

'Evaluating Makerspaces: exploring methods used to assess the outcomes of public library makerspaces.'

by

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**'Evaluating Makerspaces: exploring methods used to assess
the outcomes of public library makerspaces'
(hereafter referred to as 'The MIS Research Project')**

being undertaken by

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Abstract

Research Problem

This study explores how public libraries assess the outcomes of makerspaces, and examines whether the approaches taken can be justified as appropriate. An increasing number of public libraries throughout the world are establishing makerspaces, and to date there does not appear to be literature on how outcomes of these services are assessed. This study explores the methods that are being used, making comparisons to best practice revealed in the literature.

Methodology

A two-case case-study design was selected. Literal replication logic was used, whereby cases with similar contextual environments were chosen for comparison. The Central City Library makerspace (Auckland Libraries, New Zealand) and the 4th Floor (Chattanooga Public Library, Tennessee, USA) were selected. The study collected evidence from documents, archival records, and 11 interviewees.

Results

The findings revealed that while efforts are being made to assess the outcomes of makerspaces, methods and techniques are primarily informal. Current formal reporting relies upon quantitative measurement, such as visitor or participant numbers, which fails to capture the effects of the service on users.

Implications

The implication is that staff may develop more structured and formalised approaches to assessing the outcomes of makerspaces. Further research could include the design of a prototypical outcomes assessment model that is then tested on a public library makerspace to determine the practicality of the approach.

Keywords

Outcomes assessment, evaluation, makerspaces, programmes and services, performance measurement.

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1 Introduction

1.1 Topic statement

This study investigates approaches used to evaluate the outcomes of public library makerspaces. The focus of this study is to examine whether the methods used can be justified as providing meaningful evidence of outcomes.

1.2 Problem statement

A review of the library literature and the results of searching online reveals there is a growing international trend for public libraries to introduce makerspaces as a new opportunity to engage users in participatory learning. The Library as Incubator Project (2012, May 13, para. 2) define makerspaces as

“...Collaborative learning environments where people come together to share materials and learn new skills... makerspaces are not necessarily born out of a specific set of materials or spaces, but rather a mindset of community partnership, collaboration, and creation.”

The makerspace reframes the public library's role as information storehouse by shifting emphasis away from the loan of information materials towards the provision of a physical space, tools, equipment and expertise for information sharing and knowledge creation. A panel at the 2014 American Public Library Association (PLA) conference discussed how makerspaces and enabling participatory learning in libraries brings value to communities, and highlighted the need for libraries to take a different approach with their service offerings “to facilitate learning and engagement in our communities” (Scott, 2014, para. 3).

Heron et al (2015) note that anything and everything the library does can be the subject of evaluation. The nature of the makerspace service model poses interesting questions about the types of evaluation methods and measures that may be appropriate for performance assessment. Traditional techniques such as counting programme attendance will not provide meaningful information to gauge the value or benefit of the service for the participant or wider society. As more libraries offer makerspaces and follow a general shift towards providing more participatory learning

opportunities, adopting suitable techniques to evaluate the effects or outcomes of these services will grow in importance.

People who use libraries generally understand the value they bring to communities without hard evidence (Tenopir, 2013; Showers, 2015). However, in a competitive economic climate of “decreasing resources and increasing alternatives for information...” (Tenopir, 2013, p.270) libraries require more appropriate ways to measure and demonstrate the value of their service offer (Tenopir, 2013; Aabo, 2005; Closter, 2015). In a study of the benefits of academic libraries Tenopir (2013 p.271) asserts that the value of library services relates to outcomes – how the library supports the success of the people it serves. When it comes to assessing these outcomes, measures that indicate the quantity and quality of performance tell little of how users have benefited from library services, or the wider effects of library services to the community (te Boekhorst and Poll, 2007; Closter, 2015).

While there is coverage in the library literature about the theory of maker culture and history of the ‘maker movement’, case studies of particular makerspaces in public libraries and descriptions of the various tools and technologies typically provided for use, there appears to be a gap in the scholarly research to date about how public libraries assess the outcomes of their makerspaces. This research intends to begin to close that gap and to highlight the opportunity for further research on this topic. The literature on outcomes assessment reveals a number of methods used by libraries internationally to assess the social and economic outcomes of library services generally. These methods will be explored in the literature review to follow.

2 Literature review

This literature review starts by summarising the general aims and objectives of the makerspace **(2.1)**. This discussion is contextualised within a broader description of the value of public libraries today identified in a number of international impact studies **(2.2)**. How evaluation is carried out and the purpose of it is then discussed **(2.3)**. Traditional library evaluation methods, and whether these methods are appropriate for assessing makerspace outcomes, are examined **(2.4)**. Finally, a

description of possible evaluation methodologies is provided **(2.5)** and the challenges of outcomes evaluation are examined **(2.6)**.

2.1 Makerspace aims and objectives

The Makerspace Playbook is a freely available guide introducing the core aims and principles of the makerspace and the Maker Movement. It emphasises that the makerspace aims to engage a diverse group of people in experimentation and play by providing technologies and tools to ‘tinker’ with in an inclusive and accessible environment (Maker Media, 2013). A core principle is that innovation is born out of experimenting in a well-equipped space and by working with others to “cross-pollinate” ideas (Maker Media, 2013, p.7). The popular literature highlights that making learning fun and aligning it with peoples’ specific areas of interest, personal or professional, creates an optimal environment for meaningful learning (Britton, 2012; Maker Media, 2013; Grinberg, 2014; IMLS, 2014).

Another guiding principle of many public makerspaces is to democratise access to manufacturing technologies such as 3D printers and laser cutters which until recently were prohibitively expensive to purchase but are now slowly beginning to decrease in price allowing institutions, like public libraries, to purchase them (Britton, 2014 August 18; Dubrow, 2015, September 8). Providing access to these technologies gives innovative DIY thinkers and tinkerers in the community the opportunity to test their ideas, and encourages them to become producers or creators of products rather than simply consumers (Maker Media, 2013).

In the United States a number of makerspaces have been created in response to a growing need to up-skill young adults in STEM (Science, Technology, Engineering and Mathematics) education. While unemployment rates are generally high in the United States, many jobs requiring an education in STEM fields are going unfilled (Engler, 2012). Many libraries have received external funding in response to a nationwide ‘call to action’ by the Obama Administration in 2014 to support initiatives to increase the number of university graduates in these fields. Philanthropic organisations such as the Bill and Melinda Gates Foundation, government agencies such as the Institute of Museum and Library Services and private institutions have donated to the cause.

In New Zealand, Hutt City Libraries offer a similar initiative with their creative technologies spaces called Clubhouses (part of an international Intel network), which provide afterschool learning programmes using various popular technological platforms and on topics such as computer programming, coding, fashion, textile design and cooking (Taita Computer Clubhouse (n.d.)).

2.2 Outcomes and value of public libraries today

The makerspace shifts the role of the public library from a place of information consumption to a place of information and knowledge production (Britton, 2012; Derry, 2014). Norman (2013) notes that the makerspace joins a long list of public library programmes and services for which the provision of space and equipment for user participation and learning is the focus, such as, story-times, craft sessions, computer training for seniors, homework help and author talks (Norman, 2013, p. 235).

General impact studies on the effects of library services reveal that people use public libraries for a number of reasons and that they provide a number of benefits. Part of Huysmans & Oomes' (2013) two-phased study of the societal value of public libraries involved reviewing a number of large international studies focussed on understanding, evaluating or estimating the value libraries have for the communities in which they are located. A separate impact study (Usherwood, 2002) using a social audit technique conducted in Somerset and Newcastle discovered very similar findings. Both studies revealed the public library was a place of social inclusion and connection with others, the "heart of the community" and played a role in building community confidence (Usherwood, 2002, p.6). Both studies emphasised the educational role of libraries, being to support lifelong learning, as well as personal and community development. The economic impact of libraries was also recognised in the studies, supporting local businesses and the career development of citizens. Finally, democracy and providing equitable access to learning opportunities for the community was a finding shared between the two studies.

Slatter & Howard's (2013) case study research of the benefits and challenges of providing makerspaces in Australian public libraries revealed that fostering

community engagement was the most emphasised benefit of the makerspace. Offering open and equitable access to emerging and expensive technologies such as 3D printers and helping to ‘future-proof’ the library by following wider “cultural shifts” (such as a growing interest in DIY) were also revealed as key benefits (Slatter & Howard, 2013, p.279). This study did not reveal how the participating institutions evaluated these key benefits - a gap which will be explored in this proposed research study.

These studies (Slatter & Howard, 2012; Huysmans & Oomes, 2013; Usherwood, 2002) reveal that the influence public libraries have on society is broad, takes different forms and is valued in many different ways. They indicate that an investigation and description of outcomes provides a greater picture of value. What is required is a reliable and meaningful way to accurately capture outcomes.

2.3 The process and purpose of evaluation

Hernon et al (2015, p.36) argue that evaluation is ‘an essential part of organisational learning’ and, as aforementioned, that anything the library does can be the subject of evaluation. It is a process that primarily involves gathering information, analysis and reporting (Hernon & McClure 1990, p.1). The process requires the development of appropriate research designs and methodologies to guide the evaluation, and to ensure that the data collected as evidence is comparable to appropriate evaluation criteria (Hernon & McClure, 1990).

Depending on the needs of the institution outcomes assessment (or evaluation in general) can be carried out for many reasons. Data can be gathered for the purpose of identifying and addressing problems, looking for evidence of effective and ineffective programmes, making decisions such as whether to continue or adjust a service, monitoring performance and progress, making improvements, justifying funding or as evidence to advocate for ongoing support from stakeholders (Office of Arts & Libraries, 1990; Streatfield & Markless 2009; Hernon et al, 2015; Hernon & McClure, 1990). Evaluation approaches are typically distinguished into two main groups – formative evaluations, which focus on examining a programme or service being delivered in order to strengthen it or make improvements, and summative evaluations, which examine the effects or outcomes of a programme or service, or

degree of success after it has been delivered (Trochim, 2006; Hernon et al, 1990; Connaway & Powell, 2010). Hernon & McClure (1990, p.9) clarify, “The purpose of formative evaluation is to *improve*, while that of summative evaluation is to *prove*”. An evaluative research methodology can incorporate both formative and summative methods, depending on the purpose and requirements of the evaluation (Hernon & McClure, 1990).

2.4 Traditional public library measurement methods

As aforementioned, traditional approaches to measuring performance in public libraries that rely upon statistical analysis of input data (e.g. expenditure, collection size, user space) and output data (e.g. item loans, door counts), cannot provide proof of how library users benefit from services (Poll, 2003; Closter, 2015; Lyons, 2012; Tenopir, 2012, Tenopir, 2013). Closter (2015, p.108) adds these measures do not, “demonstrate the full picture of the institutions success”. Norman (2013. p.224) comments that libraries generally gather great statistics but questions how well traditional measurement methods allow libraries to understand the difference they make in peoples lives. Mulgan (2011, p.216) indicates that using numbers to represent value destroys the relevant information that is crucial for decision-making. ISO 16439:2014 (‘Information and documentation - Methods and procedures for assessing the impact of libraries’) describes quantitative measures and counts as inferred evidence of outcomes (ISO 16439:2014, p. 21).

An example from a New Zealand context illustrates this point further. A review of aggregated usage data collected from public libraries by Public Libraries of New Zealand (for APLM) indicates there is a need for New Zealand public libraries to think more broadly about how gather data and evaluate their services. In recent years there has been a slow decline in total issue (checkout) numbers, and the latest Public Library Statistics report indicates an 8% decrease in total issues since June 2014, and a decrease of nearly 3% total visitors (Public Libraries of New Zealand, 2015). These trends highlight that the use of quantitative measures alone does not provide enough information; what is required is a greater understanding of the benefits and value libraries have on the communities that use them.

2.5 Outcomes evaluation methods and techniques

Lyons (2012 p.334) specifies that the purpose of outcomes evaluation is,

“To assess the extent to which programs and services produce desired changes that typically involve the betterment of clients and recipients. The specific type of betterment is defined by the organisation’s values.”

To achieve this, evaluation needs to be made against clearly articulated goals and objectives – asking the question “is the library doing what it set out to do?” (Office of Arts and Libraries, 1990, p.6). Then, appropriate measures or indicators should be carefully selected to address those goals and objectives (Office of Arts and Libraries, 1990; Streatfield & Markless, 2009). Schwartz (March 7, 2014) points out that it is important to think about the types of impacts a new programme or service intends to make at the early design and planning stages, and to also decide how best to assess whether that outcome is occurring.

On the topic of evaluative research practices, Connaway & Powell (2010, p.76) indicate evidence can be collected using most of the same methods that are used in ‘basic research’. This means that all the implications of basic research, such as threats to validity of the data, should be considered and minimised in evaluative research practices to bring reliability to the study’s findings. Connaway & Powell (2010) elaborate that measurement of data is just one aspect of the evaluation process, which requires careful consideration of using consistent data collection techniques, limiting biases, selecting appropriate instruments and sampling techniques.

Outcomes assessment methods explained in the literature can be broadly split into two categories: those dealing with understanding the *social outcomes* of library services, and those that reveal the direct or indirect *economic value* the library brings or supports in the community (Poll, 2003; Poll 2012; ISO 16439:2014).

2.5.1 Measuring social outcomes

Outcomes of social value show the importance of library services on individuals and society, in particular the intangible effects experienced as a result of using the library (Poll, 2003; Poll 2012; Showers, 2015). ISO 16439:2014 provides examples of social

outcomes - “social inclusion and cohesion, participation in information and education, local culture and identify, cultural diversity, community development, individual wellbeing and preservation of cultural heritage” (p.13). Matthews (2010, p.2) describes these values as “indirect use benefits” or intangible outcomes facilitated by use of library services of library use. It is the social outcomes of library services that are particularly difficult to represent using traditional methods because their value cannot be easily quantified (Showers, 2015).

Methods to measure social outcomes can be differentiated into *solicited* and *observed* techniques (Streatfield (n.d.), in ISO 16439:2014). Both techniques involve understanding value directly from users and stakeholders by gaining information through interviews, surveys, questionnaires, focus groups, self-assessment, and behavioural observation (Poll, 2003, ISO 16439:2014). Tenopir (2013, p.271) describes testimonials solicited through interviews or focus groups where participants are directly engaged as measures of “explicit value”.

A summary of a number of approaches to evaluating social outcomes is described in Tables 1 and 2 below. These lists are not exhaustive, but provide a short introduction to a number of techniques uncovered in the literature. Sources noted should be referred to for more detail for practical advice about how to carry out these methods and techniques.

Table 1 – Solicited Evidence

Technique	Description
Interviews	A type of oral questioning gathering one-to-one opinions from customers on a topic under evaluation. Structured and unstructured approaches can be used, depending on the level or generalizability required from the findings (ISO 16439:2014; Hernon et al, 2015; Connaway & Powell, 2010)
Surveys/ questionnaires	Structured standardised questionnaires completed by sample of user population. Closed and open-ended questions, use of ratings scales also. Results can be quantified. Short, anonymous, delivered in either paper form, orally, or electronically (ISO 16439:2014; Hernon et al, 2015; Connaway & Powell, 2010).

Focus group interviews	To gather a deeper level of understanding on a topic, especially into expectations and opinions of customers. Can use structured or unstructured approach, and should be facilitated by an experienced moderator (ISO 16439:2014; Hernon et al, 2015; Connaway & Powell, 2010; Poll, 2003).
Exit interviews	Customers are interviewed after taking part in a programme. Can be conducted relatively quickly and is easy to randomly select candidates by age, gender, ethnicity etc. to allow greater statistical accuracy of data (Hernon et al, 2015).
Self-assessment	A type of survey asking users to indicate skills gained through a service to determine how the library influenced the newly learned skills (ISO 16439:2014; Poll 2003).
User tests	Tests to determine skills gained through a service. Often pre & post encounter with service or programme to allow some analysis of the impact (ISO 16439:2014; Poll 2003).
Anecdotal evidence	Informally obtained from observations and experiences, through feedback & comments forms, or shared with library staff (ISO 16439:2014).
Diary/journal	Participants keep written, audio or visual records of their activities, thoughts, motivations, emotions and decisions throughout their interactions with a programme or service (Connaway & Powell, 2010).
Narrative enquiry	An interview that is concerned with understanding how people make sense of what happened in a certain circumstance, and to what effect. People are deliberately recount stories in a structured way, using prompts such as - what happened? How? Where? Why? Etc. (Hernon et al, 2015; Bryman 2012).

Table 2 - Observed Evidence

Technique	Description
Structured vs. non-structured	If structured, observer is provided with directions about what to observe and how to code the data collected.
Participant vs. non-participant	If participant, observer takes part in the activities being studied.
Open vs. covert	If open, subjects are aware they are being observed, which may influence their behaviour (ISO 16439:2014).

2.5.2 Measuring economic value

Economic value describes the actual or potential benefits of library services to users quantified into monetary terms (Poll, 2002; ISO 16439:2014). ISO 16439:2014 presents a number of methods to calculate the cost of library services (e.g. substitute or surrogate value, calculation of time costs, Contingent Valuation Method) and also details how those calculations can be used to analyse whether the economic benefits the library returns to the community outweigh the costs (e.g. cost-benefit or return on investment analysis). Tenopir (2012, p.6) describes the comparison of benefits of library use to costs as the measurement of “derived value” because the analysis draws upon data collected on the benefits (return) using qualitative methods such as surveys and interviews combined with data about the libraries monetary investment (costs).

Evaluating in this way may be required if a service objective relates to economic outcomes, or if a funding body or management team require a demonstration of a library’s economic value in the community. As a number of makerspaces aim to up-skill users in STEM education subjects and a long-term focus to help improve the number of graduates in those subjects, the assessment of the economic outcomes of a makerspace may be applicable. Many makerspaces make available expensive equipment, such as 3D printers, laser cutters, soldering equipment, audio creation hardware and software, laptops and computers. Funders or library management may wish to see that on balance the value the service brings to the community outweighs the cost of providing it.

Table 3 provides an overview of different techniques and methods to evaluate economic value.

Table 3 – Economic Evidence

Technique	Description
Contingent valuation (CVM)	Survey-based technique to determine costs of services or products not available on open market (directly sold to users). Uses Willingness To Pay (WTP) and Willingness To Accept (WTA) measures.
Substitute value	Ascertain current market value of service as substitute or surrogate value (ISO 16439:2014)
Lending value (proxy price)	Survey-based technique asking customers to indicate a price for borrowed items they enjoyed or profited from. Compare average figure against purchase price of collection items (Morris et al, 2001, in Poll, 2003).
Consumer surplus survey	Ask customer to place a value of a service or product in excess of what they paid to get it, by adding on costs for time, effort and travel (Matthews, 2010)
Calculate time costs	User time travelling to library to attend a service + time spent participating in service. Multiply sum by the average salary rate of population or actual salary rate of participants (ISO 16439:2014).
Method	Description
Cost-benefit analysis (CBA) or Return on investment (ROI)	Compares costs (to run) with the benefits (in monetary terms) of an undertaking (Matthews, 2010). Total benefits are divided by total costs. A ratio greater than 1 means that benefits outweigh the costs. Often uses CVM to determine the value of services not available on open market.
Economic Impact Analysis (EIA)	Measurement of indirect effects of library programming on the economy of a given area, usually measured in terms of changes in economic growth. For example, increased employment and income in local area, resulting from library programming (ISO 16439: 2014).

While most studies discuss the use of these methods to determine the economic value of the library as a whole, they methods can also be used to assess the value of single services, by using the Critical Incident Technique (CIT). Tenopir (2012) describes the use of CIT in a return-on-investment study where participants answered survey questions in reference to the last journal article they read. In this case, CIT was used to improve the chance participants' memories were accurate, and therefore increase the reliability and validity of the data. Focussing on a single critical event can also be applied to measuring social outcomes using techniques such as narrative inquiry and other oral questioning techniques, depending on the purpose of the assessment.

2.6 Challenges of outcomes evaluation

A key challenge of evaluating for outcomes is that it is very difficult to pinpoint an outcome back to being caused by the library (Lyons, 2013; Poll, 2003; Poll 2012; Streatfield & Markless, 2009). Lyons' (2012, p.332) examination of library evaluation approaches unearthed little evidence to suggest that evaluation methods used were effective in understanding the outcomes or impact of services evaluated, and that it was commonly accepted that "evidence of causality" was very difficult and was therefore not actually required in practice.

Streatfield & Markless (2009, p.136) acknowledge that because of the complexity of the assessment methods, it is quite a leap to expect library managers to look beyond traditional performance measures into qualitative approaches to understand "deeper effects of their services on users and their communities". Poll's (2012) comments that because there is no prescribed or standard methodology to evaluate the goals of services, libraries have responded to the gap by developing their own approaches, which has resulted in divergent measurement methods and use of terminology. Poll (2012) sees the use of the new ISO 16439:2014 as a potential way to address these issues and to support evaluation practices. Because of the work involved in designing appropriate measures and methods, many recommend that libraries only carry out this kind of assessment where appropriate on a few, rather than a lot of programmes or services (ISO 16439:2014; Paley, in Schwartz, 2014).

A potential way forward is to combine the use of quantitative and qualitative data drawn from different outcomes assessment methods for evaluation purposes (Tenopir, 2013; Tenopir 2012; ISO 16439:2014). Tenopir (2012, p.9) states that anecdotes shared by users through solicited methods, such as comments fields in surveys or questionnaires, can be used to add explicit evidence to quantitative findings that have implicit or derived value only (Tenopir, 2012). The ISO 16439:2014 recommends using a combination of solicited and observed methods to provide a “richer set of findings that may lead to better insights... and greater confidence in conclusions made in evaluation study” (ISO 16439:2014, p.56).

3 Research questions & objectives

3.1 Research questions

The results of the literature review led the researcher to endeavour to answer the following key questions -

1. How are the outcomes of public library makerspaces being evaluated?
2. On what grounds can the methods used be justified as suitable?

3.2 Research objectives

The following research objectives have been pursued to answer the research questions –

1. Determine the objectives (or intended outcomes) of the makerspace to be evaluated
2. Determine the methods and tools being used to evaluate whether outcomes have been achieved
3. Discuss how the tools, methods and outcomes relate and whether the approaches used can be justified as appropriate;
 - a. Within the context of the organisation’s internal evaluation practices and capabilities
 - b. By comparison with outcomes assessment methodologies explored in the literature as best practice
4. Determine any opportunities for improvement to the evaluation methods used.

4 Research design

This research follows a qualitative multiple-case study design using two cases. A case study design was selected because the researcher assumed it was likely the specific outcomes and assessment methods used by public libraries would vary in response to local needs and capability. To elaborate, situational and contextual factors influencing makerspace objectives may be too divergent to draw generalized conclusions about outcomes assessment approaches used in public libraries. A case study approach has allowed the researcher to gather in-depth and in-context information about each case to explore and gather insight into contextual factors influencing the outcomes assessment practices used.

Literal replication logic was used to select the cases for the study to ensure the cases had similar contextual environments that could be compared. The decision to select two cases from similar contexts was to increase the likelihood that evidence gathered revealed similar results (Yin, 2014, p.57). A two-case study was chosen over a single case because as Yin (2014, p. 64) states “analytic conclusions independently arising from two cases ... will be more powerful than those coming from a single case alone”.

4.1 Units of analysis

Yin (2014, p.33) notes that clearly defining the “units of analysis” or cases to be studied by differentiating the primary *phenomenon* of the study from its *context* helps to “bound the cases” and makes explicit the focus of the investigation. Distinguishing between the *phenomenon* and the *context* has allowed the researcher to focus primarily on investigating the phenomenon directly and how it is influenced by external contextual or environmental factors. For this study the units have been defined as follows:

- **Phenomenon** (subject, or primary focus): assessment of makerspace outcomes
- **Context** (external contextual factors): large destination public library located in a built-up urban area in a medium to large city.

4.1.1 The cases

- **Case A** – The Central City Library (CCL) Makerspace, located in downtown Auckland, New Zealand. This library is part of the Auckland Libraries (Auckland Council) network.
- **Case B** – The 4th Floor, located in the Downtown Branch of the Chattanooga Public Library, Tennessee, USA.

The researcher reviewed general information available online and spoke with representatives from both makerspaces to determine the cases were suitable for this study. Both makerspaces are located in downtown branch libraries in either large (in the case of Auckland) or mid-sized cities. While there were clear differences in the size of the makerspaces and the populations of the cities, the researcher believed their operational models and environments were similar enough to be considered replicable for this study. Confirmation was also obtained that both spaces were assessing outcomes in some way.

One notable difference was that the 4th Floor's budget was three times that of the CCL makerspace, however the researcher believed budgetary differences would not have significant impact on the evaluation practices used by Chattanooga Public Library for the 4th Floor, unless some of the budget was used to carry out outcomes assessment. This was not the case. (See the 'Case Selection Criteria' Table in the Appendix for more details).

4.2 Theoretical proposition

This case study will explore the proposition that public library makerspaces are likely to use evaluation methods that provide evidence of social value as their key outcomes to measure. While on a secondary level (intermediate or long term) these outcomes may also lead to creating economic benefits for users or the community, the public library is unlikely to evaluate economic benefits directly.

To define 'social value' the study will adopt the ISO 16439:2014 definition of "social impacts" as: "influence of a library's existence and services on the population in the surrounding community or on society in general" (ISO 16439:2014, definition 3.64)

The purpose of qualitative inquiry is to test the rigour of the theoretical reasoning made, rather than to generalise findings to a population (Bryman, 2012). Therefore, it is not the intention for this case study to make broad claims about the outcomes assessment of public library makerspaces in general. Rather, findings will be explored in relation to the theoretical proposition stated above.

5 Methodology & analysis

5.1 Data collection

A case study approach has allowed the researcher to collect evidence from a number of sources to corroborate the data and bring greater construct validity to the research (Yin, 2014; Riege, 2003). Evidence was gathered from three sources - documents, archival records, and interviews. The study attempted to obtain as much evidence as possible to compile a rich bank of data to explore the research questions. Data collection focussed upon gathering evidence to support the theoretical proposition for the study.

5.1.1 Documents and archival records

The researcher requested access to copies of documentation and archives related makerspace assessment and wider organisational evaluation practices. The documents reviewed included -

- Project team notes
- Planning documents
- Reports prepared for managers and stakeholders
- Spread sheets with compiled statistical data
- Spread sheets explaining measures used
- Guidelines explaining how to use assessment techniques
- Conference papers
- Published stories featured online
- Blogs, social media and online communities (e.g. Instagram, Flickr, Facebook, Twitter.)
- Community snapshot report (Auckland Central City Library)
- Census and demographic data (found online)

Please see the Appendix for a list of all documentary and archival evidence used for this case study.

5.1.2 Interviews

The greatest source of evidence for this study was gathered through interviews. In total 11 interviews were undertaken, 6 for the CCL makerspace, and 5 for the 4th Floor. Interviewees were recruited using the snowballing technique. Face to face interviews were carried out with Auckland-based interviewees, and Skype was used interviewees in Tennessee. The interviews were semi-structured as 'guided conversations' (Yin, 2014, p.110) with topics and lines of inquiry related to the main objectives of the research. Interviewees were sent interview schedules to prepare prior to their interview. The conversational approach allowed the researcher to ask additional questions and probe avenues of interest that surfaced during the interview related to the research questions. The interviews were recorded, with consent, so the researcher could focus on the conversation.

5.2 Ethical considerations

The researcher sought formal agreement from the Executive Director of Chattanooga Library and the General Manager of Auckland Libraries to carry out this study. Permission was also granted to disclose the names of both libraries in this final report. As human subjects were used to gather information the researcher gained approval from the School of Information Management Human Ethics Committee to proceed with the study. Each interviewee provided informed consent to be a part of the study and their identities have been kept confidential in this report.

It is also important to note that Auckland Council currently employs the researcher in a role supporting Auckland Libraries, however there is no chain of accountability between the interviewees and the researcher. This was declared to and accepted by the Human Ethics Committee. The researcher has some personal and professional interest in the topic of this study. While the data was collected and analysed, the researcher minimised any personal biases and remained "naïve on the topic" so as to not influence the findings (Yin, 2014, p.110).

5.3 Data analysis

5.3.1 Preparing the data

Raw data from the interview transcripts and documents was compiled into two separate Excel databases, one for each case. This process of compiling the data started what Yin (2014, p.135) describes as “conceptualising the data”. The data was categorised by source (or interviewee) and structured as it was compiled into groupings related to the key study objectives. Documents were reviewed and analysed and key information relating to the research questions were added to the database. The two databases were kept separate to ensure data was not confused between the two cases.

5.3.2 Analysing the data

Once the data was compiled, each database was read through individually to obtain a macro-view of the data set before looking at the detail. Codes were defined from the data at this stage and added to both the interview data and documentary data. Yin (2014, p.121) explains that case studies need to ensure that findings are based upon a “convergence of evidence” from the various sources, and not simply a summary of separate conclusions, which helps to strengthen construct validity to the case study. The researcher compared the two sources of evidence to corroborate findings that developed through analysis. The codes were clustered in some circumstances to further refine the findings.

The researcher checked that the data and analytic thinking related back to the study’s proposition and research problem, and ruled out lines of enquiry that did not apply. Then, key findings were summarised from the data as it was coded and sorted. The researcher tested the analysis by looking for rival explanations in the data, which led the researcher to reconsider findings made and look for greater triangulation of evidence, all of which helped to strengthen the internal validity of the study (Yin, 2014).

The researcher used a case study protocol when working with the data (Yin, 2014). This involved comparing the findings of Case A to the theoretical proposition to test whether it was appropriate for the study. The researcher found that the proposition

was suitable and continued to use the statement to guide and work with the data collected from Case B.

5.4 Pilot study

A small pilot study was conducted to test the proposed data collection and analysis methods. The pilot led the researcher to revise and simplify the interview schedule, by removing the use of jargon and adding additional questions where gaps were identified. Definitions of key terms, such as 'outcomes' were also added. The database designed by the researcher to collect the data were expanded to include further categories related to the objectives of the study.

Conducting the pilot also helped the researcher to determine how much time it would take to conduct and transcribe the interviews, review the data from various documentary sources and code the information.

5.5 Assumptions

The researcher assumes that contextual and environmental differences mean the specific aims and objectives of public library makerspaces differ. This is why a case study design was selected as the most appropriate method for this study. The environmental context of a makerspace in a medium-large urban downtown city was specifically selected as the researcher assumed makerspaces fitting this description would be more likely to be well-established and assessing outcomes. Both cases confirmed prior to their selection for this study that they were assessing the outcomes of their makerspaces in some way.

The findings in this report rely upon documentary and interview evidence. The researcher assumes that the documentary evidence shared provides accurate and complete information, and that all relevant documents were shared where practicable. The researcher also assumes that all interviewees provided honest and complete answers to the questions posed, and that the lines of enquiry used were appropriate.

5.6 Limitations

The number of interviewees taking part in this study was relatively small – 11 in total. This was in part because there are only a small number of people from each organization with appropriate knowledge to take part in the study.

Another limitation was that the researcher was not able to obtain as much documentary evidence from the 4th Floor as was collected from the CCL makerspace. This may be due in part to the distance between the researcher and the case and the reliance of email through a key informant as the main means of communication. It is also possible that there was no other documentation appropriate for the research. Please see the Appendix for a list of documents consulted.

6 Case A: Central City Library Makerspace

6.1 Background

The CCL makerspace was first established by a small team of library staff in 2013 in response to a business plan objective for the fiscal year 2013/2014. The makerspace was initially introduced as a pilot to see how the community would respond to having a makerspace in the library. Equipment and technology was purchased including a 3D printer and robotics kits, and computers operating source software and providing access to online coding and gaming software were made available. The makerspace was initially located in a small room on the First Floor of the library away from open public areas. To launch the space and draw interest from the community the library organised an event called 'Makesplosion' for which they set up a number of interactive stations around the library to introduce people to making activities and the maker ideology. A number of local tinkerers, makers and experienced mentors from independent maker groups participated in the launch, which was attended by two hundred visitors over two days (Dugmore et al, 2014, p.3)

At present, the makerspace is located on the open public floor of the First Floor, opposite an enquiries desk. At the time the interviews for this study were conducted the primary focus of the makerspace was to facilitate access to the 3D printer. Students from local schools and members of the public use the 3D printer heavily for course work or personal DIY projects. One interviewee noted, "I think for last

fortnight we had a media design school student come in on an almost daily basis...for 12 hours at a time printing things out."

During the school holiday's events are coordinated with system wide programmes offered for children. Initially, the makerspace provided a mixture of workshops coordinated by staff or volunteers from the community, as well as "hang-outs" which were open sessions for people to meet-up and work together on projects. Currently fewer workshops are being coordinated, as the team responsible for running the makerspace goes through a period of adjustment with new staff members being hired and plans being made to relocate and rejuvenate the space.

6.2 Findings

6.2.1 Summary of findings

In exploring the research questions and study objectives, three main themes were identified.

- 1.** A strong relationship between the CCL makerspace and the Auckland Libraries strategic plan was revealed in the research data. While there are specific objectives documented for the makerspace, the researcher found these objectives were not widely known by interviewees. However, analysis on data gathered on the topic of aims and objectives shows a number of key overlapping themes.
- 2.** Assessment of the makerspace has been undertaken since the space was established and some of the techniques used look at the outcomes of service. The assessment techniques are primarily informal, used for formative purposes, and many are no longer in use.
- 3.** The organisation requires a plan for assessing and demonstrating the outcomes of programmes and services that could be applied to the makerspace.

6.2.2 Makerspace objectives

To begin to establish whether the evaluation approaches designed and used to determine the outcomes of library services were appropriate, the researcher sought to understand the objectives of makerspace. The researcher found that a distinction had to be made between what was found in the documentary evidence collected and what the interviewees themselves described as the objectives or aims of the space.

The documentation and interviews both revealed strong links between makerspace planning (and aims) and the “key focus areas” described in Auckland Libraries strategic plan *Te Kauroa – Future Directions 2013-2023*. The following statement from a business-planning document represents many of the documented descriptions on this subject of strategic alignment -

“The makerspace appeals to the Te Kauroa – Future Directions, particularly to the focus areas of the ‘Digital library’, ‘Children and Young People’, ‘Library Spaces’ and ‘Customer and Community Connection’.” (*Makerspace Cases*, 2014)

The documentary evidence revealed how the key focus areas and additional business planning initiatives provided the group with a context in which to develop a set of “actions” (also referred to as “objectives”) related to delivering a makerspace in the library. These actions describe the priorities for the makerspace. Table 4 provides an integrated view of the strategic key focus areas, Auckland Libraries Business Planning objectives 2013/2014 and the actions or objectives set for the makerspace. This table has been adapted from the documentation provided for the case study (Dugmore et al, 2014; *Pilot Makerspace Launch Central City Library* (n.d.))

Table 4 – CCL Makerspace planning

Te Kauroa focus areas	Business Plan objectives 13/14	Makerspace actions / objectives
1. Digital Library	To work more courageously	<ul style="list-style-type: none"> To pilot a makerspace area at Auckland Libraries
2. Children and Young People	Develop and resource programmes for 14+.	<ul style="list-style-type: none"> Provide maker activities for young people facilitating meaningful play. To demonstrate our commitment to <i>Te Kauroa – Future Directions</i> in providing services that inspire learning and participation.
3. Library Spaces	Engaging spaces	<ul style="list-style-type: none"> Pilot new types of spaces in libraries,

	at the heart of the community	which offer learning and creative opportunities for all.
4. Customer and Community Connection	Create opportunities to connect with and learn from customers	<ul style="list-style-type: none"> • Provide opportunity for the Central city community and library staff to create, connect, collaborate, and innovate with each other and experienced mentors

Nearly all of the interviewees validated the emphasis in the documentation of Te Kauroa being an important strategic influence on the creation and programming activities of the makerspace. However, there was some inconsistency in responses on the objectives set for the makerspace. Most interviewees were not aware there were documented objectives, and it is unclear whether these were shared or formalised. This may be because a number of pioneering staff members have left and new staff have come on board since the makerspace was set up in 2013. It is also important to consider that over time the objectives, or what staff members consider are the aims of the makerspace, may have evolved since its inception without changes being formally documented or perhaps even consciously acknowledged by the group.

A couple of interviewees noted that setting clear objectives was not a priority in the beginning stages, and that an experimental approach characterised planning the space. One interviewee noted - "In a sense we wanted to model the maker ideals of ... trying it out and giving it a go, and building things up and just seeing if it worked". There was an interest to see how staff and customers used the space without having objectives or programming approaches predetermined.

The researcher sought to determine whether a clearer understanding of the objectives could be revealed through the research data. Analysis of interviews and documentary evidence revealed overlapping concepts, which lead to four themes being determined:

- 1. A collaborative learning environment connecting the community.** Offering a space for members of the community, mentors and library staff to learn from each other while working on projects or using the technology available. Ultimately the space would become community-directed and co-led with library staff.
- 2. A place to experiment, play and create.** A space that captures people's imaginations and allows people of all ages and skill levels to create and make. Some events and programmes may have a special emphasis on young people. The makerspace would support a learn-by-doing approach.
- 3. Reinvent the public library as a responsive community space.** Experiment with and confront people's perceptions of a public library space – not just a place for information consumption, but also a transformational place for experimentation, creation and sharing knowledge. A challenge would be to see whether the public accepted it as an extension of the founding principals of public libraries.
- 4. Democratise access to new technologies.** Carry on tradition of offering equitable access to information and technology by extending this access to new and expensive digital/manufacturing technologies such as 3D printers and robotics machines. To be the place community members are introduced to these technologies, and mentors who can provide support.

As previously stated, although some interviewees were unclear about the documented objectives for the makerspace, the thematic analysis reveals clear linkages with the makerspace "actions" (in Table 4) showing there is a consistent sense of what the CCL makerspace is trying to achieve. This was important for this study to establish in order to answer the research question on the appropriateness of the assessment methods and techniques used.

6.2.3 Assessment methods and tools

The research data revealed a variety of methods and techniques have been used to evaluate the makerspace since its inception, a number of which were designed with the intention of gathering evidence and gaining insight into the impacts or values the makerspace brings to the community.

Early in the planning stages of the pilot four uniquely-named measures were designed by the small group involved in launching the makerspace to indicate how it was progressing against some concepts the team had discussed were important markers of success for them. Evaluation methods and instruments were assigned or designed to gather data for each measure. One interviewee noted,

"... [the team] came up with a number of measures that seemed to fit... it wasn't really what we were trying to achieve, but it was the kind of thing that we wanted to know about..."

The following table lists the measures designed for the CCL makerspace with a description of the concept the team was interested to understand. The researcher notes that the measure description (column 2) in the table hint at possible objectives or aims for the makerspace.

Table 5 – CCL Measures

Measure name/ theme	Description	Measure	Assessment Method/ Tool
Grow-like-a-weed-ittude	"Measures the resilience and sustainability of the idea from a staff and library system perspective"	Number of libraries in Auckland Libraries with permanent or semi-permanent maker activities	Count
Social Interestingness	"Ability of the makerspace ideas/activities to engage community imagination"	Average social interestingness score from Word Tool.	"Word Tool" (Flashcard questionnaire)
Filling-in-form-ability	"Rigour behind the thinking and quality of the business model"	Percentage of Social Lean Canvas that can be filled out	Staff completing a Social Business Canvas template
What-would	"Social and	Number of projects or	Count

Andre-say	environmental impacts”	workshopped activities that are demonstrably linked to making a positive social/ecological impact	
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(Sources of data in table: Dugmore et al, 2014, pp. 7-8; [Excel spread sheet of Makerspace Measures] (n.d.); *Measuring Makerspaces* (n.d.)).

It should be noted the case study data collected on the CCL makerspace measures was inconsistent, meaning the data in Table 5 has been drawn from a number of documentary sources. The researcher has tried to ensure as best as possible that the measures are represented in the table accurately. It should also be noted that the researcher believes these measures are not currently being used for the CCL makerspace.

A number of assessment techniques were identified in the case study data, not all of which are linked to the measures designed for the CCL makerspace in Table 5. The following table summarises the methods and techniques the researcher discovered, and also expands on some of the methods /tools identified in Table 5. Each method has been tagged as either ‘explicit’ (the assessment directly involved customers) or ‘inferred’ (the evidence of outcomes is based of quantitative findings) – terms used by Tenopir (2012) and ISO 16439:2014.

Table 6 – CCL assessment methods and techniques

Technique / Name	Method	Description
n/a	Quantitative (Inferred)	Number of makerspace (3D printer) bookings. This data is collected via a bookings spread sheet and an Eventbrite (online bookings software) listing for the makerspace. This count is the only current mandatory evaluation data required for regular performance reporting and governing body reporting

		at a programme level. All libraries are required to capture attendance numbers for the programmes and events they deliver each month.
n/a	Quantitative (Inferred)	Number of other libraries in the Auckland Libraries system that have adopted maker activities or set up makerspaces after the Central City Library was launched. This figure represents to the group how far the makerspace idea had reached other parts of the library system. The count is used to measure “Grow-like-a-weeditude” – the resilience and sustainability of the makerspace idea in a public library. How the count is made and the data is captured could not be established in the case study data.
n/a	Quantitative (Inferred)	Number of workshops linked to making an impact in the community. This count is used to measure “What-Would-Andre-Say” – the social and environmental impacts of the space. How the count is made and the data is captured could not be established in the case study data.
Flashcard questionnaire / “Word Tool”	Quantitative (Explicit, solicited)	A rubric used at the end of a makerspace event or workshop. Participants and staff are asked to sum up their experience by selecting positive or negative statements printed on flashcards such as “too hard”, “too easy” or “I learned something new”. Users are also able to make open comments, which are coded afterwards as ‘positive’, ‘negative’ and ‘neutral’. The cards are tallied-up and input into a spreadsheet that calculates a value to give a final numerical “social-interestingness” score. This score is used to measure “Social-interesting-ness”, - the ability of makerspace ideas and activities to engage with the community’s imagination.

Storytelling / “Makerspace stories”	Qualitative (Explicit, solicited)	This involves writing brief stories describing interesting interactions and projects happening in the makerspace. Stories are gathered through observation and informal discussion with users and compiled in a Word document. They are structured using as who, when, where, what happened format. The impact that the staff member infers from the interaction was also documented, and in some instances photographs and comments from customers are included. The method was inspired by a wider Auckland Council initiative to share stories of customer interactions called “Every Interaction Counts”.
Feedback (ad-hoc)	Qualitative (Explicit, solicited)	Staff members often gather informal feedback from customers when supporting them to use the technology and equipment, such as the 3D printer. The feedback is not formally documented but it is shared between the team on occasion.
Observation	Qualitative (Explicit, observed)	To look for stories to collect and document, staff informally observe activities occurring in the makerspace, in both in participant and purely observational roles.

It should be noted that, with the exception of counting the number of bookings made, the researcher could not establish evidence that the evaluation methods and techniques above have been widely adopted or formalised for the CCL makerspace. It must also be noted that not all interviewees were involved in the development of the evaluation measures and techniques, or aware that some of the measures or methods existed. Current assessment activity involves documenting booking numbers and informally gathering feedback from customers while helping them to use the 3D printer. One interviewee noted the lack of assessment may be due to a loss of institutional knowledge, as key staff involved in setting up the makerspace

had moved on to new roles. It is also worth noting that at the time the interviews were taking place the makerspace was undergoing a period of replanning.

Apart from booking numbers being used for scheduled performance reporting and quarterly local board (governing body) reports, it was unclear how the team used the additional evaluation data that was gathered. Some interviewees noted that the “social-interestingness” score generated from the flash-card surveys was used formatively to gain a sense of how appropriate the workshop or event was for the audience attending it, and whether adjustments needed to be made. Ad-hoc feedback collected was also used to look for improvement opportunities. The ‘Makerspace Stories’ were captured with the purpose of sharing outcomes with the wider organisation. One interviewee explained that,

“...given that it was a very new experiment of a service, I think we wanted to capture some sort of understanding of the effect it was having. So for storytelling to the wider organisation, but also just an understanding amongst ourselves about what impact it had.”

At the time the interviews were being conducted for this study, the Makerspace Stories document had not been updated since October 2014 and some interviewees were not aware of it.

6.2.4 Organisational context and barriers

The team that set up the makerspace recognised that evaluation was an important part of running a pilot and had a keen interest in understanding more than booking numbers. The novel evaluative approaches devised showed they had an interest in exploring the effects of the makerspace and to determine measures of its success. They also showed the team did not see the measurements and methods being used by the organisation as appropriate for their purposes. The team did not want to be confined to a set of methods that they felt would constrain their assessment approaches.

The researcher notes that some of the assessment techniques devised overlooked the opportunity to capture potentially rich qualitative data in favour of a quantitative approach, such as the *number* of workshops delivered that demonstrated impact, or

the *number* of libraries setting up makerspaces or maker activities following on from CCL. In the case of these two examples, what may be more interesting and meaningful are the specific stories of impact –what the effects were on the customers using the makerspace, and a description of how the CCL makerspace came to influence other libraries to create their own makerspaces. When discussing the decision to use the quantitative over qualitative, one interviewee said

"The actual measures... we were trying to turn qualitative stuff into a quantity. That could then be tracked, and measured and understood in those terms. I don't know if we did it as such, but that was the attempt."

There was a general sense from the interviews that Auckland Libraries has a strong interest in understanding the outcomes of library programmes and services generally. One interviewee spoke of local boards being drawn to the dropping visitor numbers and a need to supplement this figure in reports with data or stories that indicated outcomes, or as one interviewee put it, the “heart-side” of the service.

“...what the count doesn't tell them is the value that people actually intrinsically place in libraries as a community space, as a free service more or less, as a place where people meet each other”.

Library managers are asked each quarter to provide a brief highlight of activities happening in their libraries and specifically to focus on programme or service outcomes. They are not required at this stage to formally assess the outcomes. One interviewee noted a project team had been formed to look at how to measure outcomes of programmes and services and indicated they believed this was where reporting was heading for the organisation.

These findings will be compared to the 4th Floor in the Discussion section.

7 Case B: The 4th Floor

7.1 Background

The 4th Floor makerspace opened in March 2013. It is positioned in a very large 14,000 sq. foot space (1300 sq. metres) on the fourth floor of the Downtown branch. The floor used to be a storage facility for obsolete technology and broken library

furniture, and was transformed into a makerspace after a new management team was introduced with the goal of improving use and bringing the library into the twenty-first century. The makerspace occupies half the space of the floor and the other half is used for library events. They have a range of technologies and equipment on offer, including a 3D printer, laser cutter, screen-printing equipment, vinyl cutter, button making station, zine and publication resources, a sewing machine, loom, tool section, virtual reality headsets, and more. The makerspace has recently expanded its opening hours to be staffed any time the library is open. There are currently three dedicated staff members responsible for supporting patrons using the makerspace.

The team worked with external community partners to gain advice on how to set up the space. They used the partners existing networks to leverage and build-up interest and further support, such as the small business start-up accelerator Company Lab (CO.LAB). The makerspace was launched with a major event called 'Thinking in 3D' which saw approximately 1200 people visit the space in one day. Local additive manufacturing companies, business start-ups and other groups the library had partnered with helped to deliver the event, with equipment, such as industrial sized 3D printers, and expertise. The makerspace opened officially the following week with a single 3D printer, and as interest in the space began to develop new technologies were purchased and workshops set up.

A lot of the early visitors to the 4th Floor were people who were already familiar with maker culture and interested in pursuing their projects in the space. Over time, as more alternative makerspaces have opened up in the city and people have moved on, the space has become a place more targeted to novice makers; people of all ages interested in learning more about 'making' and pursuing their personal projects.

"We want a place that is for you, a place for you to come and explore and be creative, and work with other creatives, or discover your creativity. So it's not just for the 'maker' or the 'tinkerer'. It's for the sewer and the grandma and her grandkids too".

Chattanooga is a very innovative city. It is known as the 'Gig City' - one of the first places in the United States to offer an Internet connection at one gigabit per second

(Rushe, 2014). The downtown library is situated in the Innovation District, within walking distance to a number of start-up businesses, entrepreneurs, business incubators and accelerators (Innovation District Chattanooga, n.d.). The library wants to offer the 4th Floor as the gateway space for patrons into other maker institutions, in the city. As one interviewee put it, “we want to be that first stop on your journey”.

The programming delivered on the 4th Floor is differentiated into a number of approaches. The space is organised into a series of different ‘walk-up stations’ based around the technology, tools and equipment available. Patrons are free to approach any station and staff members are on hand to support them should they require assistance. There is an impetus to encourage patrons to become self-sufficient in the space, for the staff to act in a coaching or co-learning role. Workshops on how to use particular machines or software are also regularly scheduled and delivered by staff. Larger events are planned, in some cases with external institutions such as Etsy, who they partner with to deliver the Etsy Success Workshops every month. Sporadic ‘pop-up’ programmes are also a feature, when a group of people arrive with a common interest, and the 4th Floor responds by putting together a programme on the spot.

The 4th Floor has been organised into a well structured and in-demand service. Many interviewees were of the opinion it was now time to focus on evaluating the outcomes of the space, and shared with the researcher some approaches they are currently undertaking.

7.2 Findings

7.2.1 Summary of findings

In exploring the research questions and study objectives, three main themes were identified.

1. 4th Floor objectives are yet to be formally set or documented. However, thematic analysis for this case study reveals a number of common themes indicating that there is a consistent view of the purpose and aims of the 4th Floor.
2. Assessment methods and techniques to understand outcomes are being used, but they are predominantly informal.

3. Although there is an interest in sharing stories and demonstrating the outcomes of the service, there is no current formal requirement to do so, other than standard performance reporting on visitor and programme attendance.

The sub sections below will elaborate on these themes in more detail.

7.2.2 Objectives

As was described for the CCL makerspace, an experimental approach characterised the planning of the makerspace when it was first set up. The team responsible knew that they wanted to have a makerspace in the library, but did not want to prescribe too early on what the space was going to do or try to achieve in the community, instead opting to start by seeing how the community responded once it was launched. This meant that objectives or assessment strategies were purposely not planned or formalised when the makerspace was first established. One interviewee noted the team decided –

"...Let's not get bogged down in numbers and statistics and what everyone else is doing, and our outcomes, because we just want to put this thing in the hands of the people and let it grow organically, and then when we see what it has become, then it will be time for some assessment and analysis".

The case study data revealed that the 4th Floor draws its biggest strategic influence and impetus from the energy happening in the wider city of Chattanooga to support additive manufacturing initiatives in the community. One interviewee explained the library wants to "...insert ourselves into the momentum and ecosystem that was already happening in this city ...". One interviewee did make a connection between the 4th Floor and the library's mission to be "the catalyst for lifelong learning", but there appeared to be a greater connection made to city-wide goals than library specific goals. At the time the interviews were being conducted for this study a new strategic document was being worked on.

The 4th Floor has now entered a period of stability of its programming delivery and operational model and staff are now thinking about formalising an assessment approach, and are interested to understand how to improve the ways the outcomes of the service/department are demonstrated. The topic of objectives was discussed

with interviewees and despite these not being formally documented, a number of common themes became apparent:

1. **The gateway to the Innovation district.** The 4th Floor as a microcosm of the Innovation District in downtown Chattanooga; a service that offers any library patron the opportunity to become interested in and learn about making and tinkering, which may result in their interest leading them to other maker opportunities and support services available in the city. Through the makerspace, patrons are helping the city realise city wide strategic goals.
2. **A responsive and open community workshop and meet-up space.** The 4th Floor is the community's workshop and meet-up space; a comfortable and accepting environment for groups to work on projects and interact with others. A space for everyone that responds to the needs of the community with the technology and tools it makes available and the programming offered. Ideally, the 4th Floor is a space that people frequently return to, gaining greater knowledge on the different equipment and expertise on offer.
3. **Self-sufficient makers collaborating together.** A place that the community feels ownership over and decides the direction the space should take. Library staff members encourage patrons to 'learn-by-doing' to help them to become self-sufficient makers in their own space. A service that enables customers to collaborate and learn together as a community.
4. **A place of curiosity, exploration and learning.** A place where people's curiosity about the world of additive (3D) manufacturing and technology is piqued and they are invited to play, explore and investigate. Ultimately a place where new skills and knowledge are gained and customers feel rewarded for the time they spend there.

7.2.3 Assessment methods and techniques

Table 7 presents all techniques currently being used (both formal and informal) on the 4th Floor. As for the CCL makerspace methods (Table 6) each method has been tagged as either 'explicit' or 'inferred' (Tenopir, 2012; ISO 16439:2014)

Table 7 – 4th Floor assessment methods and techniques

Technique /	Method	Description
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Name		
n/a	Quantitative (Inferred)	Visitor numbers (walk-ups) - Number of visitors to the floor tracked manually by staff throughout the day on a tally sheet, noting the equipment/station being used against an age group, e.g. children, tweens, teens, adults. This data is used to gauge interest levels of the various walk-up stations by different patron segments and to understand patterns of use during the day. Total visitor numbers are compiled into a formal monthly report that gets shared with the City Council.
n/a	Quantitative (Inferred)	Participant statistics (programmes) - Number of participants attending programmes organised on the 4 th Floor, by age groups. Participant numbers are used for formal reporting, as above.
Comments cards	Qualitative (Explicit, solicited)	Available throughout the downtown library (and branches), patrons can submit comments about their library experience or make improvement suggestions. Cards are collated by the Assistant Director and distributed to appropriate managers to share internally or use to make changes, as required.
In-person interviewing (ad-hoc)	Qualitative (Explicit, solicited)	Staff informally interview patrons using the 4 th Floor to either ensure they have the support they require, or to learn more about patron projects and share tips or suggest other tools the patron might be interested in. Interviewees highlighted the collaborative nature of the space supports an open dialogue between patrons and staff.
Photographs / Online storytelling	Qualitative (Explicit, solicited & observed)	Sharing photographs and short descriptions of events or projects occurring on the 4 th Floor on online communities and social media, such as the 4 th Floor blog, Flickr, Instagram and Twitter. Stories are usually selected after a staff member observes something of

		interest happening in a makerspace workshop or during an event.
Learn/Teach cards	Qualitative / Quantitative (Explicit, solicited)	Cards patrons fill out to identify something they would like to learn and something that they would like to teach. The suggestions are collated and analysed by the team for matches to help with planning future programmes.

Again, parallels can be drawn between the assessment methods and techniques used in the 4th Floor and the CCL makerspace. The 4th Floor assessment approach is primarily informal, apart from gathering visitor or statistics, which has become part of the daily duties of the team. A lot of the interactions they have with patrons where feedback, suggestions or stories are shared are not formally documented, apart from what is posted on online communities (Instagram, Flickr), which appears to happen on a regular but ad-hoc basis.

7.2.4 Organisational context and barriers

Other than documenting and sharing stories online the 4th Floor has not yet determined how to formally report and demonstrate outcomes. Like the CCL makerspace, interviewees noted they are untrained with evaluation practices and would require support to design an approach, especially if it was necessary for staff to carry out the evaluation. Interviewees acknowledged that patrons using the space would probably agree to discuss their work and the effects of the space on their lives; such is the sharing nature of the space.

A number of interviewees shared some ideas they had considered to improve their outcomes assessment practices, such as,

- Making and displaying in the library videos of interesting projects patrons worked on
- Adding a note to the library records of people who had learned how to operate machinery to proficiency
- Following the development of a patron's project and regularly interviewing them to understand any longer term outcomes.

Data captured through the visitor sheets and comments cards, verbal feedback and stories collected are shared and discussed at weekly team meetings. These discussions often lead to formative changes to the space, such as the way staff interact with patrons, changing the layout and tweaking the programming. A number of interviewees emphasised the importance they attributed to reflecting on this data - "If we didn't pay attention to that stuff then we'd just be doing it for us and our particular interest. But that is not what our space is for; it's for our community"

A need to have a mechanism to capture and distribute findings was also a theme picked up in the research data. One interviewee acknowledged how librarians like to share the qualitative experiences amongst themselves, but what was required was a simple way to take that information and demonstrate how the experiences related to goals of the library and wider community.

8 Cross-case discussion

The aim of this study was to establish the methods and techniques public libraries are using to evaluate the outcomes of their makerspaces, and whether the approaches used can be justified as appropriate. To do this, the researcher started by exploring the objectives of the CCL makerspace and the 4th Floor. Then, assessment methods and techniques were identified, and the organisational contexts explored. In this section the findings from both cases will be examined and discussed together.

As aforementioned, many parallels can be made between the CCL makerspace and the 4th Floor regarding the objectives for their spaces, assessment methods and how their organisations currently approach outcomes assessment. This indicates to the researcher that the selection of the two cases for comparison was appropriate.

8.1 Reliance on quantitative evaluation methods

The only assessment or evaluation data currently formally required in both cases are booking numbers or visitor statistics. In both cases this data is captured and submitted for analysis and utilisation in various reports going to library management and other Council departments or board members. If the purpose of outcomes

assessment is to "...assess the extent to which programs and services produce desired changes... defined by the organisation's values" as Lyons (2012) states, it is worth considering the extent to which quantitative data can be used for the purpose of outcomes assessment.

As revealed in the literature, traditional output measures such as counting visitor numbers provides an indication of use, but does not show "the purpose, satisfaction or outcome of use" (Tenopir, 2012, p.6). In relation to 'impact assessment' ISO 16439:2014 refers to quantitative measures and statistical counts as inferred evidence that should be "corroborated" with data from other methods such as surveys or interviews (ISO 16439:2014 p. 21). Both cases practice a number of varied techniques (albeit informally), some of which can elicit from customers their opinion on how satisfied they were or what they learned. There is potential for this qualitative data to be collected more formally and used to corroborate the quantitative data that is systematically captured.

The gathering of output data is an established practice for public libraries and relatively easy to collect. The literature reveals that institutions feel safe using the data as it is considered 'hard and verifiable' which might explain why it is still the only formal evaluation data gathered at this stage (ISO 16439:2014, p.19). This may also explain why the CCL makerspace turn qualitative opportunities into quantitative measures. Counting the number of libraries that have set up makerspaces or maker activities may in some ways indicate how well the maker ideology has been received by the wider community. This count could have been strengthened or "corroborated" by supplementing it with survey or interview results from users and staff on the topic of how sustainable the idea of the makerspace is to the community.

Collecting qualitative data requires knowledge and careful planning, as determining findings can be perceived as difficult and problematic (ISO 16439:2014, p.19). To many, qualitative data is considered subjective and unreliable and thus not appropriate for sharing with stakeholders and the public (ISO 16439:2014, p.19). This problem may in part relate to the question of generalizability. On one hand, because effects or outcomes of service are varied, generalising the values or benefits of the service to the population is not possible. On the other hand, outcomes

assessment is concerned with effects of service through people's opinions and experiences, which quantitative data fails to capture.

In most cases the intention for collecting qualitative data (in research or evaluative research) is not to make statements about a population – instead, it is used to develop findings against a theory (or proposition, as with this case study) known as “analytic generalisation” (Yin, 2009, in Bryman, 2012, p. 406) or “theoretical generalisation” (Mitchell, 1983, in Bryman, 2012, p.406). Bryman (2012, p.406) explains that “...it is the quality of the of the theoretical inferences that are made out of qualitative data that is crucial to the assessment of generalisation.” If this is the case, the researcher posits that the same can be said of qualitative outcome assessment. If objectives or intended outcomes are clearly defined, qualitative data can be analysed to gather insights of how the programme or service is meeting these objectives (or research questions) and not with the intention to make broad statements about the whole makerspace user population.

8.2 Informal methods and techniques to understand social value

The theoretical proposition posed for this case study was that public libraries are most likely to be concerned with understanding the social outcomes of their service, and therefore will have developed or adopted assessment approaches to provide evidence of social values. The literature review stated that social outcomes show the importance of library services for individuals and society, in particular the intangible effects experienced as a result of using the library (Poll, 2003; Poll 2012; Showers, 2015). ISO 16439:2014 provides examples of outcomes with social value being “social inclusion and cohesion, participation in information and education, local culture and identify, cultural diversity, community development, individual wellbeing and preservation of cultural heritage” (p.13). Aims and objectives identified from the thematic analysis for both CCL and 4th Floor were in line with these social values.

The findings revealed the CCL makerspace and the 4th Floor collect data and information about social outcomes using both *solicited* and *observed* techniques to understand value from the point of view of the users. In both cases, staff members gather anecdotal evidence through informal interviewing or questioning techniques to gather feedback and learn more about interesting projects and interactions they

observe happening in the space. On an ad-hoc basis these anecdotes and observations are documented in either the “Makerspace stories” in the case of the CCL makerspace, or posted to online communities and social media for the 4th Floor.

The storytelling method is being used in different ways by the two cases to capture a brief insight of the effects of the makerspace on users. The CCL makerspace structures the narrative in the following way -

- What was happening – e.g. game making or 3D printing,
- Who was taking part, e.g. group of 12 year old boys, or family of four
- How the interaction took place

Following this structure ensures data collected is consistent which allows for greater comparison and the potential for the data to be analysed for themes. Most stories had a photograph included and were tagged with codes related to social outcomes, such as “staff learning from youth customers” or “community knowledge sharing”.

Similarly, photographs of interesting projects on the 4th Floor being posted to social media and online communities demonstrate the social outcomes of service. These photographs (or series of photos) are sometimes accompanied by brief descriptions of what is taking place. The benefit of posting these photographs and stories to social media is that they reach a wider and external audience.

Both cases could benefit from developing a plan for collecting these stories, using consistent methods to collect the information required, and linking the stories back to objectives or intended outcomes for the space. Developing a plan to use the information, such as online via social media (with permission) is a good way of engaging with the community, stakeholders and other library advocates on what the makerspace is achieving. The literature explains that narrative enquiry/ analysis is a method used in social research to create an understanding of how people make sense of what happened in a certain circumstance and to what effect (Bryman, 2012). It can be employed in two ways – by taking existing data collected directly from customers (comments cards, interview transcripts etc.) and using it to create patron or customer narratives in their own words, or, by interviewing people directly in a structured way to elicit a story about a particular event (Bryman, 2012; Hernon et

al, 2015). Recognising that this is a method that can be used purposively and with structure could help to strengthen the practices currently used by both cases. Showers' (2015, p.80) believes user narratives are a "key ingredient" in being able to meet the needs of users or improve services.

The flash-card survey or "Word Tool" created by the CCL makerspace provides examples of social outcomes in quite a different way. It involves soliciting explicit data from customers using a series of flash cards, which are related to the customer's satisfaction with the service, i.e. whether they liked it or would recommend it to others, as well as the quality of the service in their opinion. It works well with people of all ages, and it has an element of fun to it. There are two potential considerations. Firstly Hernon et al (2015, p.15) note that assessment of satisfaction is based on a participant's emotional response to programming that "may or may not be directly related to the performance of the library on a specific occasion". That is the participant may be predisposed to giving positive or negative responses due to many other factors influencing them on that day. Secondly the data gathered from this tool is enumerated into a single "social-interestingness" score. The literature review revealed that a reliance on numbers to represent value overlooks relevant information that is required for decision-making (Mulgan 2011, p. 216). An alternative approach could be to document the tallied counts of each flash-card and track their totals over time against demographic data such as age, ethnicity, time of workshop etc. to look for trends and develop insights. The data being captured using this tool could provide more opportunities than a single numerical score.

The Learn/Teach cards were a novel idea created on the 4th Floor. While being designed to gather community input for organising programming activities the cards have the potential to provide data that could be used for assessment purposes. The cards help the 4th Floor to realise their aim of creating a space that is community-led and allows for volunteers to take on teaching roles. The data from the cards could be collated for analysis to determine whether the goal of having community led workshops is being met. From this data, staff could also start to build narratives about patron led workshops that could feed into reports or social media stories.

One of the aims revealed in the case study data for the 4th Floor was to act as the gateway to the Innovation District, which links into the wider economic impetus of the City. A possibility could be for the 4th Floor to look at the economic impacts it creates in the local community by using some of the techniques highlighted in the literature, such as an Economic Impact Analysis (EIA – see Table 3). This method examines how the local economy has profited from the use of library services. If participants experience an increase in skills as a result of using the makerspace and then go on to find local employment (for example) an EIA would be a suitable method to measure and understand the relationship of this outcome to the library.

8.3 Objectives not clear or not documented

A key finding in both cases was that the formal objectives or intended outcomes were either not clearly documented, or not widely known. The literature review reveals that a key component of evaluation is to start with well defined statements or objectives which guide and structure assessment activities by indicating appropriate measures and assessment methods (Schwartz, March 7 2014; Becker, 2015; Streatfield & Markless, 2009). In both cases, not starting with clearly stated objectives for assessment led to some confusion about what techniques were appropriate. In the words of one interviewee, "I mean, if you don't objectify your objectives then understandings can vary". A risk of not having objectives clearly defined is that staff members develop their own interpretations of what the space is for and the original purpose is lost.

Both spaces talked about starting out with an experimental approach and not wanting to be pinned down to any particular set of objectives or outcomes. What may have been missing from these experiments was the identification of a hypothesis or hypotheses that helped to determine whether or not the experiment was a success or a failure. These hypotheses would have structured assessment while in the initial stages of the makerspace. Then a set of data would have been available to help guide decision making for the space upon completion of the experimental period, and helped to guide the creation of objectives for the space.

The thematic analysis conducted by the researcher on the topic of objectives showed many similarities between the aims of the 4th Floor and CCL makerspaces.

At a high level there are similarities connecting the two cases in terms of what they are trying to achieve in the community.

Table 8 – Cross-case thematic analysis of aims and objectives

CCL Makerspace	4 th Floor
Co-learning environment connecting the community	Self-sufficient makers collaborating together
A place to experiment, play and create	A place of curiosity, exploration and learning
Reinvent library as a responsive community space	A responsive and open community workshop and meet-up space
Democratise access to new technologies	Gateway to the Innovation District.

These themes relate to the three key benefits identified in the research conducted by Slatter & Howard (2013) of Australian makerspaces, being – community engagement, equitable access to expensive technology and to help future-proof the library. If the themes accurately represent what both cases are trying to achieve with their makerspaces, then these concepts or aims will require careful consideration of how the service/programme is to be measured and what assessment techniques will gather appropriate evidence. Some of the current techniques used have the ability to provide appropriate information in relation to these themes, but, as aforementioned, would be greatly improved by formalising them and giving them structure.

8.4 Organisations under-prepared for outcomes assessment

As stated in the literature review, Lyons' (2012, p.332) examination of library evaluation approaches unearthed little evidence to suggest that methods used were effective in understanding the outcomes or impact of services. Streatfield & Markless (2009, p.136) acknowledge that the complexity may be a barrier for library managers to look beyond traditional performance measures into qualitative approaches to understand “deeper effects of their services on users and their communities”.

Because understanding outcomes requires a different (and more time consuming) approach than gathering output data, outcomes (or impact – see definitions in

Appendix) assessment should be considered for those programmes that link strongly with strategic outcomes (ISO 16439:2014; Poll, 2012). In the case of the CCL makerspace the link to strategic outcomes was made quite clearly in the case study data. For the 4th Floor, discussion of strategic relationships link into wider goals for the City of Chattanooga. There is a sense that spending time analysing the outcomes of makerspaces is justified and appropriate for both cases because of these relationships to wider organisational or community-based outcomes. However, a barrier to what is currently being done to understand outcomes is that staff members lack knowledge and wider organisational support for conducting this type of assessment in both organisations.

The researcher identified that because of a lack of knowledge and expert support outcomes assessment has not yet been prioritised or formally required in both cases. This means the data (apart from participant/booking counts) and stories are being captured by staff because they feel the need to understand the broader picture for their own purposes, and to make formative changes, if required. Therefore, no plans currently exist to carry out assessment, and what is being done is a largely ad-hoc and performed irregularly. What both makerspaces would benefit from is devising a plan for the assessment and reporting of outcomes. The researcher noted interviewees understood the importance of this type of assessment, but were at a loss to understand where and how to do this accurately. Staff have not been trained or cautioned on the implications of carrying out research, such as minimising threats to the validity by choosing appropriate techniques, being consistent with data collection, limiting any biases, selecting appropriate samples, etc. Ensuring that the data is captured in a valid way will improve the overall reliability of the findings shared with funders and management (Connaway & Powell 2010).

The Welsh Public Library Standards (2014) provide an example of a structured approach to incorporate more qualitative data on library outcomes into key reporting practices and documentation. The framework requires each local authority to produce at least one case study detailing how the library has made an impact on an individual, or group of individuals in that reporting period (Welsh Government, 2014, p.25). The standard also stipulates a narrative is required that shows how the library contributes to the foci of the local authorities and “wider Welsh Government priorities

and Strategic goals” (p. 25). This is to get libraries to consider how they contribute to wider social and economic outcomes, and gives them the opportunity to make clear their impact and value to “policy makers at local, regional and national level” (p.25). Welsh public libraries are provided tools and support to undertake this assessment. While the Welsh standard is set at a national level, the approach that has been taken provides an example that could be adopted at a regional or local level.

8.5 Interest in understanding outcomes of makerspaces

The findings revealed there is a growing interest from both organisations to understand the outcomes of their programmes and services, and an acknowledgement that numbers do not represent the outcomes of the makerspaces well. There was also a recognition that more needed to be done to improve their current practices. While interviewees indicated they were comfortable speaking with customers about their experiences, they lacked a formal process to structure their assessment.

On the topic of impact assessment, Streatfield & Markless (2009, p.137) summarise an approach they designed to support public library managers. The process was to:

- Design appropriate impact objectives for the service
- Determine which indicators will be most useful to show whether the service is a success or not
- Decide what evidence needs to be collected to show the impact, and how best to collect the evidence,
- Decide how to use the evidence

Streatfield & Markless (2009) stress that it is important to recognise what types of evidence are going to be useful, and that impact assessment typically requires a qualitative approach, in the form of interviews, focus groups, and observation studies. Library managers are encouraged to develop impact evaluation methods that follow these principles in a way that can be easily managed and achievable within the resources at their disposal (Streatfield & Markless, 2009). The emphasis is on ensuring that assessment is well planned and suitable for the type of service. As evaluation methods rely heavily upon engaging the user, thorough planning and controls are required to keep the data valid and reliable (Lyons, 2012).

Interviewees for both cases indicated that their makerspaces had evolved since their inception and that goals or objectives needed to be established and assessment approaches designed. As both makerspaces are currently in a phase of change, this is an opportune time to develop clearly defined objectives that are linked with standardised assessment methods.

9 Conclusion

This two-case case study has identified that a number of methods and techniques are being used to understand the outcomes of the 4th Floor and the CCL makerspace. Efforts are being made to gather explicit evidence from customers of social value by using both solicited and observed techniques. However, these techniques are not formalised and much of the data or information gathered is not documented or formally analysed.

The researcher found examples of both formative and summative evaluation. There was more emphasis on formative evaluation practices used to make tweaks and improvements to programming. In both cases, summative reports demonstrating the performance of programmes and services rely predominantly on quantitative figures, which the literature notes does not demonstrate the effects of service well. However, both organisations are yet to formally adopt a plan for outcomes assessment, and the researcher believes that the appetite for understanding and demonstrating outcomes exists in both cases.

One of the research questions for this study was to determine whether the assessment methods and techniques used can be justified as appropriate. Taking into consideration the findings of this study the researcher deems that the approaches taken can be deemed as appropriate but in need of improvement. What is required is a formalised approach to outcomes assessment, starting with clearly articulated objectives or intended outcomes against which to gather meaningful data and select appropriate techniques and instruments. Adopting a 'measured' and consistent approach will bring greater validity and reliability to the techniques being used.

9.1 Implications

The implication of this research is that staff involved in running makerspaces may develop a formalised approach to gathering outcomes data to use in combination with traditional quantitative data currently collected.

Another implication is that staff may begin to take a more planned approach to developing programmes and services, ensuring assessment occurs regularly against well articulated objectives related to wider organisational goals.

9.2 Recommendations

Recommendations have been made throughout the Discussions section. Here the researcher summarises key recommendations to strengthen how CCL and the 4th Floor approach outcomes assessment:

- Set and formalise objectives for the makerspace. Review these objectives regularly to ensure they are current and adopt an evaluation approach that is cyclical, frequent and potentially in line with any current existing performance measurement reporting timeframes. Consider how best to gather evidence of the outcome to decide upon a data collection technique.
- Relate the findings back to the objectives when presenting them in a summative report.
- Formalise and structure existing techniques to bring greater validity and application to the data being captured.
- Provide training to staff on methods of outcomes assessment, or consider hiring an external company to do the assessment. An added benefit of training staff is long-term application of skills gained. However, it is recognised that using these techniques requires considerable training and effort, which may make using an external organisation more practical.
- Use resources and toolkits available to help guide outcomes assessment, such as the new ISO 16439:2014 'Information and documentation - Methods and procedures for assessing the impact of libraries'.
- Use a combination of methods to bring data together to demonstrate the outcomes, such as interview data and observational data, matched with attendance or visitor statistics.

- Determine how the information gathered will be shared and presented for example as a written report, a newsletter, a presentation, an info-graphic or a programme logic model. Determine how frequently the assessment be required and how often will it need to be reported on.

9.3 Further research

The researcher has identified a number of further ideas for research in relation to this topic:

- An expansion of this study using a greater number of cases and replicating the units of analysis to test how far the theoretical proposition extends
- An examination of makerspaces that have received grants from philanthropic institutions to understand their requirements for assessment and reporting
- A study incorporating the design of an outcomes assessment framework that is then tested on a makerspace in a public library setting to determine the practicality of the approach
- A content analysis of makerspace stories on social media and how they relate to organisational goals
- An exploration of the use of narratives as a technique to assess and demonstrate outcomes in public libraries.

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11 Appendix

11.1 List of documentary/ archival evidence

11.1.1 CCL Makerspace

- Auckland Libraries (2014) *Tāmaki Pātaka Kōrero – Central City Library Community Snapshot*
- Auckland Libraries (n.d.) What's On: Makerspace at Central City Library. Retrieved 10 December 2015 from <http://www.aucklandlibraries.govt.nz/EN/Events/Events/pages/makerspacecentralcity.aspx>
- Auckland Libraries (2016) in Facebook [homepage] *Auckland Central City Library Makerspace*. Retrieved on 22 December 2015 from <https://www.facebook.com/CentralCityLibraryMakerspace/>
- *The case for a 3D printer at Auckland Central Library Makerspace* [MS Word document] (2013)
- [Spread sheet of Makerspace Measures] [MS Excel document] (n.d.)
- Eventbrite (n.d.) *Central City Library Makerspace*. Retrieved on December 10 from <http://www.eventbrite.co.nz/o/central-city-library-makerspace-2240418915>
- *Facilitator feedback* [MS Word document] (2015)
- *Maker FAQs* [MS Word document] (2016)
- *Makerspace Case* [MS Word document] (2014)
- *Makerspace community of practice* [MS Word document] (2016)
- *Makerspace Locations* [MS Word document] (2015)
- *Makerspace Stories* [MS Word document] (2014)
- *Making a makerspace* [MS Word document] (2013)
- *Making a Makerspace: Approaches and Options* [MS Powerpoint] (2013)
- *Measures* [MS Excel document] (2016)
- *Measuring makerspaces* [MS Word document] (2015)
- *Pilot Makerspace Launch Central City Library* [MS Word document] (n.d.)
- *Word Tool* [MS Excel document] (2015)

- *Report on the Makerspace experience at Central City Library: 6 months from launch* [MS Word document] (2016)
- *Social Lean Canvas V5* [PDF Document] (2014) Available from www.socialleancanvas.com
- Statistics New Zealand (2013) *2013 Census table about a place: Auckland*. Retrieved from http://www.stats.govt.nz/Census/2013-census/data-tables/tables-about-a-place.aspx?request_value=24395&parent_id=24394&tabname=#24395

11.1.2 4th Floor

- Chattanooga Public Library (n.d.) *4th Floor*. Retrieved 10 December 2015, from <http://chattlibrary.org/4th-floor>
- Chattanooga Public Library (2016) in Flickr [homepage] *The 4th Floor*. Retrieved on 23 December 2015 from <https://www.flickr.com/photos/chattlibrary/sets/72157631269756074/>
- Chattanooga Public Library (2016) in Instagram [homepage] *Chattlibrary* (2016) Retrieved on 23 December 2015 from <https://www.instagram.com/chattlibrary/>
- Chattanooga Public Library (2016) in Twitter [homepage] *4th Floor Chatt*. Retrieved on 23 December 2015 from <https://twitter.com/4thfloorchatt>
- Chattanooga Public Library (2016) in Facebook [homepage] *The 4th Floor*. Retrieved on 23 December 2015 from <https://www.facebook.com/the4thfloorchattlibrary/>
- Cook, N (2013) Chattanooga's Makeover Secret: A River Runs Through it. *The Atlantic*. Retrieved from <http://www.theatlantic.com/business/archive/2013/08/chattanooga-makeover-secret-a-river-runs-through-it/425658/>
- *Ethnic breakdown (for state report)* [MS Excel document] (2016)
- *4th Floor Stats Spreadsheet* [PDF document] (2016)
- *Main Events 2015-2016* [MS Excel document] (2016)
- *Stats – 2015 – Q1* [MS Excel document] (2015)
- *Stats – 2015 – Q2* [MS Excel document] (2015)

11.2 Interview schedule

Thank-you for agreeing to meet with me today. My name is Pia Gahagan and in this study I am exploring how public libraries evaluate the outcomes of their makerspaces. This research will also explore how the assessment approaches used can be justified as suitable, by making comparison to what is described as best practice in the library literature, as well as the organisation's capability to execute those methods and techniques. As you know, makerspaces provide the opportunity for library staff, users and community members to collaborate, make, and share knowledge with one another in a space equipped with a variety of technologies and tools – providing the environment and opportunity for information and knowledge production, not just consumption. This is an example of a service where the library is no longer the information repository or storehouse, but a place which invites and facilitates making 'things', connecting with others and sharing information.

This term 'outcome' is defined in this study as: 'the effect of a library program or service related to the library's planning. An outcome is a type of output, which has direct predefined effects, and can lead to impact and value'. (ISO 16439: 2014, p.13).

Do you have any questions or ideas about the topic for me at this stage, before we begin the interview?

- Can you provide a brief overview of how the makerspace programme is delivered at your library?
- What are the objectives (or intended outcomes) of your makerspace?
- How did you determine these objectives / outcomes?
- How do these objectives relate to the wider purpose or vision for your library and parent institution?
- Tell me about the ways you evaluate your makerspace. Can you describe how you gather evidence of outcomes? What performance measures or metrics do you have for your makerspace?
- For what reason(s) do you evaluate your makerspace? In what ways are the results of your makerspace evaluation used?
- How do these evaluation methods and measures provide evidence of outcomes?

- How was your evaluation approach decided upon? Why did you adopt these evaluation techniques?
- How does the approach you have taken to evaluate the makerspace relate to wider institutional evaluation practices?
- Do you follow any standards, such as ISO standards, to carry out evaluation? If so, what are they? If so, why? If not, why not?
- How is the evaluation data analysed and who conducts the analysis?
- What opportunities are there to improve the way you evaluate your makerspace?
- Do you face any barriers to conducting outcomes assessment? If so, what are they?

Thank you for your time. Do you have any questions or comments about what we have discussed today?

Can you suggest anyone else that might be able to provide information for this study?

11.3 Participant consent form

Participant Consent Form

Research Project Title: Evaluating makerspaces: exploring the methods used to assess the outcomes of public library makerspaces.

Researcher: Pia Gahagan, School of Information Management, Victoria University of Wellington

I have been given and have understood an explanation of this research project. I have had an opportunity to ask questions and have them answered to my satisfaction.

I understand that I may withdraw myself (or any information I have provided) from this project, without having to give reasons, by e-mailing gahagapia@myvuw.ac.nz by Monday the 11th of April.

I understand that any information I provide will be kept confidential to the researcher and their supervisor, the published results will not use my name, and that no opinions will be attributed to me in any way that will identify me.

I understand that permission has been granted by my library's Director/General Manager to identify the name of makerspace and the library in the final report.

I understand that the data I provide will not be used for any other purpose or released to others.

I understand that, if this interview is audio recorded, the recording and transcripts of the interviews will be erased within 2 years after the conclusion of the project. Furthermore, I will have an opportunity to check the transcripts of the interview.

Please indicate (by ticking the boxes below) which of the following apply:

- I would like to receive a summary of the results of this research when it is completed.
- I agree to this interview being audio recorded.

Signed:

Name of participant:

Date:

11.4 Participant information sheet

Participant Information Sheet

Research Project Title: Evaluating makerspaces: exploring the methods used to assess the outcomes of public library makerspaces.

Researcher: Pia Gahagan, School of Information Management, Victoria University of Wellington

As part of the completion of my Masters of Information Studies, this case study is designed to examine the methods used to evaluate the outcomes of public library makerspaces. Specifically, the study will address the following questions,

- a) How are the outcomes of public library makerspaces being evaluated?
- b) On what grounds can the methods used be justified as suitable?

Many public libraries around the world are establishing makerspaces to invite library users and members of the wider community to participate in collaborative learning experiences. To date, the literature published on makerspaces does not cover how public libraries carry out the evaluation of these services. As more and more makerspaces pop-up in libraries around the world, the need to use evaluation techniques that provide meaningful information about the value of makerspaces increases. This study will start to build a picture of what evaluation techniques are being used to begin to address the gap in the literature.

Victoria University requires, and has granted, approval from the School's Human Ethics Committee.

I am inviting public library staff involved in running, managing or evaluating makerspaces to participate in this research. Participants will be asked to take part in approximately 45-minute semi-structured interviews. Permission will be asked to record the interview, and a transcript of the interview will be sent to participants for checking.

Participation is voluntary, and you will not be identified personally in any written report produced as a result of this research, including possible publication in academic conferences and journals.

Permission to identify the name of your makerspace and library as one of the cases used in the final report has been provided by your Library Director/ General Manager. This is because the identity of the institution is likely to be revealed in a discussion of important contextual factors relating to the case.

All material collected will be kept confidential, and will be viewed only by myself and my supervisor Dr Philip Calvert, Senior Lecturer, School of Information Management. The research will be submitted for marking to the School of Information Management, and subsequently deposited in the University Library. Should any participant wish to withdraw from the project, they may do so until Monday the 11th

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April 2016 and the data collected up to that point will be destroyed. All data collected from participants will be destroyed within 2 years after the completion of the project.

If you have any questions or would like to receive further information about the project, please contact me at gahagapia@myvuw.ac.nz or telephone 09 361 3029 / 021 157 0676 or you may contact my supervisor Philip Calvert, Senior Lecturer, School of Information Management at philip.calvert@vuw.ac.nz or telephone (04) 463-6629

Kind regards,

Pia Gahagan.

11.5 Case selection criteria

	CCL Makerspace	The 4 th Floor
Network	Auckland Libraries (55 library branches)	Chattanooga Public Library (4 library branches)
Location	Downtown Auckland City, part of the Central Business District.	Downtown Chattanooga City, located within the 'Innovation' District.
Library type: municipal, regional, private	Municipal library, in the Waitemata Local Board area, and governed by Auckland Council. Library funded by taxpayers	City library, governed by a board of directors under the City of Chattanooga. City Council appoints library board members to govern the library. Library mainly funded by taxpayers, also receives some funding from Friends of the Library ¹
Residential population of city	Total: 1,415,550 (Census 2013) ² 55, 023 residents ³	Total: 173, 778 (2014 estimate) ⁴ Daytime downtown population: 50,000. ⁵
Lifestyle user demographic:	Commuters, tourists, students, shoppers and inner city residents	Urban inner city apartment dwellers, college students, young families, seniors and working professionals.
Makerspace audience	All ages, all skill levels	All ages, all skill levels
Makerspace programming	Sessional: workshops and events organized. The space	Walk up programming, pop up programming, and sessional –

¹ *Bylaws of the Chattanooga Public Library Board* (2014) Retrieved 10 December 2015 from <http://chattlibrary.org/sites/default/files/documents/October%202014%20Board%20Attachment.pdf>

² Statistics New Zealand (2013) *2013 Census table about a place: Auckland*. Retrieved from http://www.stats.govt.nz/Census/2013-census/data-tables/tables-about-a-place.aspx?request_value=24395&parent_id=24394&tabname=#24395

³ Auckland Libraries (2014) *Tāmaki Pātaka Kōrero – Central City Library Community Snapshot*

⁴ Downtown Chattanooga (n.d.) *About Chattanooga: city demographics*. Retrieved 10 December 2015 from <http://www.downtownchattanooga.org/new/discover/demographics>

⁵ Downtown Chattanooga (n.d.) *About Chattanooga: city profile*. Retrieved 10 December 2015 from <http://www.downtownchattanooga.org/new/discover/city-profile>

approach	is bookable too. 3D printer is bookable any time the library is open.	events and workshops organised. Open all hours the library is open.
Makerspace budget	NZ\$10,000 (\$6,000 spent) ⁶	US\$25,000 (NZ\$37,340) ⁷
Makerspace funding structure	No special funding for project. Equipment /technology was purchased at good prices through Digital Services budget and running costs came from budget from Learning Services department.	No specific budget for the 4 th Floor. Initially funded by an Innovation fund, through the Friends of the Library group. Currently funded by budgeted annual programming money. Some grant money (such as Friends of the Library) is also contributed to the space.
Partnerships	Support from external partners in set-up phase, such as Tangleball and Mind Labs. Internal support from Digital Services (library) department.	Initial support to establish the space from local businesses such as CO.LAB. Ongoing support from community partners - local groups, businesses and patron volunteers.

⁶ Dann, J. (2015) 12 Questions: Baruk Jacob. *New Zealand Herald*. Retrieved from http://www.nzherald.co.nz/entertainment/news/article.cfm?c_id=1501119&objectid=11566878

⁷ Thompson, C. (2014) Why your library may soon have laser cutters and 3D printers. *Wired*. Retrieved from <http://www.wired.com/2014/09/makerspace/>

11.6 Definition of key terms

- **Evaluation** – “process of estimating the effectiveness, efficiency, utility and relevance of a library service or facility”. (ISO 16439; 2014, definition 3.21). NB: In this case study the term ‘assessment’ is used synonymously with ‘evaluation’.
- **Impact** – “difference or change in an individual or group resulting from the contact with library services. Note 1 to entry: the change can be tangible or intangible.” (ISO 16439: 2014, definition 3.25)
- **Outcome** – “direct, pre-define effect of the output related to goals and objectives of the library’s planning (e.g. number of users, user satisfaction levels. Note 1 to entry: This includes outcomes that concern the library’s institution or community.” (ISO 16439: 2014, definition 3.44)
- **Participatory learning:** ...”emphasises two important aspects of the learning process...(which) leads to deeper learning. They are, first, active learning: doing, not just passively absorbing the content of a subject, and second, the notion that learning is a social process” (Lippincott, 2015).

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Name: Pia Margaret Gahagan

Word count: **Approximately 14,900, including** in-text citations (excluding references, bibliography, appendix, headings, title page, contents page)