What counts as a science and discipline in library and information science?

Fredrick Kiwuwa Lugya

Graduate School of Library and Information Science, University of Illinois at Urbana-Champaign, Champaign, Illinois, USA

Abstract

Purpose – The convergence of librarianship and information science to form library and information science (LIS) is seen as a recent phenomenon, with the term "information science" originally focused on the application of computers to library operations and services. LIS as a science and multidisciplinary field applies the practice and perspective of information with the aim of answering important questions related to the activities of a target group. As a science, LIS is more than a collection of facts to be memorised or techniques to be mastered but is instead an inquiry carried out by people who raise questions for which answers are unknown and who have gained confidence in their ability to reach conclusions, albeit tentative ones, through research, experiment and careful thought sharpened by the open criticism of others. What is described here is a dynamic and changing field of study called LIS which differs from Cronin's (2004) conclusion that library science or LIS is neither a science nor a discipline. Like any other science, LIS continues to emerge, evolve, transform and dissipate in the ongoing conversation of disciplines.

Design/methodology/approach – To understand LIS, this paper thoroughly reviewed the literature by paying attention to the genesis of the terms "information", "documentation", "science" and "librarianship", and then the interdisciplinary nature of library science and information science.

Findings – The differences between librarianship and information science are an indication that there are two different fields in a strong interdisciplinary relation, rather than one being a special case of the other. LIS has grown to be a scientific discipline, knowledge and a process that allows abandoning or modifying previously accepted conclusions when confronted with more complete or reliable experimental or observational evidence. Therefore, like any other science, LIS is a science and discipline in its own right that continues to emerge, evolve, transform and dissipate in the ongoing conversation of disciplines.

Originality/value – What is described here is a dynamic and changing field of study and a science called LIS that differs from Cronin's (2004) assessment that library science or LIS is neither a science nor a discipline. The originality of the paper is rooted in a growing discussion to understand the relevance and appreciate the continued existence of LIS as a science and a field of study.

Keywords Documentation, Science, Librarianship, Information science, Disciplines

Paper type Viewpoint

Introduction

The concept of library and information science (LIS) became predominant in the mid-twentieth century as a move to rename library schools into schools of LIS and to reflect curriculum changes, the needs of the profession, continuous technological changes, the needs of the instructors and instructional methods and materials. For example, the Graduate Library School at Illinois changed its name to the Graduate

School of Library and Information Science at Illinois (Auld, 1992; Richardson, 2010; Smith, 1992; Waples, 1931). LIS history is rooted in the relationship between two areas of study – library science and information science – which can be explained in three different, though presumably related, ways, as suggested by Hayes (1985). First, information science is concerned with the information content of books and documents, while library science is concerned with the books and documents as physical records. Second, information science is concerned with the practical knowledge of value for the solution of specific problems, while library science is concerned with the full range of knowledge. Third, information science is concerned with the application of computers and other automated systems, while library science is concerned with intellectual processes as handled by people. The convergence of librarianship and information science to form LIS is seen as a recent phenomenon, with the term "information science" focused on the application of computers to library operations and services. It is important to note that the issues with which information science is concerned are far deeper than simply the use of computers and have been the focus of research for centuries. To understand the relevance and appreciate the continued existence of LIS as a science as well as a field of study, this paper seeks to discuss the science in LIS, its disciplinary nature and finally to draw lessons from Buckland's (2012) argument that "if information science is concerned with what people know […] it is a form of cultural engagement, and at most, a science of the artificial".

But what is LIS? To understand LIS, this paper draws attention to the genesis of the terms "information", "documentation" and "science" and then the interdisciplinary nature of library science and information science.

Information

As in other fields, the problem of how to define information is often raised in LIS. Information is a popular word widely used in people's daily life as an important and powerful force, although an elusive and controversial concept. It may refer to messages, news, data, knowledge, documents, literature, intelligence, symbols, signs, hints, tips or cues. Information exists and functions within and outside the human society, and it relates to a number of philosophical categories, such as space, time, motion and energy.

The rhetoric about information is now abundant but suffers from diversification of its definitions which has been a result of misunderstandings in scientific and cultural communications, as discussed by Yuexiao (1988). First, information is not a singular concept, but it is a series of concepts with complex relationships. For example, the concept of information is derived from the Latin word *informatio*, which originally meant a process to communicate or something to be communicated. To date, many ways to process and communicate information have been discovered and created, so that it has become increasingly difficult to distinguish them with only one term. Similar trends are observed across cultures and languages worldwide. Second, at the most comprehensive level of information definitions is the philosophical range information. From this perspective, information is neither any specific type of object nor does it have any specific kind of content. It is the carrier of interrelations and interactions among objects and contents. Third, between a broad philosophical and a more narrow semantic definition, philosophical definitions tend to center equally on computer commands or binary scales and the interaction of electrons, whereas semantic definitions treat only the computer command as information. Fourth, the biological definition emphasises the

properties of information in living objects, whereas the non-biological one does not. Fifth, the human designation of some information, for example, information is defined anthropocentrically as a human phenomenon; human–non-social or human–social information, which is natural sciences and social sciences–oriented, respectively; then the human–non-mental or human–mental information, referring to the physiological and human mental-orientated ranges, respectively. The foregoing distinctions are necessary because the ranges of definitions are covered by different scientific disciplines, and failure to identify them causes further misunderstandings. Finally, scientific information is not equal to all of knowledge information, and information communicated in the scientific community is not equal to the qualitative scientific information. Thus, there are many different levels, ranges and categories of information.

The data–information–knowledge–wisdom pyramid, historically known as Claude Shannon's communication or information theory (1940), reflects the evolution of the information concept which can take a top-down or the traditional bottom-up approach. On top of the three aspects of information – technical, semantic and influence – human behavioural research has led to cognitive and sociocognitive perspectives (Davis and Shaw, 2011; Hjørland, 2002), meaning that information can no longer be understood objectively. What is informative will depend on the person assessing the meaning and truth of a message (Davis and Shaw, 2011). Given the ambiguity and overlapping ways that the term information has been used in the literature, Meadow and Yuan (1997) put it that authors should adopt the practice of relating whatever terminology they choose to a standard. For that reason, the use of the term information in this paper corresponds to how the term has been used to relate to librarianship, information science, library science and documentation. In this case, information could be the physical embodiment that constitutes information, the contents of the physical materials or the meaning that comes when a reader ingests the content into their own knowledge structure.

This approach to information fits well within the context of this discussion as suggested by Colin Cherry (1957, cited by Meadow and Yuan, 1997). Niall F. Teskey (1989) (cited by Meadow and Yuan, 1997, p. 699) argues that if information science is to justify itself as a science, then it must produce a scientific theory of information that can be tested and evaluated across the entire field of information sciences. However, Andrew Dillon, in his foreword to Bawden and Robinson (2012, p. xvii) questions "what hope would there ever be for a disciplinary emergency if we had to agree definitions in advance?" Andrew Dillon believes that it is by identifying commonalities among the scholastic efforts that we often find the truth. It is evident from the literature as cited by Bawden and Robinson (2012), Meadow and Yuan (1997) and Yuexiao (1988) that LIS researchers have attempted to provide different approaches to defining and understanding information within the context of LIS. In recognition of the ongoing conversation of disciplines, Andrew Dillon (in Bawden and Robinson, 2012, p. xviii) suggests iSchools to contain intellectually diverse faculty willing to engage collectively in shared problems, hence avoiding disciplinary monopoly on appropriate theories and methods for studying information; an understanding and treatment of information that conceives of it as mediated by people and technology across multiple environments, rather than one based on the practices of traditional agencies of collection; and a commitment to research activities that seek answers to fundamental and pressing questions about information in all human endeavors.

Information and its role in reshaping librarianship

Capurro and Hjørland (2003) argue that information has a much richer history than library science, information science and LIS which are largely products of the twentieth century. By a variety of measure, Jonathan Furner (in Bawden and Robinson, 2012) puts it that information science is equally in excellent health. LIS is a merger of the two fields library science and information science. The term library science (German: Bibliothekswissenschaft) goes back to a textbook of 1807 by Martin Schrettinger (Hjørland, 2000; Ingwersen, 1992). Library science is defined by the American Library Association as the professional knowledge and skills by which recorded information is selected, acquired, organised and utilised in meeting the information demands and needs of a community of users. On the other hand, information science is an interdisciplinary science that investigates the properties and behaviour of information; the forces that govern the flow and use of information; and the techniques, both manual and mechanical, of processing information for optimal storage, retrieval and dissemination (Floridi, 2002). Moving forward, information science is about knowledge production in the society and how this knowledge is materialised in documents, organised, labeled and managed, to serve different groups and individuals (Bawden and Robinson, 2012). Library science is the profession which aims to meet the demands and needs of users, while information science is a model of inquiry. Capurro and Hjørland (2003) are opposed to defining LIS as "a field concerned with the generation, collection, organisation, interpretation, storage, retrieval, dissemination, transformation and use of information, with particular emphasis on the applications of modern technologies in these areas". They argue that "no science should be defined by its tools (e.g. modern technologies), because all fields are supposed to utilise the most appropriate tools available". Therefore, a science should be defined by its object of study, and in that context, LIS can be defined as a study of libraries and information. But what is information? Capurro and Hjørland (2003) describe information as:

> The concept of information itself can be defined universalistically (e.g. Bateson, 1972). Information is anything that is of importance in answering a question. Anything can be information. In practice, however, information has to be defined in relation to the needs of the target groups served by information specialists, not in a universalistic or individualistic, but rather in a collectivist or particularistic fashion. Information is what can answer important questions related to the activities of the target group.

Seeing through Capurro and Hjørland's (2003) lens, this paper defines LIS as a field of study that applies the practices and perspectives of the generation, collection, organisation, interpretation, storage, retrieval, dissemination and transformation of strictly proven ideas with the aim of answering important questions related to the activities of a target group. Therefore, information must be based on the views/theories about the problems/questions and the goals that the information is going to satisfy. For example, in public libraries, these goals are related to the democratic role of the public library in society. In medicine, they are related to the solving of health problems. In women's studies, they are related to the understanding and emancipation of women. In commercial systems, they are bound to the business strategy.

On defining LIS as applied philosophy of information, Floridi (2002, p. 46) notes that LIS is "the discipline concerned with documents; their life cycles; and the procedures, techniques and devices by which these are implemented, managed and regulated". This viewpoint agrees with the adopted definition for this paper, but further suggests that LIS applies the

fundamental principles and techniques of philosophy of information to solve definite, practical problems; deal with specific, concrete phenomena; and sequentially conduct empirical research for practical service-oriented purposes. A detailed account of the relationship among LIS, philosophy of information and social epistemology has been provided by Floridi (2002). The social aspects to which library science and information science relate bring LIS closer to social epistemology. Social epistemology refers to the sociology of knowledge – the descriptive and empirical study of the historical causes and conditions of knowledge – and the epistemology of social knowledge – the critical and conceptual study of the social (multi-agents) dimensions of knowledge. Unlike the sociology of knowledge, LIS has a normative stance and requires more than a purely descriptive approach. This normative stance makes LIS lean towards the epistemology of social knowledge (Floridi, 2002), however, this relationship is limited because LIS works at a more fundamental level than epistemology and has a much wider scope.

LIS is a multidisciplinary field and according to Saracevic (1992), library science and information science are two separate fields with a common ground. He argues that:

> The common ground between library science and information science, which is a strong one, is in the sharing of their social role and in their general concern with the problems of effective utilization of graphic records. But there are also very significant differences in several critical respects, among them in: (1) selection of problems addressed and in the way they were defined; (2) theoretical questions asked and frameworks established; (3) the nature and degree of experimentation and empirical development and the resulting practical knowledge/competencies derived; (4) tools and approaches used; and (5) the nature and strength of interdisciplinary relations established and the dependence of the progress and evolution of interdisciplinary approaches.

In the same spirit, Holland (2006) observed that LIS is often cited as both an interdisciplinary and multidisciplinary area of research and practice. Referring to Klein and Newell's (1998) and Dogan's (1996) works, respectively, Holland (2006) notes that interdisciplinary refers to a process of answering a question, solving a problem or addressing a topic that is too broad or complex to be dealt with adequately by a single discipline or profession, and it requires an integration of knowledge and/or methods from the various disciplines brought together to address an issue or problem. On the other hand, multidisciplinary refers to the simple juxtaposition of two or more disciplines, focused on the proximity of the disciplines rather than the transformative effort to produce new forms of knowledge. Within information science, these terms are either intentionally used synonymously or inadvertently interchanged based on implicit assumptions of meanings. All these differences warrant the conclusion that librarianship and information science are two different fields in a strong interdisciplinary relationship, rather than one being a special case of the other.

Information science
The earliest formal use of the term information science dates back to 1958 when the Institute of Information Scientists (IIS) was formed in the UK (Bawden and Robinson, 2012; Ingwersen, 1992; Robinson, 2009). It is suggested that the use of the term information scientist was intended to differentiate information scientists from laboratory scientists (Farradane, 1970, as cited in Ingwersen, 1992; Robinson, 2009). The IIS membership constituted of highly distinguished scientists from various disciplines, who devoted themselves to organising and providing scientific information to their fellow researchers in

research and development. This fact collaborates with the seventeenth and eighteenth century perspective that librarians were scholars from other fields with strong desires to understand and organise human knowledge through compiling, classifying and making the world's knowledge available. It is believed that the period after World War II that led to "document explosion", increased physical and intellectual access to documents, complexity of problem-solving, opportunities offered by the new information technologies and the Shannon–Weaver Information Theory (Robinson, 2009), gave birth to information science. During that time, information science studies stressed the importance to study scientific information and the processes involved in scientific communication, bibliometrics of publications among scientists and social survey of books and libraries use. Through these studies, information scientists attempted to establish the core areas of research in information science and to define its boundaries from other fields. However, other post-war disciplines such as information theory, systems sciences and computer science competed alongside information science because all had in common the handling of data in various ways which made independence difficult to date, hence, a cause for discussion.

Information science has received conflicting views from different commentators in what seems to be a search for identity; the most recent being Bawden and Robinson's (2012) textbook chapter on "What is information science?". Information science has been regarded as:

- a practical solution to establish new procedures and technologies;
- informatology – the science of information that discovers fundamental laws governing the experience;
- the scientific study of the communication of information in society;
- a cognitive science – requiring careful experimental study to identify measures, errors and controls;
- a strongly positivist and behaviourist approach;
- Karl Popper's three worlds model, where worlds 1, 2 and 3 consist of nature and human and physical artifacts, subjective and objective knowledge, respectively;
- information systems and their design; and
- symbolic/social interaction, or in a psychological view, concerned with information, knowledge and understanding (Bawden and Robinson, 2012; Corkett, 2009; Holland, 2008; Ingwersen, 1992; Robinson, 2009).

For Belkin (1977, 1978) and Ingwersen (1992), the scope of information science constitutes:

- the formal and informal transfer of information;
- the generation and development of needs for information within the society;
- specific groups or individuals;
- methods and technologies to improve performance and quality of information;
- generation of knowledge and forms of its analysis and representation; and
- relevance, use and value of information.

Therefore, the goal of information science is to facilitate the effective communication of desired information between human generators and users. As the

search for identity and various influences on its formation, information science has continued to face dispute as to what kind of discipline it is. For example Bawden (2008) and Heilprin (1989, as cited in Robinson, 2009) observed that despite many laws, hypotheses and speculations about information that have been proposed, adequate scientific and epistemic foundations for a general science of information have not yet appeared. This is true of the repeated arguments that information science is a social science, metascience, interscience, postmodern science, interface science, superior science, rhetorical science, nomad sciences, liberal art, knowledge science or mediating science and humanism (Robinson, 2009).

Based on a long-standing perspective of the field, combined with more modern insights, Robinson (2009) defines information science as a field of study, with human-recorded information as its concern, focusing on the components of the information chain, studied through the perspective of domain analysis and in specific or general contexts. This modernistic definition gives attention to how the user benefits from the works of the information scientist, i.e. no matter the nomenclature used to describe someone engaged in information work, their ultimate goal is to further information access and therefore are regarded as information scientists. For example, if someone is designing retrieval systems to give access to recorded information or organising information collections by some form of classification, then they are "doing information science" as it is understood here, and it does not matter whether they style themselves as an information scientist, computer scientist or a librarian. As defined by Borko (1968) and expressed by Saracevic (2010), later re-echoed by Bawden and Robinson (2012, p. 2), information science is the science and practice dealing with the effective collection, storage, retrieval and use of information. It is concerned with recordable information and knowledge and the technologies and related services that facilitate their management and use.

Ingwersen (1992) argues that the problems of information science with respect to its boundaries with other disciplines are mainly found at interdisciplinary level, less often at the disciplinary level. Similar ideas were still held by Robinson (2009) and Cronin (2008) a decade later, and Holland (2008, p. 39) argued that like science and philosophy, information science shares an encyclopaedic scope, i.e. an umbrella word for a large variety of disciplines, that to understand it we need something much more specific and, thus, the real challenge is to develop specific knowledge, which is relatively independent of the subject knowledge, but which is not an empty abstraction. Information science studies large texts containing preserved knowledge, with more interest in solving theoretical and practical problems of information organisation and representation in systems for later retrieval. Information science can be viewed as one of several sciences:

- behavioural sciences contributed on the methodological side and provided a framework for understanding the use of information in the context of society;
- communication theory was used to model knowledge transfer;
- citation analysis developed from communication and statistics;
- linguistics theories provided the basis for text representation and retrieval (cognition and artificial intelligence);

- population biology and behaviour ecology used to develop foraging theory and information scent;
- Dervin's Sense-Making developed from communication and LIS; and
- berrypicking from the analogy of picking huckleberries in the forest.

This signifies the interdisciplinary nature of information science as an overlapping subject linked to many other subjects. This evidence re-echoes Cronin's (2008) and Robinson's (2009) arguments: the chunky concepts which make up our field's intellectual core (e.g. knowledge, information, communication and representation) are neither owned by information science nor likely to be assembled into an entirely credible canon without the judicious addition of perspectives and approaches taken from established disciplines, such as computer science, linguistics, philosophy, psychology and sociology, as well as from newer fields such as cognitive science and human–computer interaction.

Documentation and LIS

The line of argument in the studies by Hayes (1994) and Davis and Shaw (2011) is that librarianship or library science serves as one of the most visible and well-defined contexts for theoretical studies of information processes, while information science serves as one of the foundations for library science (p. 23). Farkas-Conn, (1990) noted that the era after the end of World War II was a remarkably creative period for librarianship that saw changes in linguistics and the beginnings of several of the new information sciences. In about 1960, information science emerged as the name for the field (Davis and Shaw, 2011). Thereafter followed a tendency to replace "document" with "information"; for example, the name-shift of the American Documentation Institute in 1968 to the American Society for Information Science and then in 2000 to the American Society for Information Science and Technology (Aspray, 1999; Farkas-Conn, 1990; Wedgeworth, 1993).

In some European countries, the term documentation science is preferred to information science (Aspray, 1999; Rayward, 1994). The term "documentation" is a neologism invented by Paul Otlet (1868-1944) to designate what is today called as Information Storage and Retrieval (Hjørland, 2000). According to Mikhailov, the Russian key-figure in documentation, informatics is the study of scientific communication and knowledge transfer. In the early twentieth century, when documents were considered the basic objects of study, the term document was used with a special meaning to include informative physical objects. Buckland (1991) and Davis and Shaw (2011) noted that the word document comes from the Latin word '*docere*', meaning to teach or inform, and the suffix '*-ment*', meaning a tool; thus, the word meant a tool for teaching or informing, whether through lectures, experiences or texts. Therefore, information science was called documentation. The science of documentation coined by Paul Otlet represents the means of bringing into use all of the written or graphic sources of our knowledge, and has been used in the indexing and abstracting of documentary materials and specialised information services (Davis and Shaw, 2011, p. 21). However, this intellectual discipline had considerable influence in Europe, not until Watson Davis was influenced by the European documentation movement and founded the American Documentation Institute in 1937 to study the problems of the distribution of scientific information.

Through the years, the concept of documentation has been expanded beyond Paul Otlet's ideas by defining documents broadly to include much more than text, hence, the term information science. In his opinion, Hjørland, (2000) argues that the effects of this

terminological shift have not always been positive, and have, rather, caused much confusion. The expansion led to close ties between computer science and information science, resulting in the formation of other concepts like informatics in 1962, which represents the conjunction of information science and information technology, and one decade later was demonstrated by the starting of the informatics conference in 1973 (Briet, 1951; Buckland, 1991, 1996; Davis and Shaw, 2011; Ingwersen, 1992). Buckland (1991) and Hjørland (2000) argue that "the concept of document is the most fruitful one to consider as the core concept in LIS". They define a document as any concrete or symbolic indication, preserved or recorded, for reconstructing or for proving a phenomenon, whether physical or mental. Therefore, documentation is interchangeably used to mean information and vice versa. Based on the aforementioned, I argue that there is no difference between LIS and library and documentation science. The two terms are used to suit context of use, but not representing a change in or introduction of a new discipline or science within the LIS domain.

LIS as a science and a discipline

First and foremost we need to understand what constitutes a science and a discipline. According to Frazier (1972), science is a dynamic process, an imperfect and sometimes tumultuous search for answers, rather than a static collection of agreed-upon truths. Similarly, Kuhn (1970) agrees that science is not a steady cumulative acquisition of knowledge, rather it is a series of often conflicting and sometimes turbulent episodes (punctuated by episodes of relative stability) which do not necessarily build on each other in a sequential or ordered manner. Andrew Dillon (in Bawden and Robinson, 2012) concurs with Frazier's and Kuhn's statements that "it is in looking at what people do rather than what they say that we often find the truth". Therefore, community acceptance of a science carries at least equal weight to its verification or falsification by testing shape and order of facts. The International Encyclopedia of the Social Sciences (Darity, 2008) emphasises that science is "knowledge […] of strictly proven ideas, to the exclusion of hypotheses or speculations". Similar opinion is held by Slife and Williams (1995, as cited in Hjørland, 2000) that "all sciences operate with theoretical models of different parts of their objects"; however, in LIS the challenge has been in proving those ideas.

Kuhn (Horwich, 1993) further urges that science rests on judgments which are of a community rather than a personal nature and that reason is not the primary, or at least not the sole, mode of persuasion in a community structure. The central notion of Kuhn's (1962) understanding of the dynamics of science is the concept of "paradigm". Paradigm is defined universally as recognised scientific achievements that for a time provide model problems and solutions to a community of practitioners. As the paradigm is increasingly accepted and adopted by the scientific community, it emerges as the normal science and directs the puzzle-solving activities of that science. For a paradigm to be adopted in a competitive field, it must have two features:

(1) it must provide a better explanatory framework than its competitors, and therefore must offer "better" explanations for known problems in the field (Kuhn, 1962, p. 206); and

(2) it must be accepted by the community as its guiding norm.

It is the mandate of this paper to discuss the science in LIS through these lens.

On the other hand, LIS has been regarded as: a social science, not a science at all, a liberal art, a form of cultural engagement or an applied philosophy of information (Arms, 2005; Cronin, 2008; Bawden and Robinson, 2012; Buckland, 1996, 2012; Floridi, 2002; Hjorland and Albrechtsen, 1995; Roberts, 1976). Other commentators such as Bates (1999), Bawden (2007) and Hirst (1974) prefer to categorise LIS as a field of study based on a unique form of knowledge, for instance mathematics or physical sciences, and oriented to solving practical problems, such as engineering and medicine (Bawden and Robinson, 2012). In their lens, this approach keeps LIS within sensible bounds, restricted to recorded information and produced and used by humans. Thus, LIS will be understood as "a multidisciplinary field of study, involving several forms of knowledge, given coherence by a focus on the central concept of human recorded information" (Bawden and Robinson, 2012). These diverse approaches confirm LIS as a broader discipline with an ambiguous set of topics which may assume a role once played by philosophy in mediating science and humanism or a metadiscipline like education. A discipline is a conversational community with a tradition of argumentation that participates along with other disciplines in a broader conversational community – the conversation of disciplines – with its own traditions of argumentation (Craig, 2008). Academic disciplines such as LIS are not founded upon eternally fixed categories of knowledge; they are discursive formations that emerge, evolve, transform and dissipate in the ongoing conversation of disciplines.

Following on from the aforementioned description of a science and a discipline, LIS is both a body of knowledge and a process that allows abandoning or modifying previously accepted conclusions when confronted with more complete or reliable experimental or observational evidence. Historically, the epistemological concept of information has led to the transformation of librarianship and change in name from documentation, to library science, to information science/information studies, to LIS, to library and document studies and now information schools (iSchools). Library Science Abstracts changed its name in 1969 to Library and Information Science Abstracts. From these examples, it can be argued that LIS is a science which is more than a collection of facts to be memorised or techniques to be mastered, but it is instead an inquiry carried on by people who raise questions for which answers are unknown and who have gained confidence in their ability to reach conclusions, albeit tentative ones, through research, experiment and careful thought, sharpened by the open criticism of others (Frazier, 1972).

According to Craig (2008), academic disciplines like LIS are not founded upon eternally fixed categories of knowledge; they are discursive formations that emerge, evolve, transform and dissipate in the ongoing conversation of disciplines. For LIS, this is evidenced in the increasing trends using the terms library science, information science and documentation in the institutions of LIS and the profession. For example, the names commonly associated with the field are: library science/library studies, information science/information studies, documentation/documentation studies/documentation science. The combinations of these terms have resulted in LIS and Library, Documentation and Information Studies. Capurro and Hjørland, (2003, originally quoted by Shapiro, 1995, p. 384) give some key events, including:

Information desk appeared as an alternate to reference desk by 1891. Information bureau was in use by 1909 to denote an office where reference service was provided; in 1924 the Association of Special Libraries and Information Bureaux (Aslib) was founded in Britain. In

the Aslib Proceedings for 1932, information work was introduced to describe reference assistance. Use of information as an equivalent of reference began to give way, under the influence of developments in computing, to more sophisticated usage.

The ongoing conversation within the field of LIS is evidenced in the increasing trend towards using the terms library science, information science and documentation in institutions of librarianship and documentation. For example, in 1968, the American Documentation Institute (founded in 1937) changed its name to the American Society for Information Science (Aspray, 1999; Farkas-Conn, 1990; Wedgeworth, 1993). From that time, "information" gradually replaced "documentation" as a name for a profession and field of study. A similar trend followed the change in the name of library schools to LIS schools in the late-twentieth century, and the late 1990s and early 2000s saw a movement to broaden and reorient information science education, where some LIS schools were renamed into Information Schools or iSchools (Saracevic, 2010). Like any other science, LIS continues to emerge, evolve, transform and dissipate in the ongoing conversation of disciplines. Between 1850 and 1900, considerable progress was made in the development of the techniques and content of library science. For example, formal education classes and training of librarians, archivists and bibliographers were introduced alongside informal courses and in-service education leading to two different philosophies and types of library science: one focused on scholarly libraries and the other on popular libraries (Davis, 1994; Davis and Shaw, 2011). Like any other discipline and science, library science education advancement was greatly influenced by the sheer amount of literature in all fields of study that become so technical to manage and acquire, hence, the need for new approaches to summarisation and subject access. The tools developed, such as indices, bibliographies and abstracts required individuals with subject and information organisation and management skills.

Davis and Shaw (2011) note that information science has intellectual roots in a number of disciplines including library science itself and applied fields of study and practice. Thus, it is described as interdisciplinary, transdisciplinary, metadisciplinary and multidisciplinary. Library science and information science are both interdisciplinary fields to each other, and according to Buckland (2012), while being interdisciplinary, it is widely considered to be a good thing for planners in the university environment; it is also a position of weakness in the times of economic crisis where political power tends to reside in well-established disciplines. Merging library science and information science to form a more concrete LIS discipline positions it with well-established disciplines like psychology, medicine and law. Jackson (1930) argues that scientific methods allow collected facts to be classified according to their interrelationships and every new discovery on any topic makes still further advances in the continuous growth of science possible. The merging of library science and information science to LIS justified Jackson's (1930) argument. Furthermore, Churchland notes that "it is now evident that where one discipline ends and the other begins no longer matters, for it is the nature of the case that the boundaries are ill-defined" (cited in Hjørland, 2008). Put in context, Hjørland, (2008) emphasises that:

> […] much research in LIS is related to the Internet. When is Internet research a part of LIS, and when is it a part of other disciplines? Or is it becoming a new discipline itself? Does it matter, whether it belongs to one discipline or another?"

For example, training of curators or teaching of archival studies is established in schools of LIS in the USA and Canada, with a few having strong collaborations with

departments of history; similar cases exist with communication or computing departments, as per the specialisation. Such relationships emphasise the interdisciplinary nature of LIS and position it as a strong discipline and science.

Craig (2008) argues that "a discipline is a conversational community with a tradition of argumentation that participates along with other disciplines in a broader conversational community with its own traditions of argumentation". However, commentators such as Buckland (2012), Cronin (2004), Dervin (1999), Floridi (2002), Hjørland (2000), Holland (2006) and Robinson (2009) caution the continued dependence of LIS on other disciplines and suggest the need for LIS to develop a special research discipline with its own theories, terminologies and methods other than engaging in cultural studies, identifying themselves with other fields of scholarship such as social sciences and publishing in journals in other fields. Moving forward in the context of Craig's conclusion, LIS has existed alongside other disciplines like physical, natural and social sciences from the earliest historical times, but did not begin to show a distinctively modern shape until the late 19th and early 20th centuries as a response to the vast changes in economic, social and cultural life. This indicates that LIS is an evolving scientific discipline in its own right that continues to participate alongside other disciplines in a broader conversational community with its own traditions of argumentation. This is true from Hjørland's argument that "mutual exchange of knowledge between disciplines is a sign of progressive science, whereas disciplinary isolation can be a sign of a degenerated research program" (2000, p. 521). Correspondingly, librarians as information professionals are not the only "information scientists" working with "the generation, collection, organisation, interpretation, storage, retrieval, dissemination, transformation and use of information"; other groups such as astronomers, publishers, researchers, historians, lawyers and teachers are said to handle information professionally. Capurro and Hjørland (2003) emphasise the need to specify the special role of information scientists in handling information. In line with the above, Buckland (2012) stated that:

> Each academic specialty develops its own culture of knowledge, language, values and social structures. In consequence they are necessarily more or less different from each other in scope and potentially incompatible, or at least dissonant. No specialty is likely to prefer a unified culture (epistemology, terminology) to its own evolving native culture, so a tension is to be expected between a desire for the benefits of compatibility with other specialties and the discomfort of dealing with the more or less alien cultures of other specialties. […] the most productive position was to be firmly grounded in one's own field and to then go prospecting at or over the frontiers with other fields.

A disciplinary voice derives its strength and disciplinary authority from its entrenchment in existing institutional schemes of organisations (Craig, 2008). Hjørland (2000) observed that "professional knowledge is […] influenced by institutional ideologies". Therefore, the content and the truth of research in LIS are influenced by its institutional affiliations. Rhetorical resources for constructing and legitimising disciplines can be found in institutional contexts of universities and departments, professional organisations, funding agencies, publishers, libraries, databases and associated classification schemes.

Since its early history, librarianship has established itself with widespread international awareness through local and international library and bibliographical organisations that have continued to fulfill a wide range of functions, including:

- regulating the loan or exchange of documentary materials;
- regulating international commerce related to these materials (postal and tariff regulations, publishing and distributing copyright agreements and censorship);
- generating, standardising, exchanging or publishing bibliographic data in various formats for books and non-book publications and indexing and abstracting data for journal articles and related materials;
- creating, maintaining and operating international information systems of various kinds;
- providing moral, technical and financial assistance to developing countries to help them improve their use of existing documentary materials and information systems; and
- publishing reports, manuals, directories, monographs and proceedings (Abbott, 1988; Hjørland, 2000; Rayward, 1996; Wedgeworth, 1993).

Therefore, librarianship, like any other discipline, draws from a complex mixture of institutional, intellectual and cultural resources, and it has negotiated the tensions among these different sources of legitimacy in specific ways that have led to its evolution from the early days as a documentation science to library science and finally to LIS in the 21st century.

LIS is a strong science and discipline by its societal role. According to Buckland (2012), the most respectable academic departments, for e.g. history, chemistry, and languages, originated in the nineteenth century perceptions of the societal needs of the nation-state. Likewise, Buckland acknowledges the societal relevance of LIS and its significance towards cultural practices and beliefs throughout society. Similarly, Craig (2008) argues that:

[…] if disciplines can be invigorated by their resonance with the wider culture, they can also be enervated by loss of contact with the general public if they become excessively specialized, technically sophisticated, and professionally insular.

Therefore, the interdisciplinary nature and societal relevance of LIS qualifies it as a strong discipline as well as a science. Davis and Shaw (2011, p. 17) noted that "to a significant extent, all societies are information societies […] the ultimate foundation of information science involves the interactions between information and society" (p. 24). As a science, LIS aims to solve practical problems in the society. Craig (2008) argues that:

[…] a science which cuts itself off entirely from the broader intellectual debate will […] retain only localized significance; its professional technicalities will have no power to influence "common sense" or "common knowledge," and "the science itself will be in danger […] of expiring […] for lack of good new recruits to cultivate it.

The provision of credentials to persons uniquely qualified to serve as librarians, archivists, information scientists and curators allows continued conversation and external application of LIS, spreading reified definitions of the discipline and its content throughout society as a whole. The argumentation described previously qualifies LIS as a strong science and discipline.

Scientific methods of inquiry require that, in the search for scientific knowledge, progress is greatly facilitated by careful and accurate measurement of the things

observed. A similar stance by many eminent scientists including Leonardo da Vinci (as quoted from Jackson, 1930) has observed that "no human investigation can call itself true science unless it comes through mathematical demonstration", which, according to Hjørland (2000) and Jackson (1930), is absolutely untrue. Jackson (1930) comments that "mathematics, in scientific study, is a tool of priceless value and unlimited promise; but it is not an absolute essential". For example, "Faraday managed to make some highly important discoveries in electromagnetism without the aid of mathematics". Based on this background, this paper argues that the use or failure to use mathematics in LIS research does not necessarily mean that LIS is not a science. Like other sciences and disciplines, LIS's strength and disciplinary authority is in its intellectual distinctiveness and productivity found in the intellectual contexts of classic and current texts, theories, problems, methods and modes of analysis: for example, classification systems (e.g. Dewey Decimal Classification System, Universal Decimal Classification and Colon Classification); vocabulary and authority control systems (e.g. Library of Congress Subject Headings, Sear's List of Subject Headings, National Library of Medicine Subject Headings); Ranganathan's Five Laws of Library Science; and Anglo-American Cataloguing Rules. For example, in 1841, Anthony Panizzi developed 91 rules for author-title entries, bringing consistency to cataloguing work (Davis and Shaw, 2011).

LIS is an established scientific field of study whose hypotheses, theories and laws continue to be tested for validity by other LIS and non-LIS researchers under the same conditions and published in peer-reviewed journals and conferences. Historically, LIS's intellectual distinctiveness is rooted in the desire for scholars to understand and organise all human knowledge through compiling, classifying and making the world's knowledge available. The desire started as early as the 17th and 18th centuries with the invention of a classification system of the world's knowledge, and the draft of an encyclopaedia to contain it, in 1620 by Francis Bacon, and this work later greatly influenced those in library science, documentation and information science (Davis and Shaw, 2011). This led to a number of advances in national and subject bibliographies, printed library catalogues, new schemes for subject arrangement of materials on the shelves and principles for bibliography, and later to a rapid expansion of the number of libraries, hence extensive writings about libraries and library management. This advancement further required librarians to have skills and knowledge in cataloguing, classification, shelving and library management, ending the era where one being a scholar was sufficient background for a librarian. For a science to be practiced, Belkin argues that there must be some agreement among its practitioners at least as to the basis of the science's theoretical assumptions and concepts such as information (1978, p. 58).

Conclusion
What is described here is a dynamic and changing field of study and a science called LIS that differs from Cronin's (2004) assessment that library science, or LIS, is neither a science nor a discipline. LIS is viewed as a multidisciplinary field based on other subjects, but is developing towards a discipline in its own right. The differences between librarianship and information science are an indication that there are two different fields in a strong interdisciplinary relation, rather than one being a special case of the other.

LIS has grown to be a scientific discipline, knowledge and a process that allows abandoning or modifying previously accepted conclusions when confronted with more complete or reliable experimental or observational evidence. Therefore, like any other science, LIS is a science and a discipline in its own right that continues to emerge, evolve, transform and dissipate in the ongoing conversation of disciplines. As suggested by Hjørland (in Bawden and Robinson, 2012, p. xxii), there is a need to develop a general perspective that keeps the field together to help information professionals get a clear identity in relation to other fields in the multidisciplinary field, as well as to develop a body of specific information science knowledge related to all major branches of knowledge.

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Corresponding author

Fredrick Kiwuwa Lugya can be contacted at: flugya@gmail.com