Introduction

Not everything that can be counted counts, and not everything that counts can be counted.

William Bruce Cameron (1957)

Increasingly it seems as though every organization, profession and service is subject to a mounting number of metrics and performance indicators. League tables are no longer reserved for the winning and losing of sports teams, but are used to make comparisons between a host of different bodies, from hospitals and schools to train companies and countries. The growth and interest in new metrics and indicators has been facilitated by the growth and interest in the web. The web facilitates the sharing of established metrics and data; a service such as Google Public Data (www.google.com/publicdata) now provides a user-friendly front end to a wide range of public data, enabling the simple comparison of countries according to features as diverse as the number of daily papers sold per person, to the contribution of renewable energy to a country’s energy supply. The web enables the soliciting of new data; Web 2.0 services have facilitated the ranking of politicians according to their ‘hotness’ and professors according to their helpfulness. Most importantly, the web also provides new media for analysis; in the same way the traditional media of books and journals provided the basis for new metrics, such as the number of books published in a country or the number of citations a journal receives, so new media such as web pages and blogs provide the basis for a host of new metrics. These web metrics can be far richer than those associated with traditional media as a greater variety of data can be collected at increasingly fine levels of granularity.

This book demonstrates how a host of new web metrics can be an important addition to the library and information professional’s skill set. Web metrics
WEB METRICS FOR LIBRARY AND INFORMATION PROFESSIONALS

can enable librarians to improve the online service they provide to their
stakeholders and demonstrate the impact of their services to managers and
policy makers; web metrics can be used to help identify the most relevant
resources in a field and demonstrate the value of their own online offerings.
The library and information professional's online presence now comprises a
wide variety of genres. Many libraries have Facebook and Twitter accounts,
some host blogs and wikis, and a few make use of the newer social media
services such as Pinterest or Google Plus. This book provides ways of
establishing and analysing metrics, as well as highlighting the potential
pitfalls. This first chapter provides an introduction to the topic and an
overview of the rest of the book.

Throughout the rest of the book the term 'librarian' has been adopted as
shorthand for the more longwinded 'library and information professional'.
While the intended audience of this book includes many information and
knowledge professionals who neither work in a traditional library nor
consider themselves librarians, for the sake of readability it was necessary to
adopt a more concise term. As has been seen in the recent discussions
surrounding the rebranding of CILIP, the Chartered Institute of Library and
Information Professionals, there is no single term with which the whole
profession identifies, so the book has resorted to the most established.

Metrics

As 'metrics' form the basis of this book, it is important to start with a clear
understanding of what is meant by a 'metric'. The term 'metric' is used
throughout this book to refer to a quantifiable standard of measurement, or as
the Oxford English Dictionary defines it: 'system or standard of measurement;
a criterion or set of criteria stated in quantifiable terms' (OED, 2001). A
quantifiable standard of measurement is one that can not only be reduced to
an explicit number, but also be applied consistently in different situations to
allow comparisons between similar objects of investigation.

Quantitative measurements form the basis of some of man's earliest
records: the scratching of tallies on bones used to record work done and the
possession of cattle in preliterate societies (Yeo, 2010). In such instances the
standards that the scratches were based on were likely to have been fairly
simple. For example, when the farmer marked off his number of cattle most
people were likely to know what was meant by a head of cattle without the
need to create a definition that explicitly excluded the field mouse. However,
as society becomes more complex and trade is extended over greater
distances, it becomes necessary for standards to become more explicit. Greater specialization means the same norms can no longer be assumed, especially between different communities. The extreme of such a situation may be seen in France in the late 18th century, where up to a quarter of a million different weights and measures were used throughout the country (Russell, 2005). Such diverse weights and measures have obvious implications for the free flow of trade, and the same is true with a lack of standardization in web metrics. If one company wants to place advertisements on another company’s website, but there is no standardized way of measuring the number of page views of a website, a complex series of negotiations may need to take place. Equally, if a large multinational organization wants to engage the services of a social media marketing company, but there is no standardized measure of impact, it is difficult to determine whether the marketing company has met its objectives or it is being paid without delivering. It is therefore in people’s interests to develop widely adopted standards, and they are beginning to emerge online.

Standards can emerge via consensus, imposed by an authority, or through a combination of the two (Russell, 2005). Where a diverse range of standards is perceived to have a significant impact on the economy or on the safety of individuals, standardization may be imposed by government, although in many areas standardization is left for a consensus to emerge from the community of interested parties. This is something that can be particularly difficult in a fast changing environment with new technologies disrupting existing systems. Such technological disruptions have become a well established part of librarians’ work.

The community of librarians has a long history of engaging with metrics. Its own field of bibliometrics was defined by Alan Pritchard in the 1960s as ‘the application of mathematics and statistical methods to books and other methods of communication’ (1969, 349). Its roots may be traced back much further. While the application of bibliometrics was popularized by Garfield and Price in the 1950s, Godin (2006) traces the origins of bibliometrics to psychologists in the early 20th century, and Shapiro (1992) pushes its beginnings to the legal bibliometrics of the 19th century. Broadus (1987) goes even further, pointing to the forerunner of bibliometrics as being the simple counting of books or similar items that can be traced to the third century BC and the identification of 490,000 scrolls in the Library of Alexandria. However, even with a history dating back over 2000 years, answering bibliometric questions is not an easy matter, whether it is the number of items a library holds, or even the more specific number of books a library holds.
The question ‘How many books does a library hold?’ quickly raises issues regarding what is meant by a book and, in an age of e-books, what it means for a library to hold it. While we all have a vague idea of what is meant by a book that is sufficient for most everyday interactions, standardization requires an explicit definition, but there is no single universal agreed definition of ‘a book’. UNESCO (1985) defines a book, for the purposes of collecting statistics on the production and distribution of printed publications, as ‘a non-periodic publication of at least 49 pages exclusive of the cover pages, published in the country and made available to the public’, but the US Postal Service (2012) defines a book as anything over 24 pages, with no mention of its availability to the public. Selecting one definition over another could increase or decrease the size of a library’s holdings at the stroke of a pen. While it would be easy to be cynical about the public official who decided to select the less restrictive standard of what constitutes a book, and thus increase the size of the library at no additional expense, it is also easy to envisage situations where the stricter definition is inappropriate. For example, in a children’s library where a large number of what most of us would consider ‘books’ have less than 49 pages, the US Postal Service definition of a book would seem a more appropriate definition than categorizing what many of us would consider books as UNESCO ‘pamphlets’.

An even greater challenge to determining the number of books a library holds has been the introduction of electronic books in recent years. As libraries increasingly sign up to electronic publications, a focus on printed publications alone is obviously only part of the picture, but how should e-books be included if we are to be able to compare the holdings of two institutions? Is the subscription to a 10,000 e-book bundle more significant than the subscription to 1000 individually picked titles? Does a hyperlink to Project Gutenberg (www.gutenberg.org) from a library’s website allow the library to claim an additional 39,000 e-books? What if the Project Gutenberg collection is incorporated into the library catalogue and librarians have used their expert knowledge to provide added value? If an e-book can be accessed by multiple users simultaneously does that count as multiple copies? There are no simple answers, although standards are being established for traditional and new media. COUNTER (www.projectcounter.org) is an international initiative to establish standards for exchanging usage information between publishers and libraries about journals, databases and book subscriptions, while the Web Analytics Association (a precursor to the Digital Analytics Association, www.digitalanalyticsassociation.org) has published definitions of a wide variety of concepts, such as ‘page view’ and ‘referral’ to facilitate
communication and best practice in the analysis of web usage. Although standards and definitions may have been created, that does not mean that the most appropriate metrics have been identified for a particular situation. There are numerous ways web content can be measured. In his marketing blog David Berkowitz (2009) lists 100 ways to measure social media. He includes many of the direct metrics that may be immediately obvious, such as friends (Facebook), followers (Twitter) and page views (blogs), and less obvious and direct metrics, such as the number of customers assisted and job applications received.

The appropriate metric depends primarily on the purpose of the metric, but where a comparison is being made between individuals or organizations the selection of a particular metric is inevitably contentious as the metric may be seen to favour one group over another.

**Indicators**

Metrics are not counted for their own sake, but for a purpose. For example, when a library counts its holdings and states that it has a collection of 1 million books it is generally expected to be taken as an indicator of the library’s ability to support its users’ needs. The use of such a metric as an indicator may be implied if the step is obvious or well established; for example, a library is unlikely to feel it is necessary to state that the size of the collection is an indicator of its ability to serve the needs of its users. However, when the use of a metric as an indicator of something wider is not obvious or widely agreed, its adoption can cause considerable animosity, especially when there are significant potential consequences.

Bibliometric methods established within the field of library and information science are regularly adopted within the wider academic community to provide indicators of individual and institution research excellence, although they have generally been met with a less than enthusiastic response by the subjects of such investigations. Following the announcement that bibliometrics would be contributing to the 2013 Research Excellence Framework (the way research quality is assessed in UK higher education institutions and which informs the way billions of pounds of funding is allocated) there was a raft of negative headlines regarding the use of bibliometrics: ‘Metrics Will Kill Diversity Claim’ (Lipsett, 2006); ‘Popular Beat May Drown Out Genius’ (Lawrence, 2007); ‘Report: bibliometrics could distort research assessment’ (Lipsett, 2007).

The concerns on the use of bibliometrics reflect those on the use of metrics
more generally. There have been three main problems in bibliometrics being widely accepted for the provision of indicators of research excellence: a lack of agreement that research excellence can be quantified; concerns about the tools that are available; and concern regarding the impact of the indicators on the research and publication processes.

The sorts of concerns touched on above are not limited to the application of bibliometrics, but are equally relevant in the adoption of other metrics, especially when it comes to the letter of the metric over-riding the spirit of the indicator. For example, Banerjee and Duflo (2012) highlight a school in Calcutta that had a perfect pass record each year, but unfortunately this was achieved through a policy of expelling the bottom students in the class each year; the desire for a perfect pass rate surpassed the desire for the provision of a good education that the metric was designed to indicate. This does not mean that such indicators are useless, but rather that they need to be treated cautiously, especially in web metrics, where the creation of content is cheap and so much of the material is ephemeral.

**Web metrics and Ranganathan’s laws of library science**

The term ‘web metrics’ is used throughout this book to refer to the quantitative measurement of the creation and use of web content. It would be hard to over-estimate the impact of the web on people’s lives; it is not only a place that people go to discover information, but also one where they increasingly interact with one another and create their own content. Over the last two decades the web has transformed the publication of traditional forms of media, and introduced a host of new genres of digital media. The early home pages and websites have been joined by blogs and wikis and massive social network sites that have attracted millions of users. Twitter, Facebook, LinkedIn and Flickr are now essential platforms for many individuals and organizations, and those that ignore such platforms are potentially ignoring the opportunity to engage with vast numbers of actual or potential stakeholders. The type of content that is being published has also widened, from documents to data, from text to rich forms of media. All of these new media and platforms provide the opportunity for new ways for librarians to share information, and new metrics and indicators for librarians to measure this information. With so much that can be counted, it is important for librarians to keep in mind the underlying philosophy of library and information science and their role in the information ecosystem. Librarians who find themselves the holders of a particularly salacious piece of gossip
about a celebrity may be in a position to increase their online impact rapidly, although it seems unlikely that such behaviour would adhere to the underlying philosophy of the library profession.

The goals of the library and information profession are not necessarily the same as those for other businesses, and the types of metrics that it needs to establish should reflect that. In his book *Social Media Metrics*, Jim Sterne (2010) emphasized the importance of identifying metrics that align with the three big goals of business: increase revenue, reduce costs and improve customer satisfaction. Each of these has its place in the library. The library needs to find ways to increase revenue and lower costs, but the key factor is customer satisfaction, and for that we need to consider the philosophy of library science as so eloquently expressed in Ranganathan’s (1931) five laws of library science:

1. Books are for use.
2. Every reader his book.
4. Save the time of the reader.
5. The library is a growing organism.

These laws have been regularly reinterpreted to take into account new technologies and new types of content, whether new types of media (Simpson, 2008) or the underlying data (Stuart, 2011), and when identifying appropriate web metrics it is important to have these laws in mind. Web metrics can help us to determine whether books are being used, readers have access to the information that is needed, information is being pushed to those who need it, and we are saving the time of the reader, and to reflect the fact that the library is a growing organism.

**Web metrics for the library and information professional**

While Ranganathan helps us understand the goals that librarians should be striving for, there are many ways in which web metrics can be used to help reach those goals. Behn (2003) identified eight purposes for measuring performance by managers in public organizations: to evaluate, to control, to budget, to motivate, to promote, to celebrate, to learn and to improve. Each of these purposes could drive librarians to establish a web metric, with the same web metric potentially contributing to more than one purpose.

_Evaluation_ is generally the usual reason for measuring performance, and it
is for research evaluation that bibliometrics have so often been adopted (e.g., Moed, 2005). However, the evaluative value of web metrics is not necessarily as obvious as the value of bibliometric indicators. While the importance of visitors to an online storefront may be seen as central for some organizations, for others the relationship may seem less obvious. For example, a research group’s success is not necessarily associated with its web presence to the same degree as it is with its research publications, yet some studies have nonetheless shown the number of links pointing to a website to be associated with an institution’s research excellence and business sites’ success (Vaughan and Yang, 2012). The number of Twitter followers or ‘likes’ of an organization’s Facebook page may also be seen as the success of a brand on the social web.

To control is to ensure that people are behaving appropriately. While a library may use the metric of its number of Twitter followers to evaluate the impact of its service, it should also make sure that it is engaging with those followers in the best way. It may choose to establish upper and lower limits on the number of tweets it sends in a particular day or week to provide a consistent level of service.

To budget is to allocate resources appropriately. On the web there is a host of ways librarians may attempt to engage with users, while the time available to librarians is normally extremely limited. Metrics can help librarians determine the most effective web technology for their particular purpose; new online services may take time to become established, but unless there are signs of growth after six months it may be that the service is not appropriate.

To motivate is to encourage users to reach goals. The web offers a wealth of potential opportunities, but its scale can be daunting. When the press reports on celebrities with millions of Twitter followers, or a YouTube video going viral and being watched a billion times, a library’s social media offerings may seem extremely insignificant. It is therefore important to motivate with specific attainable goals in mind, and make comparisons with similar organizations or similar attempts by the same institution. It may be that the aim of a library’s blog is to have so many thousands of readers, or a more explicit indicator of engagement, such as the number of comments left.

To promote is to convince the public, or those higher up in the organization, that they are doing a good job. Library budgets are constantly under scrutiny, and librarians need to demonstrate their value, although caution may need to be observed when a public institution is making use of a new technology the value of which may not as yet be widely accepted. Establishing a successful online presence is not something that happens overnight; although
a blog can be set up within a matter of minutes, it may take months or even years to establish a significant amount of interest. Even if a library has established a successful presence on an online service, there is no guarantee that this will be considered to be anything more than a waste of time.

To celebrate is to revel in the organizational achievements. When shared goals are reached it provides the opportunity for groups to bond around the achievement. This could be the library’s 1000th Twitter follower, the 500th download of its podcast, or the millionth visitor to its website.

To learn is to understand the impact of the contributions that librarians are making. In a world with fast changing web technologies it is necessary to determine whether a particular technology is effective. It is only through measurement that problems can be raised and dealt with. Is an organization’s Twitter account found to be more engaging when controlled by one user rather than another? Has the web redesign, which so enamoured the managing director, really made any difference to the number of visits to the website?

To improve is to strive towards the provision of better services. It is not enough to learn that certain content elicits a more favourable response; librarians need to use this information to improve the service the organization provides. If metrics show that a new design to the website has failed to work, then the organization needs to learn from the experience rather than carrying on regardless.

Behn’s (2003) eight purposes for measuring performance are internally focused, helping an organization have a greater understanding about its own workings and achievements. Web metrics also provide the opportunity for librarians to apply metrics beyond the organization: to filter; to research.

To filter is to use web metrics to help with the problem of information overload. Information overload is not new; in fact the story of scientific progress is one that is regularly punctuated by new tools to overcome the problem of information overload. The establishing of scientific journals in the 17th century solved the problem of scientists having to share the same results multiple times with different colleagues. As the number of publications increased, so did the tools to help researchers manage them. In the 18th century peer review (Kronick, 1990) and dedicated abstract journals (Skolnik, 1979) were introduced, while computers enabled large-scale citation indexes and full text indexing in the 20th century. The web has enabled the publishing of billions of documents and this requires new methodologies to deal with the information explosion unless we are going to wade through the ‘tomes of irresponsible nonsense’, a phrase that Ziman (1969) applied long before the
invention of the web. In the same way that the journal impact factor helped to identify core journals, and PageRank helped to rank pages on the web, new algorithms can be expected to help researchers filter the increasing variety of content that is available online.

To research is to apply the quantitative methodologies of web metrics for research purposes. As has been argued elsewhere (e.g., Stuart, 2011), while the work of librarians may continue to revolve around the provision of traditional document formats (books, journals and articles) for the foreseeable future, as traditional aspects of librarians’ roles are automated and as the web changes from a web of documents to a web of data it is important that the role of librarians also changes. This means not only providing users with access to traditional types of document, but also facilitating user access to the huge quantities of data that are increasingly available online. Some libraries already provide a research service for bibliometric data, from citation analyses to mapping the researchers in a particular field. Web metrics can provide additional insights to such traditional bibliometric studies, and make it possible to gain insights into a wide range of research questions, such as public opinion on topics as diverse as genetically modified crops and the latest computer games release (Thelwall, 2009) to predicting the winner on celebrity reality shows (Tancer, 2009) and the spread of diseases (Eysenbach, 2006).

The aim of this book
The aim of this book is to demonstrate the contribution web metrics can make to the work of librarians.

The focus is primarily on those tools that are freely available, or at least have useful functionality that is freely available, even if there is more extensive functionality that may require a subscription. Most librarians are unlikely to have the budgets necessary to subscribe to the increasing number of firms that offer access to a wealth of web metrics at a price, but that does not mean they cannot gain insights from the tools that are freely available. There is currently little consensus about the appropriate standards and metrics to use for particular purposes for many of the different media that are discussed throughout the rest of the book, or hope of an authority imposing a widespread set of standards in the near future. Instead librarians are generally left to muddle their way through, reaching for the nearest metrics that are freely available, whether these are those most noticeable on the service that is being used (e.g., number of friends on Facebook or
number of followers on Twitter) or one of the increasing number of third parties that promise a simple solution to a person’s metric needs (e.g., Klout.com, Alexa.com). This book aims to introduce metrics to the community of librarians, and help them understand why one metric may be more useful than another, and the limitations of the tools that are available. New metrics will emerge and become accepted within the creative destruction of the marketplace, and this book is designed to reflect practices and ideas that have been put forward by academics and practitioners, applying standards and methodologies to new areas, with a focus resolutely on the contribution to librarians.

The book does not attempt to hide the limitations of web metrics or their antecedents, but rather sees their potential as semi-evaluative and weak-benchmarking metrics (Thelwall, 2004b). It is not that it is necessarily wrong for one website to have 1000 visitors a month, when a similar institution’s website has a million, but it is something that warrants further investigation. Metrics should not be the end of a conversation, but rather the beginning. Not everything can be easily reduced to numbers, and it may be that one individual or institution does not do as well as another because their particular strengths are not reflected in the adopted metric. In such cases it is not unreasonable for a manager or governing body to ask why there has not been the expected impact, but it is important that there is room for an individual or institution to make a case for their particular circumstances.

The structure of the rest of this book
Bibliometrics, webometrics and web metrics (Chapter 2)
Chapter 2 looks more closely at the variety of metrics that have been adopted within the library community and how they relate to web metrics. Areas such as bibliometrics have an established history within the field and have faced many of the objections that may be levelled against web metrics. While recognizing these limitations, the chapter emphasizes the potential of a wide range of metrics to the community of library and information professionals, as well as the importance of measuring what is important to librarians, and the lessons that may be learnt from the traditional media environment and applied to the web.

Data collection tools (Chapter 3)
Web metrics are heavily reliant on the tools and data that are available, and
Chapter 3 considers how these tools have developed and changed over the past two decades in the area of webometrics. There have been four distinct periods of webometric research, as researchers have adjusted to the changing nature of the web and the tools available for investigating it. These periods provide insights into the limitations of web metrics that are caused by the structure of the web and those that are caused by the changing nature of the tools, and potential changes that may occur in the future.

Evaluating impact on the web (Chapter 4)
Despite the rise in third-party social media services, self-hosted content continues to be an important part of many libraries' web presence, as well as a potential source of information about other organizations and society more generally. Chapter 4 considers metrics for measuring the impact of websites, blogs and other hosted content, from the use of analytic services, to references on the web. It also discusses the use of content analysis to gather additional insights into this highly unstructured data source.

Evaluating social media impact (Chapter 5)
Third-party social media services have an increasingly important role in the hosting of content, providing opportunities for the establishment of new metrics and new problems for data collection. Chapter 5 considers the types of metrics that should be considered for different types of social network sites, and the potential adoption of sentiment analysis enabled by the ever more structured content.

Investigating relationships between actors (Chapter 6)
Web metrics are not restricted to evaluative purposes, but may also be used to provide relational insights on the web and the social web. Chapter 6 considers some of the tools and techniques that are available for mapping and analysing the relationships between online entities.

Exploring traditional publications in a new environment (Chapter 7)
As new genres of online media grow in importance, traditional bibliographic items continue to be the most significant part of most librarians' work, whether the traditional hard copy format on the shelves, or an electronic
version thereof. However, new technologies provide new avenues for the investigation of the impact of traditional formats, whether mentioning texts online, or counting the number of document downloads or bookmarks in Mendeley’s reference manager.

Web metrics and the web of data (Chapter 8)
The web is moving from a web of documents to an ever more semantic web. Not only are library repositories expected to host raw data as well as documents, but websites are increasingly marking up data within web pages. This requires the development of new metrics if we are to understand the data that is being made available and the impact that it is making. This chapter discusses some of the challenges that need to be overcome, and some potential solutions.

The future of web metrics and the library and information professional (Chapter 9)
The future is likely to bring the introduction of new technologies, increased pressure on library budgets, and a greater emphasis on the use of metrics. The final chapter discusses the challenges and issues this raises for librarians and offers some potential solutions so that librarians can meet future challenges with confidence.