big impact on how these things are used, and who the likely users are. At Aitkenvale library, non-traditional equipment is locked away in small rooms, visible to the public but distinctly separate from the main library space. The library is well resourced with four or five 3D printers, as well as tablets and e-readers. Staff are encouraged to treat this space like an R&D lab and 'try things out'. However, this is very much an ad hoc process and there has not been much public uptake yet. Downstairs in another separate room the library has installed recording equipment and a microphone. None of these spaces were occupied at the time of our visit.

By comparison, Hybperdome's TLC Lounge was bustling on a weekday afternoon. The 3D printer sat at the centre of the Lounge, slowly printing out a labelled orange key-ring. An elderly librarian came up to us as we looked at it. She showed us a bag of colourful trinkets and objects designed by library users and printed on the library's Makerbot Replicator 2. At the back of the room, a man absently played a few notes on a keyboard sitting amidst a small nest of other music-making equipment. The sound mingled with the sounds of computer games and videos being played by school children on a cluster of nearby terminals. Tthe visibility and openness of all this equipment made it appealing and non-threatening to try out. Perhaps mixed up together, in the presence of young and old users, people feel comfortable experimenting as amateurs. Interaction design theory emphasizes the importance of new users being attracted to do something by watching others (Brignull and Rogers 2003).

Keeping new media separate, out of sight of general library users, militates against this kind of contingent, snowball learning. It favours a more specialized pattern of usage—fine if there is a community to take advantage of this, but less appealing for a general public that might become interested if the situation allowed.

- **Location of digital resources in central or well-used library spaces can promote their uptake**

- **Where co-location is not possible or desirable, more conscious strategies to drive public uptake need to be considered**

Makerspaces

Britton (2012) surveys the various kinds of makerspaces emerging across libraries in the United States. She charts the transition of libraries from 'collecting in an era of scarce resources to curation in an era of overabundant ones' to 'co-creation': providing the tools for users to create, learn, share and shape their own cultural worlds (Britton 2012, 1). For many makerspace programs and their advocates, these programs are about cultivating new forms of learning for a digital world, and fostering a 'spirit of entrepreneurship within the community' (Britton 2012, 4). He cites Bleiweis: 'No longer is it normal to go to college, graduate, interview, and be taken on by a big company. We are instead looking to ourselves and saying, "What can we think of? What can we create?" ' (Britton 2012, 4).

This underlines the fact that makerspaces are as much about cultivating new attitudes around cultural production as they are about providing resources for creative activity. This sensibility comes through strongly in The Edge in Brisbane. Where Britton emphasises the 'entrepreneurial' focus of makerspaces, The Edge is informed by a broader philosophy around access, diversity and multidisciplinary practice.

The Edge's investment in digital infrastructure, new media, specialized spaces and equipment goes hand in hand with a comprehensive strategy for cultivating both a diverse creative community and new forms of cross-disciplinary practice. 'Arts, science, technology and enterprise… they're not silos'. The Edge also aims to develop relationships with specific communities. 'One of our strategic goals … is about giving access to people who wouldn't normally get access'. As an example, The Edge highlighted a partnership with public radio station 4ZZZ which provided training and recording facilities to migrants with irregular visa status so they could produce their own radio programming. 'So these guys are learning, and they all come from backgrounds with very sophisticated careers and practices in their own disciplines, have come out here and can't get involved in anything because of their status'.

The Edge's 400-500 workshops a year, run by contracted industry experts, are designed to incrementally extend users' skills and investment in the space and its facilities. After a free introductory workshop, users can sign on to a 3-4 hour workshop costing $35, and then a 5 hour workshop at $75. The philosophy is one of 'scaffolding up', in terms of skills offered and commitment demanded. More than simply using resources, The Edge have integrated the space with a staffing strategy to stimulate cross-disciplinary collaboration.

IMAGE ON LEFT: NGULAIG META, STREET ENTRANCE

The importance of human resources was a feature of our discussions at The Edge:

> One of the things that really makes the whole thing work is we have a team of casual visitor services officers, so they're like our front of house staff. They run the café and they're also here to help people with bookings, but also can give really basic advice with the software. And they also – the café, you know, you get to know what people are doing – can make recommendations about people to collaborate with … [W]hen they were first talking about the building [the plan was], you know, you just have a coffee machine here. But we fought really hard to have, you know, some soft infrastructure in the space.

The Edge is not just seeking to respond to the existing needs of the public in a digital culture. Rather, they are actively seeking to catalyse new forms of cultural production. This resonates with the ambition Britton identifies for makerspaces in which users are assisted to shape their own cultural worlds. In practical terms facilitating this kind of cultural mindset requires a combination of structured and unstructured programming. From formal workshops to informal meet-ups (like Hack the Evening where diverse makers come to share experiences, techniques, or seek advice), to casual visitation, users find their way to different facilities and new collaborations and creative possibilities through being in an adaptive and inviting space, attracting diverse practitioners and mediated by skilled staff operating in a multifaceted capacity.[11]

Gaming in the Library

A number of our respondents discussed the success of gaming and gaming days in attracting young people to the library:

> Things like games, after school time, we find that there are a lot of kids who will come and use the spaces … Yeah, Scratch Computer Gaming Club.[12] So it's basically learning how to make their own games … and it is our after-school crowd that come along and take advantage of that one. [...]
>
> It seems to be the thing. So we're using Scratch at the moment to teach [young people] coding. We have a regular Minecraft club, so that's just for them to come down and just play Minecraft for an hour, and we get 20-odd kids every Monday afternoon to that.

The novelty of activities such as gaming and coding, and rapid shifts in what is popular and attractive to children, mean that libraries are compelled to seek out new skill sets in order to keep up with demand. At Logan, they have been fortunate enough to have a number of staff with an interest in games (at Marsden Library). Other gaming programs have been run using volunteers, but this can make them precarious, despite the high demand: 'We have run a CoderDojo trial for a while, but we found that we needed a lot more volunteers to be able to run that one'. The Scratch program is being run through a partnership with State Library and QUT.

The entry of new activities such as online gaming into the library space of the can challenge its traditional perception as a place of learning and knowledge. Acknowledging some negative feedback, our respondents defended the new programing as a way of catering to the current interests of young people. 'Twenty years ago we ran chess clubs, or you know, sewing circles or whatever we did that were young people's interests, and now the young people have digital interests'. Providing gaming in the library is about being 'proactive' in the context of a leisure and consumer culture: 'We have to look at what would the reasons be as a parent to come to the library instead of taking your kids for a day to the fun park or something'. Yet respondents also emphasised the educational value of these kinds of activities. 'We like our programming to have a purpose so that it's not just, you know, entertainment, there should be some sort of a learning component to it as well'.

These differing orientations are emblematic of divergences in the literature around libraries and gaming. Cilauro (2015) presents an ethnographic case study of a Minecraft Gaming Day for children at a suburban library in the culturally diverse neighbourhood of North Melbourne in Victoria. Children collaborated in the design and programming of the day, as well as being participants in the day itself. Through participant observation, Cilauro describes how the usually quiet and sedate library space is transformed by activity, movement and noise. Technological obstacles – insufficient computer terminals for all the children; computer speeds too slow to accommodate the game; inadequate connectivity – did not necessarily diminish the experience for the children. Rather, these obstacles encouraged sharing of resources and increased the sociality of the day. Cilauro's study indicates two relevant insights. First, gaming is not simply about being either educational or entertaining, but is also about socialization and building community around the library. Second, time-share frameworks can be used to shape the different ambience of practices in library space as much as spatial design. In a small suburban library that lacks flexible furnishings and spaces, programming different activities into specific timeslots can make the library amenable to new uses and new users.

- **Gaming is a strong attractor for younger library users, and can offer a range of affordances, including entertainment, education, social interaction and community building**
- **Collective activities such as Makerspaces and gaming require creative strategies for managing library space and adjudicating between needs of diverse users**

[11] See also Torrone 2011; Norman 2012.

[12] Our respondent describes Scratch as a 'free programming language and online community where you can create your own interactive stories, games, and animations'.

Libraries and Public Wi-Fi

One of the most interesting and significant examples of the hybridity of digital and physical space is the growing role of public Wi-Fi in providing network connectivity. Public Wi-Fi includes free services provided by councils and public institutions, services for patrons offered by businesses such as cafes and shops, and services offered by telecommunications companies such as Telstra's roll-out of TelstraAir, a large Wi-Fi network accessible to subscribers or for a fee.[13]

As we have described earlier, most Australian libraries now offer Wi-Fi services within their buildings (ALIA 2013). These services supports flexible use of library spaces, enabling people to bring their own devices in order to enjoy network access through the library. However, other than libraries in larger metropolitan centres, there has been little systematic exploration of extending Wi-Fi deployment beyond the bounds of the library. Why is this worth considering?

Research in the US has found that Wi-Fi attracts more people to public spaces, potentially making these places more vibrant (Hampton, Livio, & Goulet, 2010). This finding has been supported by some small-scale research in Australia (Lambert, McQuire and Papastergiadis 2013; 2014) which found that public Wi-Fi services were regularly used by groups including mobile workers and students, travellers and the homeless.

The advantage of public Wi-Fi services over more widely available cellular data services such as 3G and 4G is related to issues of capacity and cost. Cellular mobile broadband sacrifices throughput capacity for roaming ability. Wi-Fi, on the other hand, allows higher localised throughput. Although Wi-Fi networks can be meshed to cover large areas, and roaming systems do exist, Wi-Fi usually remains a localised phenomenon. This gives it the ability to transform specific places, providing network resources that are less susceptible to congestion. Also, unlike cellular services, free Wi-Fi networks hold no financial cost for end-users. Hence, Wi-Fi remains a viable means of attracting people to specific places and hence enhancing them.

Our fieldwork confirmed the popularity of Wi-Fi offerings in Queensland public libraries, with respondents noting that Wi-Fi has 'certainly' brought new users into the library, and has enabled younger users to see the library as a regular destination rather than just a place for doing homework:

> [W]e didn't have a huge teen population at the old library [but] as soon as we opened the doors, you know, from sort of day one you saw this huge increase in people – young people coming after school – and that's been really heartening. […] There's a couple of really popular Wi-Fi spots. Those concrete stairs just under the artwork as you come in are quite popular. We've also found right up the top of the building is – if you take the public lift as you came in all the way to level 2, there's a mezzanine seating area.

However, with the exception of SLQ and The Edge, none of the libraries we visited have sought to systematically deploy their Wi-Fi service into public space surrounding the library. At Logan, the Wi-Fi network extends about 100 metres beyond the building but is shut down after opening hours. Similarly, at Aitkenvale Wi-Fi 'spills' into the foyer and outside in an ad hoc way, but the service turned off automatically at 10pm. One respondent noted:

> We used to have it on 24 hours a day and we used to have people hanging out all night, literally. That caused vandalism and some social problems. […] The vandalism wasn't bad, but there was damage and spray painting and things. So one arm of council says, 'No, we can't have this'.

The popularity of all-night Wi-Fi is especially relevant to the growing rates of homelessness: 'It's largely hidden. It's not like you'd see on the streets of major capital cities, but there is a homeless population. It seems uncommon if they don't have a smart phone, a tablet or a laptop. They do.'

IMAGES L-R: AITKENVALE LIBRARY ENTRANCE; AITKENVALE LIBRARY, STREET VIEW

[13] https://www.telstra.com.au/broadband/telstra-air/how-it-works

This observation is backed up by other research in Australia (Humphry 2014) and the United States (Miller 2015), which has documented the importance of mobile phones and Internet access to homeless people, who use them to interact with government services, with Centrelink, or with family and friends. For instance, Humphry (2014) found that 95% of homeless people had a mobile phone, with 77% having a smart phone. The most important reported uses of mobile phones outside of contacting family and friends were contacting emergency services (52%), support services (49%) and medical assistance (48%). Despite the importance of network access, Humphry found that many homeless people had difficulty staying connected for reasons including lack of credit and power restrictions, exposing users to significant risks. She also found that users had developed a number of strategies for gaining network access:

> [A]lternative Internet sources such as free Wi-Fi hotspots and Internet access in public libraries and accommodation centres were key measures for keeping costs down and staying connected (Humphry 2014: 3).

In this context, extending Wi-Fi services into public space surrounding the library, as well as extending service hours, are options worth considering further. They offer the clear social benefit of providing better Internet access to needy populations such as the homeless.[14] In addition, public Wi-Fi has the potential to offer specific benefits to libraries themselves. A number of our respondents discussed the gap between the range of digital services that libraries currently offer and public perceptions of the library still based on book lending. Public Wi-Fi might be a strategic way of enhancing public awareness of how libraries have changed, and promoting the new digital services they offer.

Public Wi-Fi not only has the capacity to attract new users who might not otherwise cross the library threshold, but can also help to create a buzz of digital activity in the public space surrounding the library. This will foster a changed public perception of the library.

Any such extended deployment needs to be sensitive to the key issues identified by Lambert et al (2013) as critical to successful public Wi-Fi: namely, the 'place-attributes' of the surrounding space, and the provision of a 'user-centric' service. The former refers to spaces that provide some capacity for shelter and shade, including formal or informal seating, access to food or other attractions (including the presence of other people). The latter refers to quality of service, including connection, restrictions on browsing and use, and download caps.[15]

- **Public Wi-Fi offers a valuable means of extending digital access to the general public**
- **Public Wi-Fi can also assist in extending the library's visibility as a public facing, technologically-enhanced institution**

[14] This fits Humphry's (2014: 5-6) fifth recommendation for government and support agencies: "Work in partnership with mobile service providers, libraries, local councils and service users to develop and promote affordable Internet access and provisioning solutions that integrate with where and how people experiencing homelessness use digital technology (for example, fixed Internet access points and self-service terminals, Wi-Fi hotspots, options to switch to available Wi-Fi services, low cost and pay-per-use mobile broadband, power recharge stations and shelters for safely storing equipment').

[15] Lambert et al (2013: 21) conclude: 'Obviously not every place is suitable for a Wi-Fi service. In particular, a service should not be provided if the aim is to 'attract' people to a poorly functioning space. Rather, municipal Wi-Fi should be seen as a means of enhancing spaces that already attract the public'.

Libraries and Contemporary Public Culture

Balancing the Past and the Future

Since their emergence in the mid-19th Century, public libraries have had to accommodate diverse stakeholders and balance divergent interests. Poised between everyday and institutional cultures, public libraries negotiate between individual needs and broader policy agendas, and, increasingly, between embodied and more abstract 'imagined communities'. Digital technologies and participatory culture instil a new complexity to maintaining this balance, particularly as emergent technologies for accessing and creating content challenge aspects of the library's traditional role and demeanour (Brundy 2015; Homberg et al 2009; Norman 2012; Black and Pepper 2012).

For those such as Torrone (2011), digital technologies warrant radical and immediate transformation of the library as institution. In order to stay relevant, Torrone advocates a 'total rebuilding and retooling' in favour of technical shops, hackerspaces, laboratories, makerspaces and fablabs. In this vision, the library's historic role as a repository of public culture is given over to a new logic of production, creativity and enterprise, with the skilled individual user placed at the centre of the world they inhabit. In contrast, Librarian of Congress James Hadley Billington (1998) positions digital culture as a threat to the library's historic role as the custodian of shared knowledge.

> The idea of knowledge-based democracy is threatened, in a peculiar fashion, by the information flood generated by the new technologies and by the overwhelming advance of the audio-visual, multimedia world. (Billington 1998, 12).

In this 'time of change', Billington (1998, 16) argues that libraries 'must be gatekeepers to useful knowledge – opening windows to the wide world outside'. Torrone and Billington represent extreme ends of a spectrum of debate seeking to determine how libraries should respond in the face of digital culture. On the one hand, libraries can seek to anticipate and accelerate the uptake of digital technologies, reshaping themselves around discourses of creative industries, the 'prosumer' and the knowledge economy. On the other hand, as trusted institutions deeply embedded in the fabric of modern democracies, they can seek to retain their value by acting as filters for the overwhelming 'flood' of information in which citizens now swim.

While it is attractive to suggest that a balanced response should be based on adopting elements from each position, this solution should not obscure the real tensions— both philosophical and practical— that they embody. How do libraries remain relevant and attractive to a new generation of users disposed towards 'customization and interactivity' (Holmberg et al 2009, 669), while maintaining what Hicks (2013, 6) calls a 'trusted environment' capable of embedding the shared values and common knowledge frameworks integral to the functioning of a modern liberal democracy? This dialectic between a historical state-sponsored, public institution oriented around universal service provision and an emergent new ethic of civic engagement through specific communities of 'citizen-consumers' is evident in much of the literature in the field.

> 'I think it gets back to trying to be ahead of the curve of what are we anticipating. So that we can design and build services or resources to meet that need, so we maintain those high levels of service.'

> "We try not to react too much, we try to be fairly proactive."

Central to the question of balancing continuity and change is the long-term impact on libraries of a digitally-enabled younger generation for whom digital technologies and social media not only form some of their earliest memories, but shape core attributes of their sense of self. For libraries, then, there is no way back — even if this were desired. The question is how to move forward.

The tastes, needs and capacities of 'youth' are already strongly influencing library programming. Gaming days, robotics workshops and movie marathons were all nominated by our respondents as successful events. But our interviewees also emphasised the growing need to anticipate change. As one of our respondents put it:

> I think with a proactive approach to engaging the community and running the library, you have to have that flexibility that things might not work straight away. But I think you give everyone the opportunity to develop ideas … and over time it'll start to snowball and it will flourish eventually. Otherwise we do run the risk, if we stay too reactive, we jump on board too late.

This demand to anticipate change brings a number of challenges. Before committing too many resources, libraries need to distinguish between a transient fad and a trajectory with more lasting and widespread cultural impacts. Libraries also need to balance between investment in new offerings and provision of traditional collections and services. One of our respondents suggests that the library is 'at a bit of a cusp in terms of our service delivery … We have to provide traditional services in terms of books, borrowing, loaning and reference services. But at the same time, we recognised that we had a unique position with the building that we've got [and] that we should be increasing and encouraging more community engagement'. Finally, all of our respondents emphasized how deeply ingrained images of public libraries as silent, book-lined places have persisted amongst the general public: '[People] come in and go, you know, "I haven't been into a library for 20 years and they weren't like this when I was young."' Another respondent adds: 'So if we don't do different things to change that perception, we're going to be lost.' This challenge is partially demographic. It relates to questions around how to bring under-represented users into the library and make it relevant to them: working professionals in their 40s; 'youth' between the upper-teens and early 20s; those who are not 'inner-city elites' in the case of a creative hub like The Edge.

> 'We're really good at thinking something's cool and it's not. I think that's […] the other challenge for libraries.'

Libraries as a Trusted 'Third Place'

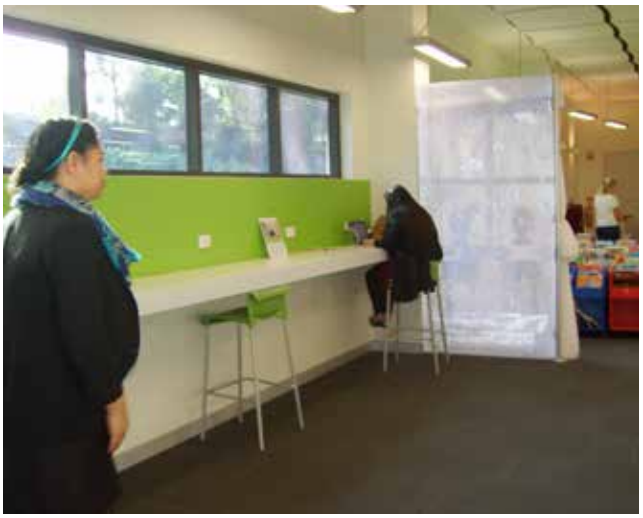
Historical studies of libraries emphasise that their value has not only been pedagogic, but is also a function of the sociality they offer to their users (Billington 1998; Black and Pepper 2012). Our research not only confirms the continued relevance of this function, but suggests that it holds increased importance in the present. It is worth providing a brief rationale for this observation.

While the literature on Library 2.0 has described the many ways social media, new design, gamification, and maker culture is transforming the library's professional role and the practices of its users, it often fails to link these changes to broader policy agendas such as cultural citizenship and multiculturalism as constitutive of national narratives in a globalized world. A small body of literature has attempted to think about the library in these broader terms, but without fully integrating the reconfiguring impacts of digital culture on the library's social democratic mandate. For example, Audunson's (2005) theoretical study develops a conceptual framework for understanding the library's role in a multicultural and digital context. For Audunson, the library exemplifies Habermas' theory of the public sphere: it provides a 'secular, rational space, independent from the state as well as from the market. It is constituted by the public's communicative action and it is a precondition for democracy and democratic discourse' (434). Drawing from examples in Norway and Denmark, Audunson argues that public libraries provide vital 'low-intensive' meeting places where newcomers such as migrants, the marginalised and excluded can gradually foster forms of belonging through low-stakes forms of participation.[16]

In a similar vein, Vårheim et al (2008) explore the way the library builds trust through the face-to-face encounters of the diverse communities who use it. They also argue that the library's institutional status builds a more generalized kind of trust that extends beyond its physical walls. Institutional trust, the perception that everyone is treated equally within a certain institutional framework or space, is the basis for creating a generalized, broadly dispersed form of social trust, or social capital. In this sense, the library's institutional status plays a vital role in shaping a participatory public culture for both users and non-users.

Another strand of literature on libraries and digital technology draws on Oldenburg's notion of 'third place' to account for the role that library spaces play in public culture. Oldenburg (1989: 16) defines third places as places that sit in between home and work: 'public places that host the regular, voluntary, informal and happily anticipated gathering of individuals'. To frame libraries as third places is to draw them into association with notions of comfort, sociality, informality and familiarity. Much of this literature also makes broader claims for the value of library spaces to individual and community wellbeing. Libraries are associated with learning, with participation in civic life, with expressions of community and possibilities for creative expression.

[16] This article establishes the conceptual framework for a later ethnographic study of migrant women's use of public libraries in Oslo (Audunson et al 2011).



Drawing on these different strands of literature we can define libraries as third places distinguished by high levels of institutional trust and which are thereby capable of facilitating the generation of social capital in a diverse society marked by new mobilities. This definition helps to situate the distinctive opportunities and challenges that digital technology offers to the library. The literature on the digitization of traditional Indigenous knowledge reveals, in sharp relief, the possible broader implication of an expanded realm of participation. National narratives and histories might be expanded to accommodate new stories, and hierarchies of knowledge might be reconfigured or pluralized. The literature on libraries in Indigenous communities also suggests that, as intermediary spaces located between the state and local community, libraries are uniquely placed to moderate and adapt the often blunt instruments of governmental policy for local constituents. The plasticity of digital technologies, their adaptability, and sociality, the way they encourage 'customization and interactivity' (Holmberg et al 2009, 669), suggests that these technologies are useful and important tools in addressing communities' needs on their own terms. As fast adopters of these technologies, and with the flexibility to adapt themselves around them, libraries might be ideal engines for creating new kinds of publics in which communities shape the terms of their own public involvement.

The new kinds of practices emerging in public libraries in the wake of a digital culture, new forms of conduct, participation and collaboration, are opening up new domains of value linked to other sectors of social life. Facilitated by digital technology, libraries are increasingly crossing over into commercial domains, subcultural movements, community memories and private forms of creativity and expression. The institution of the library is able to confer new forms of legitimacy and circulation on these activities, and provides new spaces for different communities to participate within the public sphere. But it also brings new challenges for libraries: in managing partnerships — for instance with technology providers, including privately owned social media platforms; in managing the streams of user-data that accrue in the digital milieu; in negotiating between the individual centred, entrepreneurial settings that infuse digital culture and the ethic of universal service provision that has been critical to the library as a public institution. How the library manages these challenges will not only help shape Australian public culture, but will define the library into the future.

Recommendations

Based on this research, we make the following recommendations for State Library of Queensland to:

Digital Access

1. Extend its capability to advise and support the public library network in development of their network infrastructure, with particular reference to the NBN 'Technology Choice' programme, and to exploring the opportunity for partnerships with various levels of government or with technology providers to improve this capability

2. Consider extending the availability of library Wi-fi to surrounding public spaces and outside normal library hours, where circumstances permit

3. Support the extension of free Wi-Fi access to all libraries in the network, including those in remote areas

Digital Literacy

4. Support the adoption of learning kits created by The Edge and other technologically advanced spaces throughout the public library network

5. Recognise the importance of community-driven interests in the coding and makerspace movements, and focus on supporting experimental initiatives and trials for community-led workshops

6. Advise the public library network to consider the relationship between accessibility and visibility of digital equipment and community uptake and use, and balance this with the requirement for security

7. Recognise the role of information technologies as participatory platforms that encourage the generation of local content, and encourage the expression of this in online and physical library spaces

8. Recognise that, in order for digital programs to be community driven, rapid prototyping methods have strategic and practical value. Prototype programs should be designed to use few resources, and to work or fail quickly, with the aim of learning about community interests and desires

Library Space

9. Comprehensively evaluate the effect of spatial arrangements on the effectiveness of 'non-traditional' library programs and advise libraries on best practices, including specification of preferred furnishings and fittings

10. Evaluate the positive and negative impacts of the co-location of libraries with other organisations and firms, and share strategies through the Queensland library network for maximising productive engagement for diverse users

11. Encourage libraries to consider the role that library Wi-Fi could have on integrating the external physical environment surrounding the library, and develop strategies to provide appropriate spaces and amenities over time

Media and Communication

12. Realign use of social media from being predominantly a marketing tool presenting the professional face of the institution to an engagement tool for more personalised, interactive communication

13. Support all libraries to develop autonomous presences on social media platforms around events. SLQ could, for example provide workshops for better resourced libraries, and consider providing social media management services for smaller libraries

14. Explore potential for showcasing a range of local library-produced content to the public in the street, for example using small-scale public facing screens to exhibit digital storytelling projects where appropriate

15. Foster the development of informal professional development and peer learning among library professionals through social media networks (e.g. pages, groups etc) to share ideas and learning from non-traditional activities

Organisational Support

16. Develop a networked and participatory process of future planning for libraries beyond VISION 2017, in order to maximise peer learning and support

17. Develop a systematic approach to using new technologies and platforms, with greater SLQ capacity to support development of individual library network, hardware, software and programming plans by documenting best practices in the state

18. Make more systematic use of data to increase qualitative understanding of how users engage with the library network, and consider the development of recommendation systems based on user data

19. Encourage the sharing and co-creation of data with library users—and making this transparently available to users, including through public data visualization mechanisms

20. Encourage a more systematic approach to evaluating programs and practices that extend beyond a customer-feedback model to consider the value of the library service to other aspects of users' lives

21. Consider the potential for libraries to share a pool of creative producers and technology workshop organisers who can travel, reducing the burden upon small libraries for finding and retaining appropriate staff

ANNEX A:

Queensland's Network Infrastructure - NBN and its alternatives

The overall picture for connectivity in Queensland is fluid after the change in the National Broadband Network (NBN) rollout following the change in federal government in 2013. The NBN had committed to Fibre To The Premises (FTTP) for approximately 93% of Australian premises, with the rest to be serviced by fixed wireless and satellite. Key features of the original NBN included a single network provider (NBN Co) with layered service model; mandated minimum download and upload speeds for different sections of the network; and rollout according to design efficiency (rather than driven by market profitability)

In the wake of the various reviews delivered in 2014, a new Multi-Technology Mix (MTM) strategy will implement a combination of FTTP, FTTN (Fibre to the Node delivered via VDSL), and HFC (Hybrid Fibre Coaxial), with details of the mix still to be determined. Nationally, the NBN has around 42% of homes connecting by FTTN, 28% by HFC, 24% by FTTP and 6% by fixed-wireless/satellite - according to Tony Brown at NBN there would be a roughly similar breakdown for QLD as a whole The technical differences between the solutions are as follows:

Fibre To The Premises (FTTP) is a fibre-optic connection to the premises with 100Mbps download speed, with announced plans for 1Gbps. Upload speeds are rarely affected by node congestion.

Fibre To The Node (FTTN) is a fibre optic connection to a central exchange that provides a maximum approximately 100Mbps download bandwidth via VDSL over the last mile. This theoretical throughput is at 100 metres' distance from the exchange, at 1km distance throughput is closer to 25Mbps. Upload speeds theoretically reach 8Mbps, although in practice a number of users report a quarter of that, once again dependent on distance from the exchange.

Hybrid Fibre Coaxial (HFC) was built for the distribution of cable television signal and currently reaches maximum 100Mbps download, but the planned DOCSIS 3.1 upgrade would see that theoretically reach up to 10Gbps/1Gbps for cable customers. In practice cable networks are prone to congestion when large numbers of users are present on a node, with many users reporting 3-4Mbps.

Asymmetric Digital Subscriber Line (ADSL) is the current default fixed broadband technology, using the existing copper telephony network and potentially covering 90% of Queensland households. Speeds vary but range between 8Mbps and 22Mbps (ADSL 2+), although once again distance from the exchange causes these to vary radically. Upload speeds are generally 1Mbps, though can reach 3Mbps.

Mobile: 3G/4G/LTE coverage is often seen as an adequate replacement for fixed line services, and it is an increasingly popular means of accessing the Internet. However, actual network speed is dependent on the number of users in a particular 'cell'. It is also far more expensive in terms of data, so can become prohibitive for data heavy use such as streaming video. The Regional Telecommunications Review Committee (2015) notes that although approximately 98-99% of the non-urban population has access to 3G/4G services, this only equates to 70 per cent of Australia's land mass. In their submission to the committee, the Centre for Appropriate Technology note that the $385m Mobile Black Spots programme's additional land area covered Australia-wide will only amount to approximately 260km x 260km in total coverage.[17] Even where mobile can be seen to operate effectively, backhaul issues mean that peak-time throughput can be far less than advertised speeds.

[17] All submissions to the 2015 Regional Telecommunications Review are available at http://www.rtirc.gov.au/submissions/

For reference, a 1080p audio-video stream requires approximately 22Mbps. Uploading a typical high-quality chest X-ray image (20MB) would take about a minute on 5Mbps connection.

The installed base of FTTP initiated under the previous strategy will not be further extended except through the optional Technology Choice programme (see below), with those areas previously listed as likely to receive FTTP now receiving FTTN or HFC coverage by default. We also note that in the latest rollout plan the delivery of this technology has been further delayed.

The major implication of the new MTM NBN is that there is no longer a detailed strategy for communications outcomes in regional and rural Australia, despite the findings of the 2014 Broadband Availability and Quality Report that 'broadband services are generally more available and of higher quality in metropolitan areas than in regional and remote areas.'

This means that organisations such as SLQ may need to show leadership in supporting libraries in network services for its patrons' information needs. In the absence of a national FTTP rollout post-2013, SLQ will become a more prominent strategic agenda-shaper for connectivity in the Queensland library sector, which has significant resource implications - in both capital expenditure and the skills and knowledge required through the organisation. It will also require the development of effective partnerships with councils, ISPs, and NBN Co to evaluate and support technology choices made by Queensland libraries.

The Technology Choice program

One of the most significant elements introduced in the new NBN strategy is the 'Technology Choice' programme, which enables individual premises, buildings or entire areas to make a financial contribution in order to upgrade their NBN connection to FTTP. For individual premises, this is likely to cost in the hundreds to a few thousand dollars dependent on distance to the node. For whole communities, blocks, or apartment buildings, the costs would be more substantial. However, the Technology Choice program is still 'in its infancy' and, according to NBN, there are no examples of towns, communities or local government authorities in QLD areas that have sought an upgrade under the programme so far. There is the potential for SLQ to partner with local, state and federal government agencies and the private sector for exploring upgraded connectivity through the Technology Choice program.

Fixed Wireless and Satellite

Fixed Wireless and satellite technology is being rolled out for areas outside the FTTP/FTTN/HFC networks, fixed wireless connectivity using LTE technology offers 25/5 Mbps. This is the same spectrum used for mobile data devices such as smartphones, however the ability to install fixed line-of-sight connection allows for much greater throughput. A trial is currently ongoing to deliver a higher speed service at 50/20Mbps with the expectation that the majority of subscribers will eventually be able to access these speeds.

For those outside Wired and Fixed Wireless connections, satellite connectivity is the option offered by the NBN network. The NBN's Long Term Satellite Solution consists of two satellites which have been built over the last three years and will be launched into orbit in late 2015 for operation from mid-2016.

If the launches go according to plan – approximately 4% of satellite launches fail – Retail Service Providers will offer 25/5Mbps packages, with data plans whose caps are yet to be determined. Currently in place is an Interim Satellite Solution which consists of subsidised access to existing Satellites on the IP Star network. Latency is a significant issue on satellite services, particularly where both sending and receiving parties are on satellite. Rain fade is also a problem. There will be caching services for popular content but at present the use of video services for even popular viewing sites such as YouTube) is quite restricted.

However, for users currently on dialup the availability of even a fraction of theoretical throughput will yield great speed gains, as this table of download speeds from NBN shows:

Task	Time taken using average dial-up (example 56Kps download / 33Kps upload)	Time taken using high speed broadband service over the NBN (example 25Mbps download / 5Mbps upload)
1. Download a movie	3 days 10 hours	10 minutes
2. Upload a podcast	8 hours 30 minutes	3 minutes 21 seconds
3. Download a YouTube video	1 hour 33 minutes	11 seconds
4. Open a webpage	58 seconds	0.13 seconds

TABLE: DOWNLOAD SPEEDS ON DIAL-UP VS NBN SATELLITE SERVICE (SOURCE: NBN CO 2015)

NBN Limitations Under the MTM Model

1. Assymmetry

The major critique made of the decision to back away from a comprehensive FTTP rollout is the comparatively slow upstream bandwidth in legacy copper networks and cable networks that are designed for content delivery. This is significant from a library perspective as it places limits on the potential for content creation and highly interactive synchronous communication such as in videoconferencing, collaborative design, education and telemedicine. Content consumption (e.g. video on demand) that comprises the bulk of current internet use is not necessarily compromised. However, our research has identified the importance of user-generated content in library adaptation to the new digital environment. A media ecology where library users are content consumers and not creators places major limits on the development of digital literacies and citizen participation in the public sphere.

2. Backhaul

The NBN is not an 'end to end network' - once the delivery technology is determined by nbn, Retail Service Providers will 'differentiate their services in terms of price, quality, content quotas and value-add services.' (Regional Telecommunications Review Committee 2015, 12). RSPs will also need to purchase their own backhaul, meaning that the delivery technology's bandwidth may be impacted by business and technical decisions made by the RSPs. Backhaul capacity is limited in remote areas, and according to ACCAN and Broadband for the Bush Alliance (2015, 6) 'Telstra's near monopolistic ownership of the remote backhaul infrastructure and the issues that creates locks out most competitive players on price/bandwidth.' The effect here is a marginalisation of remote users who will not be able to reach the theoretical speeds of NBN delivery technologies even when provisioned.

3. Data caps

The recent distance education working group brought together Commonwealth, State and Territory education officials and satellite experts to discuss distance education services - over 7800 students receive distance education in Queensland (Fletcher 2015). They estimated that a typical distance education student uses 15-20GB of data per month for the purposes of coursework, well in excess of the 10GB plans offered by many satellite RSPs and almost half the maximum under the 'fair use' policies recently adopted.

4. Load management

Capacity and usage of the satellite system was not predicted accurately when approving RSP plans for the Interim Satellite Service. Due to poor overall performance, a number of subscribers reported having their service throttled through a 'fair use policy', even though these subscribers had not exceeded their contracted usage. This has raised serious concerns about the potential of the satellite solution to even come close to matching the broadband potential of fixed line networks. Even though the total throughput of the LTSS is 135 Gbps vs only 4Gbps for the current interim satellite solution, with total Australian data usage having grown 33% in 2014 the service could be at capacity as soon as 2020 (Francis 2015).

Alternative Broadband Options

Broadband Over Powerline (BPL)

The Australian Communication and Media Authority has recently released a Broadband over powerline (BPL) deployment report (ACMA 2015). ACMA (2015, 1) defines BPL as 'a technology that uses the infrastructure used to supply electricity as a medium for […] the transmission of data, voice and video.' ACMA distinguishes between 'Access BPL 'and 'In-house BPL'. Access BPL uses the distribution network owned, operated or controlled by an electricity service provider, while In-house BPL uses powerlines and wiring such as those in a privately owned building. In-house BPL is usually restricted to providing short-range communication, replacing existing short-range connection technologies such as wireless, infra-red digital access or dedicated local area network cables.

The advantage of Access BPL is that it can theoretically use existing infrastructure to replace 'last mile' copper line connectivity, and thus supply an alternative mode of fixed line broadband access. It can also provide power companies with additional data for managing the electricity grid. However, BPL faces a number of technical issues, including the need to connect the powerlines back to the wider telecommunication network. ACMA (2015, 1) also note that: ' Using the electricity infrastructure to conduct BPL signals will result in leakage of radiofrequency emission that may interfere with radiocommunications services'. Moreover, not all types of powerlines are suitable for Internet applications (as opposed to low data rate communication suitable for smart grid and smart metering applications (Kikkert and Reid 2009)

While the mid-2000s saw some interest in the potential of powerlines to solve the 'last mile problem' of broadband delivery, there are no ongoing commercial deployments internationally. The primary international case study in the US in the City of Manassas (700 installations) was closed in 2010, only a few years into a 10-year deployment.

Loanable Wi-fi hotspots

Acknowledging the historical role of libraries in information provision for the home, a number of libraries in the United States have embarked on programs for the loan of portable Wi-fi hotspots. These devices (also known as 'mi-fi') are typically 3G/4G/LTE modems that act as a bridge for a mobile broadband signal, routing the data service through to a local 802.11 ('Wi-Fi') network to which users can connect their personal devices, particularly a library-supplied tablet. While many smartphones provide this functionality, it may not be available to users with lower end phones or more restrictive subscription plans, and so can be a good option for in-home Internet access where DSL or other broadband services are unavailable.

While there are no documented examples of loanable Wi-Fi hotspot programs operating in Australia, a background report on their potential has been produced for SLQ by student Teresa Butland. The report notes that detailed information on how such programs work in the New York Public Library and the Chicago Public Library and their evaluation is not yet available. However SLQ would be well placed to undertake a pilot initiative, particularly where this could be resourced from non-core funding. Such a program would have to be developed with the following cautions:

1. In the US, 'unlimited' mobile broadband data plans are far more common than in Australia. Negotiation with a network provider partner would need to include data caps, restrictions on use, notification etc.

2. Since the US examples to date involve cities with much higher population density than Brisbane, the economics of such a plan in terms of users who would benefit would need to be carefully evaluated

3. As noted above, 3G/4G/LTE mobile broadband is a not an optimum connectivity choice in rural areas due to a combination of backhaul cost and limited coverage

Microtelcos

'Microtelcos' are perhaps the most viable recent commercial alternative platform to broadband provided by conventional ISPs that can be spread across multiple regions and geographical contexts, and in theory could provide an option for Queensland's rural locations. They are particularly designed to reach remote, inaccessible communities that have no other options for accessing the internet or cellular phone networks. According to Rennie and Potts (2015) NGOs like Rhizomatica have successfully 'installed low cost mobile base stations' in rural communities of Mexico, 'transmitting using spectrum that is made available for Indigenous community radio in places where that spectrum is neglected by national spectrum licensees'. Rhizomatica states on its website:

> Currently, only very large, powerful companies have access to the mobile spectrum and the concessions to provide cellular service. But their business model and the technology that these traditional providers use have proven unable to solve the problem of connecting much of the world. We want to break this oligopoly and allow communities to become service providers as well. [18]

In areas where it is not viable for major ISPs to provide cellular phone and broadband services, entrepreneurs and community leaders can essentially create their own networks by appropriating spectrum and setting up base stations that cost approximately $7,500 each. The owners of these stations can then charge members of the community for the service at rates they determine. They remain a viable future model for remote and regional areas that don't have any broadband or 3G data access, including their public services like libraries – with some caveats.

Firstly, Australia's spectrum regulation laws are quite restrictive, and spectrum that isn't being used can't necessarily be handed back to the community. This was how Rhizomatic were able to successfully establish community-run broadband networks in rural Mexico and Nigeria. But, Rennie and Potts (2015, 8) note, 'in Australia, individuals and organisations can apply for a public telecommunications service licence using various paired frequency ranges. Licence fees are set 'having regard to spectrum location, geographical location, amount of spectrum occupied and coverage area authorised by the licence''. A recent ministerial review of Australia's spectrum licensing regime seeks a simplified management system and acknowledges the need to support spectrum sharing, but makes no clear commitments to community uses (Australian Government Department of Communications (2015).

Second, as a result, while this option would be feasible the cost of licensing spectrum would make it commercially unfeasible. The cost of setting up the base station is modest, but Australia's spectrum licensing fees would make phone calls and data over the network cost many times more than the average consumer price. Therefore 'although microtelcos could emerge in remote Australia, providing a competitive call charge rate to consumers could be a challenge without subsidy' Australian Government Department of Communications (2015).

Community Wireless Networks (CWN)

Community Wireless Networks are one way of bypassing Australia's restrictive spectrum licensing fees. According to wireless.org.au, a website designed to help people find such services, they are 'basically a group of like-minded people who got sick of paying telco's for high priced, and underperforming data links.' A group of people (3 or more seems to be the lower limit) living in close proximity to one another connect online or through meetings/workshops and set up their own wireless network through a model known as 'group purchasing'. Each member purchases various pieces of equipment (depending on which model/structure they use) to set up their own wireless access point; additional members can join by signing up and purchasing the necessary equipment to access the network. The solution is a much cheaper small-scale option than microtelcos, because as Melbourne's CWN site states the 'wireless network equipment (typically 802.11b) operates at a frequency of 2.4GHz, which means the users do not need a licence to get involved.' On the other hand, quite a bit of technical knowledge is required by those who set up the network to organise and tinker with it, and given its grassroots approach it is less likely to be publicly-funded and extended to services like libraries. Another concern is the long-term viability of these networks. While Wikipedia and wireless.org.au list a number of existing networks in areas like Geelong, Ballarat, Bathurst and Townsville, some of their sites are down or have not been updated for a year or more, suggesting that information on them is outdated or they quickly disappear after their initial set-up.

Touchscreen kiosks

A more robust commercial option for delivering broadband to remote areas are touchscreen kiosks such as those developed by Hitnet, an Australian company that have delivered interfaces to remote indigenous communities since 2008. These kiosks provide touchscreen interfaces focused on education and assisting with social issues, such as unsafe sex, alcohol and drug addiction as well as preserving local cultural values and traditions. While they are a commercial organisation, they work in tandem with organisations like Broadband for the Bush, beyondblue and Headspace and their focus is on closing the 'digital divide' in rural Australia and neighbouring countries like PNG. In non-indigenous rural locations, companies like Newtouch that build custom touch-screen interfaces with commercial operating systems and network capability may be an expensive but adaptable solution for libraries and public service centres that are looking to share information in a similar manner to Hitnet's kiosks.

[18] http://www.rhizomatica.org

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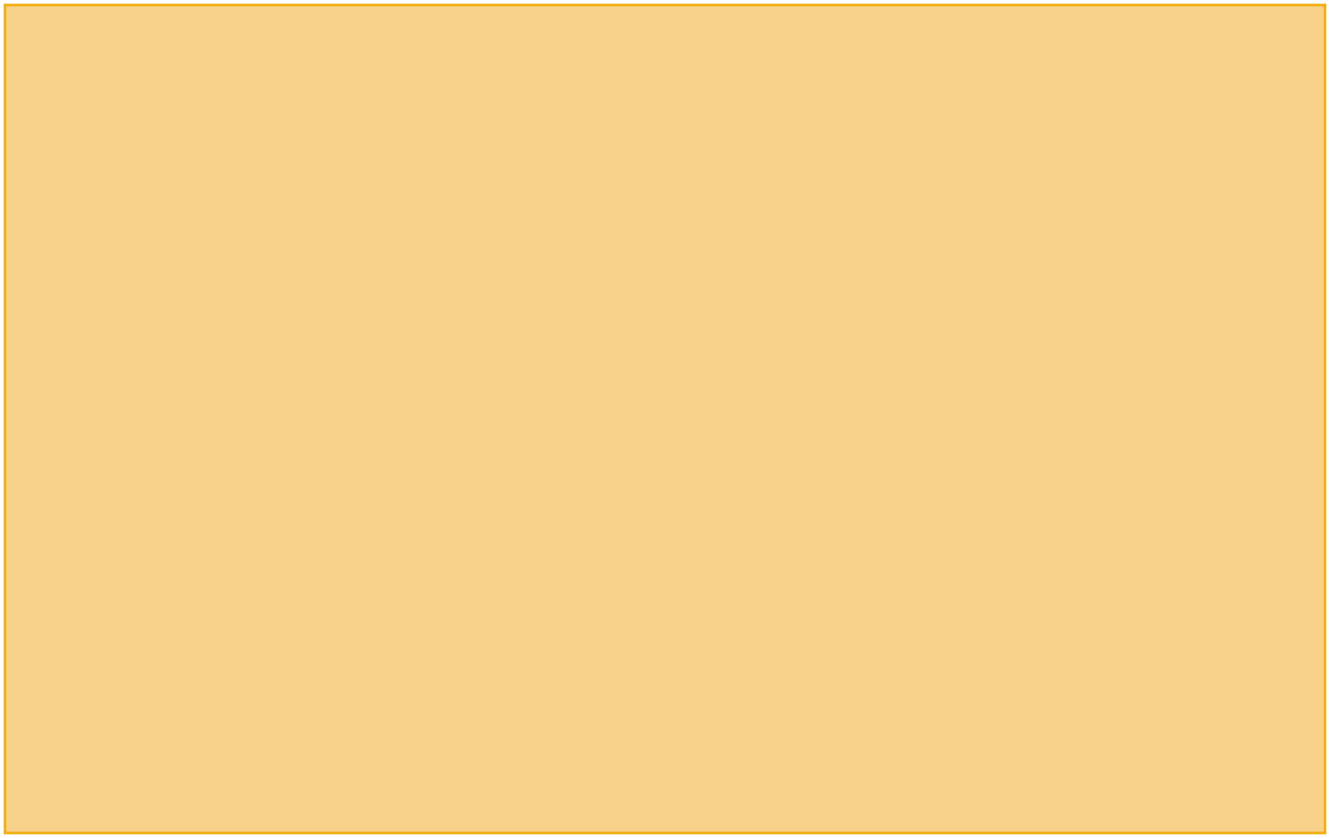

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