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Chapter 1

Library and Information Science in Context: The Development of Scientific Fields and Their Relations to Professional Contexts

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Abstract

The purpose of this chapter is to discuss how theories of social and intellectual development of scientific fields can be used to analyze LIS and especially its relationship to other research areas and the library and information field of practice. Scientific fields can be seen as reputational work organizations where degrees of task uncertainty and mutual dependency control the coordination and direction of the fields through allocation of rewards. Through the concepts of reputational autonomy, control over resources, and structure of audiences, four aspects of scientific work have been identified as a basis for an empirical analysis of LIS: definitions of the field, institutional structure, research work, and communication structures. The preliminary analysis shows large mutual dependency between LIS research and the

field of practice, while LIS in the context of Academia is dependent on other fields of research but is still relatively isolated. The results of the paper indicate that the theories proposed are useful tools for analyzing contextual factors in the development of fields of research.

At least since the 1960s, when Kuhn's *The Structure of Scientific Revolutions* (1) introduced social studies of science, the dichotomy between applied and theoretical sciences has been an important theme, together with other dichotomies such as: hard/soft or mature/immature sciences. The question can be raised as to whether these dichotomies are useful for the analysis of scientific disciplines. When one reflects on the development of the sciences throughout the last fifty years, it becomes evident that applications-oriented research has grown substantially, not only in the "Applied Sciences," but in the sciences in general.

One of these applied science disciplines is library and information science (LIS). Essentially, the raison d'être of LIS is practice-based problems of managing information. This practice-based origin is not specific to LIS but is shared with, for example, the engineering and nursing sciences. Even though all these sciences share a similar origin, they differ greatly in terms of academic legitimacy, for example, access to resources. This leads back to the question as to whether dichotomies such as applied/theoretical sciences are useful for analyzing the intellectual and social development of scientific fields. However, the close relationship between research and professional practice should have implications for research orientations, theoretical and methodological development, and so forth. The question is whether this relationship only affects the intellectual aspects of research, or if the social organization of research and its relationship to wider contexts also are affected.

The aim of this study is to discuss how the theoretical framework for the organization of the sciences developed by Whitley (2) can be used to analyze the impact of lay groups and wider scientific contexts on the development of research fields with a focus on LIS. I first introduce Whitley in the context of social studies of science and outline the main features of the theoretical framework he proposes. This relates to questions about what theories can be used for analyzing intellectual and scientific development. The following section briefly discusses the increase of an applications-oriented research, before presenting how this, and the influence of lay groups and wider scientific contexts, can be interpreted. A main question here is how Whitley's theories can be used for analyzing scientific fields that have a close connection to a field of practice. To test

the theoretical framework and to give some empirical background for formulating hypotheses for further analysis, indicators on contextual influence are identified and discussed.

Science Studies

Science has been analyzed from philosophical and historical viewpoints throughout the twentieth century and during the latter part also in terms of social issues. The wide recognition of the social studies of sciences has been largely attributed to Thomas Kuhn and his theory of the development of scientific fields based on the concepts of paradigm and paradigm shifts (1). Several dichotomies that have been a major feature in the social studies of science have been either introduced by or derived from the works of Kuhn. But Kuhn has also been criticized for a number of reasons, for example, his theories on scientific development are based on the natural sciences, excluding the social sciences, for instance, as objects of analysis. Kuhn's model can also be considered too inflexible, not only because of the exclusion of the social sciences, but also because the model is too general. By assuming uniformity and inevitability, little room is left for contextual variations in time and environment.

Particular aspects of scientific development that have gained wide attention are scientific work and communication. Different aspects of scientific communication have been the subject of analysis in numerous studies, such as Price (3) and Crane (4). The intellectual aspects of the organization of sciences have been analyzed, for example, through contextualizing studies of scientific work (5, 6). These all contribute to the understanding of the sciences and their organization but are more or less concentrated on either the intellectual or the social aspects, not how these aspects interact.

A Model of Scientific Work and Processes

One model for analyzing the intellectual and social development as well as the organization of the sciences that avoids restricting dichotomies has been developed by Whitley (2). It makes contextualization possible and also addresses how social and intellectual aspects interact. He describes modern science in terms of reputational work organizations, coordinated and controlled by the allocation of rewards. Different scientific fields of research vary in this respect and are comparable through differences and

similarities in their social and intellectual organization. Whitley (2) identifies three sets of factors having an important effect on the development of research fields.

The Development of Research Fields

The first set of factors involves the degree of control over research practice, competence assessment, and hierarchy of employers. This refers to the extent to which individual scholars have to coordinate the use of different kinds of material, techniques, and theories; the importance of coordinated research practices for assessment of research; and the extent to which reputational features govern the employer's goals and use of research skills.

The second set of factors involves the degree of independence of a research field from lay concerns and its autonomy from other scientific fields. This relates to the ability of a research field to maintain boundaries and identities in terms of research foci, problem statements, and research techniques, as well as its use of language, terms, and concepts.

The third set of factors involves access to resources and the diversity of audiences. Varying degrees of these features affect how dependent scientists are on those who control channels of resource distribution and communication.

Dimensions

The factors mentioned above are highly influential for positioning different fields of research on two basic dimensions along which variations between fields, time periods, or national scientific systems occur: the social dimension, involving the degree of mutual dependency, and the intellectual dimension, involving the degree of task uncertainty.

The Degree of Mutual Dependency

The degree of mutual dependency involves the extent to which researchers are dependent on colleagues and other groups to make significant contributions to collective intellectual goals and thus are able to gain reputation and other rewards. In the case of high mutual dependency, a scholar has to rely on a particular group of colleagues. He or she has to follow

specific standards of research practice and criteria for assessing the significance of research. This means that competition and cooperation are significant traits in the organization of research, and also implies that the variety of audiences is limited.

There are two types of mutual dependency. Functional dependency involves the degree to which results of research have to be coordinated with colleagues and must demonstrate how common competence standards are met. If there is a high degree of functional dependency, scientific contributions cannot diverge too much from existing and generally accepted perceptions. Results should be produced by the use of familiar techniques, methods, and material. Following this, the assessment of a contribution depends on the degree to which it is considered useful for the research collective and for forthcoming research.

Strategic dependency refers to the degree to which scientists have to persuade colleagues of the importance of their research problems and the extent to which they have to coordinate their research strategies to show the importance of the research problem for the collective goals.

The Degree of Task Uncertainty

The degree of task uncertainty, reflecting the intellectual dimension of scientific development, indicates the extent to which research outcomes can be predicted. This depends, for example, on the degree to which background knowledge, formalization of problem formulations, terminology, methods, and goals and expectations of the employer have to be shared.

There are also two types of task uncertainty. Technical task uncertainty refers to how well work techniques are understood and the degree to which they are expected to produce reliable results. If the technical task uncertainty is high, scholars are likely to produce results that are ambiguous and that can be interpreted in a variety of ways. This makes the task outcome less predictable and harder to reproduce, thus harder to verify and to assess for the purpose of allocation of rewards.

Strategic task uncertainty reflects the degree of stability of research problems and the extent to which there is a hierarchy of problems. High strategic task uncertainty implies a multitude of problems being addressed by the scientists. The evaluation of the importance of specific problems is subject to interpretation and is thus likely to vary. This is largely due to the lack of formulation of an overall goal for the research field.

Organizational Features of Scientific Fields

Owing to differences in degrees of mutual dependency and task uncertainty, scientific fields differ in how they organize scientific work and access and allocate resources and rewards. These differences are dependent on the degree of control over such matters as research practice and assessment of competence, autonomy in relation to lay groups and other fields of research, and access to resources and varied audiences. Within these different organizational arrangements, there are a number of features that can be analyzed to uncover organizational structures and the factors they depend on.

Configuring Tasks and Problems

Configuring tasks and problems is the first feature, which refers to how scientific work processes and goals are arranged internally. This feature has four different characteristics.

i)   The degree to which tasks and materials are specialized and standardized is linked to the reduction of the scope of problems and the specialization of research results. Such reduction and specialization can lead to restrictions on intellectual foci and the development of a far-reaching division of labor.

ii)   Related to this is the segmentation of research fields into distinct specialisms or subfields. The general intellectual orientation and perspective is still the same as in the wider field of research, but the goals and problems pursued are specific for the subfield.

iii) A contrasting development is a differentiation into distinct schools of thought and practice within the more general field. Here, the differences in terms of goals and viewpoints lead to competition within the reputational system. Different schools try to dominate the system by excluding opposing views rather than by seeing different views as being complementary.

iv)   Especially in the case of segmented fields of research, there is a tendency to regard some problem areas as more important and more crucial for reaching reputational goals than others. The degree of hierarchical structure of subunits is at least partly dependent on the level of theoretical uniformity and adherence.

Coordination and Control of Research

Coordination and control of research is the second feature. This relates to the connection and integration of scientific work around a set of common problems or concerns and the degree to which coordination constrains and lessens intellectual conflict. Here there are three sets of characteristics. In different fields, there are variations in the degree to which procedures and formal communication systems are impersonal and formalized or direct and based on personal supervision and contacts.

Another feature is the degree to which research is coordinated around certain theoretical purposes and criteria or is primarily concerned with particular phenomena and properties. This is connected to whether research problems are selected on local or specific premises or more general purposes. Variations in scope and intensity of conflicts are connected to how integrated and coordinated research strategies and task outcomes are, as can be seen, for example, in the differentiation of schools of thought.

Contextual Influence on Development of Research Fields

Since the 1950s, applications-oriented research has expanded as a result of a number of factors that include social, political, and economic changes as well as the increased value attributed to formal knowledge, organizational changes in research, and the expanding market for scientific knowledge. Gibbons et al. (7) have described this development in terms of a radical shift from "Mode 1," discipline-based science, to "Mode 2," applications-oriented research. Mode 1 science is dominated by the universities, where scientific élites organize the allocation of funds and set the standards of research competence and significance. Mode 2 research is characterized by a focus on the applicability of knowledge production and is carried out in heterogeneous organizational contexts and by transdisciplinary research teams. Research of this kind is organized around problems that are to a large extent stated by commissioning authorities, which also allocate funds and set competence and significance standards. Thus, the quality of research is not judged only by "pure scientific" criteria. This leads to a diminishing boundary between administrative and intellectual organization. As universities increasingly start conducting Mode 2 research, the autonomy of the universities decrease and disciplinary based scientific élites lose their role as definers of scientific quality.

Given this general background, it is plausible to assume that scientific development depends on both social and intellectual factors that regulate the relation between individual fields of research and their various contexts. Whitley (2) identifies three main factors affecting scientific development and organization that can be used for an analysis of the contextual settings.

Reputational Autonomy

Reputational autonomy is the first factor and reflects the degree of control over standards for assessing competence and performance. It is vital for a field of research to be able to control both work processes and the labor market within the field. To what extent this is achieved depends mainly on the level of coordination and the possibility of comparing task outcomes. This can be seen in three interconnected dimensions.

The level of performance standards and unique work methods depends on the extent to which it is possible for "outsiders" to make significant contributions to the intellectual goals of the field. If the methodology and work techniques are either general or "imported" from other fields, researchers trained in other fields are able to contribute without having to modify their procedures in any significant way. These possibilities decrease as the level of specialization of procedure increases, and thus the control of performance standards gets more in the hands of reputational élites within the field.

The degree of control over significance standards is related to how much the field itself is able to define the importance of problem formulations and research strategies. This involves the extent to which fields are able to order research questions and strategies. It affects the possibility of the coherent and systematic development of knowledge in terms of focus on the specific research problems that the field has been able to monopolize. One aspect of this is also the extent to which the values and purposes of employers, funding agencies, and other external entities are visible when defining important problems and assessing to what degree the research contributions deal with them. Associated with these factors is the degree of control over the identification of the field—in terms of characterization of the domain, its problems and descriptive language—and thus, the ability to determine its own boundaries.

How boundaries are defined depends on several different aspects, but one main aspect in this case is how the field is constructed. It can be constructed on the basis of problem areas omitted by other research fields, which leaves the field constrained by other existing boundaries and how

they have been defined. Another mode of construction is if nonscientific groups largely define central phenomena of inquiry, which leaves a limited autonomy for the field. The field can also be developed from another field by redefining central phenomena and boundaries.

Another important aspect is the degree to which the vocabulary and communication system is formalized. This affects the range of internalization of the field, the level of ambiguity and possibility of multiple interpretations of results, and the degree to which the field is subject to external influence or pressure. For instance, if the vocabulary is close to "common" language, it becomes more difficult to reduce ambiguity which makes it harder to rely on a formal communication system to reproduce and control research. This reduces the possibility to integrate results into a wider corpus of theoretical goals and also to assess the value of research in terms of reputation.

Control over Means of Production and Distribution of Research

This is the second factor. It refers to the degree to which facilities, employment, and access to communication channels are controlled (horizontal control) and the extent to which they are shared equally (vertical control). Variations in control are dependent on the organization of the national research systems: the extent to which work units are organized around one strong leader/chair, or if control is more distributed. But it also depends on the level of technical task uncertainty (i.e., if technical task uncertainty is low and skills and symbol systems are more standardized, the dependence on the local system or organization is likely to be lower and the international reputational organization becomes more important).

The horizontal dimension deals with the size and number of groups and employment units controlling the means of production and dissemination of research. This affects the possibilities scientists have to pursue their own interpretations and research strategies to fulfill wider organizational goals through local control over means and resources. For instance, if the horizontal concentration of control is high, the control over the resources is limited to a small number of central agencies, and a small group of people is able to define research goals and assess reputations.

The vertical dimension refers to whether the control over the means for research is distributed equally within the employment units or not. This determines whether authority and control over research orientations

and resources within work units is shared, or if it is gathered around a research director or a small élite group. If the vertical concentration of control is high, the leader of a department, for example, decides on the distribution of local resources and access to wider means of communication (i.e., the means of gaining wider reputation within the research field).

The Structure of the Audience

The third contextual factor is the structure of audiences. This consists of two components. The variety of distinct audiences relates to the influence of laity and groups of researchers on obtaining reputation. The impact of this varies considerably, depending on work goals and procedures, theoretical integration, and formalization of terminology among other things. Another aspect of audience structure is the number and degree of specialization of journals or other means of publication of the research. Results from some fields can be published in a number of journals with a diverse audience or in a more limited set of journals with a specialized content and audience.

The equivalence of audiences refers to whether different audiences have an equal impact in terms of control over distribution of reputation. This has implications for the choice and ranking of publication media, especially in fields with a high level of inequity, where the ranking of journals in terms of size and importance of audiences is an important feature. This is one reason that general journals tend to be ranked higher in terms of prestige and impact. In fields with a high degree of equivalent audience, there is no generally accepted hierarchy of audiences and journals, and the competition is relatively low in terms of getting attention from specific audiences or getting space in certain journals. More important is the audience's influence on control over reputation—which also means influence over the distribution of resources—and following this, over determining the importance of research problems and goals.

Identifying LIS Contextual Relations

The purpose of this section is to outline how Whitley's theories of scientific development and contextual relations can be used in an analysis of LIS in relation to other academic disciplines and to its field of practice. To operationalize Whitley's model, a set of indicators has been identified. These range from wide concepts such as definitions of the field to

more limited concepts such as research funding. These indicators can be collected under four main headings: defining the field, institutional structure, research work, and communication systems. Some of these concepts are closely related to concepts presented by Whitley, while others are derived from his model on a looser basis. All are related to at least one of Whitley's contextual factors affecting research fields and will be discussed in relation to these factors and to his general model of scientific development.

Defining LIS

The scientists' attempts at defining their fields are important in analyzing the development of a particular field and its relation to its wider context. How the general characteristics, central problem areas, and working methods are perceived by the practitioners themselves relates to all the contextual factors Whitley has identified. These perceptions also constitute one of the levels of analysis important for determining reputational autonomy.

In LIS there have been several explicit attempts at defining the field. In most of these definitions, the following main features can be found: the name of the discipline, the definition of the intellectual content of LIS, LIS in relation to other fields of research, and LIS in relation to the professional field of library and information practice.

The Name of the Discipline/Field

When discussing the name of the discipline/field, three main elements are involved: "information science," "library science" (and/or librarianship), and "documentation science." These appear in definitions in various combinations, and sometimes "science" has been replaced by "studies." A restrictive point of view considers it to be two different fields with some common ground, namely, the task of facilitating access to information and the utilization of documents. They are, however, differentiated by the problems addressed, by theoretical questions, the degree of experimentation and empirical development, research techniques, and the nature and strength of interdisciplinary relations (8). Another, more inclusive view considers library science as a special R&D activity, for which information science serves as a unifying concept (9). What name to use, or where to put the emphasis, is to a large extent dependent on dominating research specialties and theoretical perspectives (10).

Defining the Intellectual Content of LIS

One of the most comprehensive attempts at defining the intellectual content of LIS sees the field as consisting of two major subdisciplines: scientific communication and bibliometrics. It lists eleven research specialties within these subfields. In addition to the eleven specialties, a category of 'imported ideas' is also identified as a significant aspect of LIS research, with ideas coming from computer science, for example, information theory, and the cognitive sciences, but with completed work being published in LIS journals (11). To the subdisciplines might be added studies on information needs and uses, or information seeking in a broader sense. This analysis has gained wide acceptance, and received much attention, mainly because it is one of the few attempts at an empirically based, large-scale analysis of LIS research. By making a quantitative analysis of LIS journals and articles, the analysis makes an attempt not only at defining LIS, but also at identifying its cognitive structure. Basically, LIS is seen as structured around two tasks or problems (that at least partially interconnect): the development, evaluation, and use of IR-systems and the analysis of literatures and communication, with some research quite general and some more closely connected to library institutions.

A different definition has been suggested by Hjørland (10), who characterizes the intellectual aspects of the field under the categories of aim, subdisciplines, methods, and theories. The aim of LIS is basically to facilitate the communication of information between humans, which can be specified into the following research orientations: information seeking and retrieval, classification and indexing, collection development, information systems design, and management of information services. All these areas firmly connect to the field of practice. The subareas of LIS for Hjørland are topics such as information retrieval, scientific communication, user studies, and library history. For him the categories of theory and research methods are basically empty, with the exception of a few adaptations of theories from other fields, some general models, such as those for information-seeking behaviors or domain analysis, along with methods derived, for example, from the social and behavioral sciences.

His definition has not the same empirical basis as White and McCain's (11), but basically the two definitions of LIS and its main tasks are essentially the same and involve the analysis of systems for information management and the production and use of information. However, Hjørland's description of LIS is not as limited as White and McCain's when identifying how these tasks are achieved in terms of research specialties and so on. One reason for this might be that White and McCain's analysis is

based on journal articles from a limited set of journals, primarily published in the United States, and is mainly oriented toward information science (11). Hjørland on the other hand discusses the definition from an international perspective (and to some extent from a Nordic point of view), including more library science–oriented research, as well as research that is communicated in books, reports, and journals.

LIS's Relation to Other Fields

The third major aspect to be taken into account in defining LIS is its relation to other fields of research. As mentioned, one feature identified by White and McCain (11) is imported ideas from areas such as cognitive and computer sciences and information theory. The relation to other fields is clearly visible in definitions of LIS as an interdisciplinary field of research. Solving the problems addressed in LIS is dependent on research approaches from more than one field. Another important factor is the different subject background of scholars working with LIS tasks and problems. The definitional emphasis that is placed on the extent and range of related fields varies depending on how the relations are defined and also on how strong the orientation is to either library science or information science. Relations in terms of shared tasks and problems are dominated by the connection to computer, communication, and cognitive sciences.

Computer Science and LIS share an interest in computer applications for information retrieval (IR) purposes. The main difference is in terms of focus: while computer science focuses on the manipulation of symbols and the algorithmic processes that describe and transfer information, LIS concentrate on content manipulation (i.e., the nature of information and its use by humans). From this point of view, the two fields complement each other by setting different basic and applied agendas (8). However, this view is contested, for example, by an increasing interest in human-computer interaction in the computer sciences.

Depending on where to put the emphasis, the relation between communication science and LIS can be considered even stronger than the LIS-Computer Science connection. Not only does LIS and communication studies share research topics, but the two areas are also connected by increasing organizational links, especially in the United States and Canada, where there has been an increasing development of LIS and communication science departments merging, and communication and LIS research is increasingly being done by the same scholars. These developments suggest a growing convergence between the two areas (9). This is especially visible in studies of scientific communication, which is identified

as a LIS research specialty by White and McCain (11) and also a research area that connects LIS with science studies and sociology of science. However, there are also differences in terms of theoretical and research foci, objects of research (such as different types of communication and information channels), and also institutional differences such as media used for the communication of research results (9).

Apart from similar research topics, there are also other connections of LIS with other fields of research. The relation to humanities is twofold. First is origins. The notion of libraries as "humanistic" institutions is deeply rooted. At least until the end of the nineteenth century, the majority of librarians and developers of library services had their academic training in the humanities. The other connection is one of methodology and theories. Especially in library science–oriented research, there are strong links between LIS and literature, cultural studies, and history, for example (9).

An interesting aspect of the relation between LIS and other fields is the relation between export and import of ideas. White and McCain found that in their study of publications and citations the importation of ideas was as prominent a feature as the research specialties they identified in LIS (11). As discussed above, many research techniques and theories have been adapted from other fields. This is reflected, for example, in the reference lists in research reports, journal articles, and books, where the amount of citations to research done outside LIS is significant. Importation is also evident in the number of authors from other research fields who publish in LIS journals. The exportation of ideas, on the other hand, is low. Studies of citation patterns in fields that are supposed to be closely related to LIS, such as communication science, computer science, and cognitive science, suggest that the impact of LIS research in these fields is very low (9). The exception is studies of scientific communication, where there are strong links between LIS and Science Studies in both directions.

Relation to the Field of Professional Practice

This is not as explicitly discussed in the texts defining LIS as the relation to other disciplines. But its importance appears in the name of the field and when the central tasks and subfields within LIS are identified. More explicit are claims that LIS is a field of both professional practice and scientific inquiry. But even here, there is a firm differentiation between research and the practice. When discussing the relation between library science and information science, the advocates of the distinction between the two explicitly or implicitly refer to library science more or less as the

practice of organizing, preserving, and making the use of information possible in the library as an institution. The scientific aspect of this is basically to develop increasingly effective methods for this practice (8). This position does not place information science in relation to a professional practice, although the claim can be made that the significant difference is merely that library science deals with information problems in the specific setting of the library. Information science deals with the same problems independent of an institutional context. So, even though one might claim that information science examines aspects of information in a general sense, its main tasks are still related to a practical problem [i.e., how to optimize the means of access to information (9)].

More explicitly, LIS has been described as a research field legitimized by its contributions to a field of practice. Its main task is to produce research on how to organize and distribute knowledge more effectively, as opposed to the "pure" sciences whose main task is to produce generalizable results that contribute to the total body of scientific knowledge. This affects the extent to which generalizing task outcomes is possible and the development of theories that are not connected to a specific context or enterprise (9).

The variations in approaches to defining LIS are interesting from a theoretical viewpoint, especially in terms of their implications for reputational autonomy and for the control of the identification of the field. A primary aspect of the identification of a field is to characterize its domain. If there are differences even in the identification of LIS through the name of the field, it is plausible to assume that the identity of LIS is vague, taking the field as a whole. This probably affects the extent to which its autonomy is limited, which increases the "risk of invasion" from other fields. Although there is some consensus on the main tasks and the fundamental problems of LIS, the definitions of subfields and means of achieving the main tasks are diverse. This indicates a generally low degree of strategic and functional mutual dependency, although there are big variations within different research orientations.

The definitions indicator suggests that the level of task uncertainty in LIS is relatively high. Although the nature of the field's fundamental research problem is generally accepted, the routinization of tasks—through control procedures, distribution of authority, division of labor, and coordination of results—can be considered to be limited. There are differences in how LIS research tasks are solved, both within different research orientations and in different countries. The variation of research techniques and the assessment of their probability of producing reliable results indicate a high level of technical task uncertainty, which means that

information-related phenomena could be analyzed and interpreted in various ways. However, there are also subfields that do not share these general traits, where the task uncertainty is lower, and the degree of mutual dependency is substantially higher. The degree of task uncertainty in LIS in general terms suggests a low level of strategic dependence and a high level of functional dependence.

The low degree of reputational control over domain description is also connected to vocabulary. Especially in the library science orientation, the definition of the discipline is closely related to nonscientific groups. The language is, although to some extent technically oriented, largely derived from library practice work techniques, which increases the lay influence on the field. A medium degree of autonomy is suggested by the existence of a set of technical terms and concepts, but this is contested by the level of unique work methods, which is low, and the possibilities of researchers from other fields making significant contributions, which is high. This indicates a low level of reputational control over performance standards.

On the other hand, one aspect that is overlooked in Whitley's discussion of the setting of competence standards is the fact that LIS research seems to gain little attention, at least in the larger academic community. This could support a claim of reputational autonomy in terms of élites within the field deciding what constitutes competent research contributions, but the influence of lay groups, in terms of problem formulation and vocabulary, still remains.

The control over standards for judging significance can also be considered to be low. The assessment of research problems and strategies, and the probability of them contributing to the central task, is limited by the lack of general acceptance of such matters as the intellectual boundaries of the field, work methods, and research strategies. Since the main task is essentially practical, those in the field of practice are likely to be involved in evaluating standards, not only by assessing the extent to which research contributes to solving professional problems, but also by contributing to research themselves.

The connection between the definition of LIS and the control over access to means and resources is not as strong as the degree of reputational autonomy. Although the diverse conceptions of LIS and its different subfields indicate a locally based distribution of resources, the main dependency factor is national variations in the organization of higher education and employment. However, there is a relation between the level of task uncertainty, which in the case of LIS can be described as relatively high, and the dependency of local organizations (2).

The relation between the audience structure and the definition of LIS is quite strong, especially since there is a strong tendency to define LIS in relation to other fields of research and practice. One aspect of this is the degree of variety of distinct groups, a factor on which LIS rates high, especially in terms of lay audiences as a source of reputation. In terms of a general scientific audience, the variety seems less important, owing to the lack of citations in other research fields to LIS research. According to Whitley (2), these phenomena are related to a low degree of control over work goals and theoretical integration, features that are also found in LIS.

Institutional Structure of LIS

The institutional structure of LIS is diverse and depends on such things as regional and national differences in academic organization, emphasis on subfields and research orientations, connection to the LIS field in general and to the wider context of Academia, and connection to the field of practice.

The Institutional Development of LIS

There have been major changes in terms of institutional affiliation and departmentation in LIS over the past few decades. In the United States and several other national academic systems, LIS as a discipline has emphasized the information science orientation to an increasing degree. LIS departments have also sought out adjacent research fields to merge with, such as communication science departments, business and management schools, schools of education, and in some case computer science departments.

In the Nordic countries, the situation is different. In Sweden, LIS was not established as an academic research discipline until the early 1990s, when the first professorial chair and a Ph.D. program were established. This change occurred at the same time as the professional certificate was abolished and was replaced by an academic master's degree. Until then, Swedish LIS education had been monopolized by the Library School at Borås University College. When LIS became a subject that could be part of an academic examination, masters programs were established at three other universities that from the late 1990s also offered Ph.D. programs. Even though professorial chairs and postgraduate education were not established until the 1990s, LIS-related research has been carried out at least since the late 1960s. Most of it has been library science–oriented research, but there have also been contributions oriented

toward information science. Information science–oriented research has primarily been carried out by research groups in non-LIS departments and disciplines.

Organizationally, there are large differences between the different Swedish LIS schools and departments in terms of affiliation and cooperation with other disciplines, and also in size. In Denmark, the Library School is not a part of the general Danish academic system, but has been placed under the department of Culture. A Ph.D. program was not established in it until 2001. The situation in Norway is basically the same as in Sweden, while Finnish LIS research and education shows a development more similar to continental and general LIS (12).

Financing LIS Research

There are large differences in financing LIS research. However, on an international scale, the largest component of research funds seems to be provided by employing institutions (table 1).

Table 1: Funding agencies through acknowledgments in *Journal of the American Society for Information Science (JASIS)* 51 (2000), and *Journal of Documentation (J Doc)* 56 (2000).

Journal	Funding agency				
	Employer	Local/Gov. Inst.	International Inst.	Private Enterpr.	Total
JASIS	68 (0.64)	32 (0.3)*	2 (0.02)	4 (0.04)	106
J Doc	25 (0.83)	5 (0.17)			30
Total	93 (0.68)	37 (0.27)	2 (0.01)	4 (0.03)	136

* A substantial number of the research projects reported were funded by Canadian research councils.
NOTE: Assumes that lack of acknowledgment indicates funding provided by employer.

The data presented in table 1 suggest that local universities fund the majority of LIS research, and that local or government authorities, such as research councils and foundations, fund the larger part of the rest. Considering that *JASIS* is based in the United States, and the majority of its authors are based in America, while *J Doc* is based in Europe; the patterns seems to be basically the same. One thing to consider though, even though most of the authors have their institutional affiliation at a university department, there are also a number of authors employed by private companies and institutes and by public institutions such as libraries. Another important consideration, which does not appear in the data, is whether

there has been external financing of university department positions. However, considering the extent to which LIS is established internationally, one can assume that a large proportion of the university positions are paid for by university funds.

In Sweden, the situation is somewhat different. The main part of the LIS research community has some kind of position in university departments, but external funds support the majority of specifically research positions. Of the seven Swedish LIS professors, four chairs are sponsored by the Swedish Library Association (SLA), which also provides funds for almost 30 percent of the approximately 30 Ph.D. students active in Swedish LIS research. University-financed research appointments are very few and so are positions financed externally by bodies such as the research councils. It is also noteworthy that out of the four departments, only two have any senior research positions. And of the senior positions, there are only one or two "career" positions (i.e., positions into which someone might hope to be promoted to professor). Thus, the prime source of funds for Swedish LIS research comes from the SLA. The funds provided by SLA will be available only for a limited time period, and the main objective is to secure the production of LIS teachers by supporting research and Ph.D. education. It should also be noted that Swedish research resulting in journal articles or books is almost exclusively produced within the area of academic LIS research, that publishing by librarians and others like them is limited, and that those publishing in international journals are a very small minority.

The theoretical aspects of the institutional structure of LIS are mainly to be found in terms of control over the means of production and distribution of research and to some extent reputational autonomy. The financing in general terms suggests that the provision of central resources is low and that the main part of LIS research is administered through local control. This leaves scientists able to pursue their own interpretations of general goals, with their own research strategies. However, the number of research articles financed by government institutions is also significant, which would support the idea of a medium degree of horizontal concentration, but the question is whether national differences between the United States and Canada distort the figures. To what extent resources are centralized within the work units is hard to tell, but judging from texts reflecting the various research orientations of individual departments, the vertical concentration seems relatively low. This is important since the lack of generally accepted definitions of skills and symbol structures in LIS leads to difficulties in comparing task outcomes systematically. This makes it even more important to analyze who decides upon the distribu-

tion of resources and rewards. There is also a connection between local control of resources and the extent of internationalization of the field as a reputational organization. (2).

The formation and development of LIS departments seems most related to the field's degree of reputational autonomy, where the merging of departments can be seen as an indicator of loss of autonomy. What this means has yet to be shown, as this development is relatively recent and has not resulted in any significant changes in terms of media for publication or patterns of citations of LIS research in other fields.

In terms of institutionalization, Sweden requires a separate discussion in theoretical terms. It should be kept in mind that institutionalized LIS research is a very recent phenomenon there and that the number of scholars so far is very few. It is therefore difficult to draw any general conclusions, but there are some interesting observations to be made. Most Swedish LIS departments are involved in the institutional merging that is evident internationally. However, since one department is substantially larger than the other departments in Sweden, it is interesting to note that it has remained autonomous. It is situated in a university college, in contrast to the others that are located in universities, which to some extent suggests that it is further away from the general academic system.

This can be compared with the Danish context, where the LIS school is not a part of the academic system at all. An interesting question that is not raised by Whitley is whether reputational and organizational autonomy can lead to isolation. This might also have consequences for—and to some extent also be dependent on—relations to nonscientific groups such as those in professional practice. Another aspect of Swedish LIS research as mentioned above is that a large part of the research financing comes from one external association representing the field of practice. This means that the source of resources is very centralized but not situated within the LIS research organization, a phenomenon that relates both to the degree of control over the resources and the autonomy of the field.

LIS Research

The nature of LIS research is revealed in the way in which research problems are formulated, in the choice of the research methods and techniques, and in the theories that are used to interpret the results. The majority of these points has already been addressed in the section concerning definitions of LIS. The theoretical implications are to a large extent similar, but the research work deserves further comment.

Research Problems in LIS

Research problems in LIS are varied because of research orientations and other factors. Although there are research problems of a theoretical nature, such as the relations between citation and key word indexing, the majority of LIS problem statements are more or less connected to the field of practice. The problem statement process is important, since it determines how research will be done (selection of methods and theories). It is also the main factor for asserting the importance of LIS research (10). The vague boundary between LIS research and practice has implications for the statement of LIS research problems especially in terms of the differences between practical problems and research problems proper. These differences include, for example, the generalizability of research problems as opposed to professional problems which are related to specific needs of the users and organizations (8).

Research Methodology and Work Techniques

Like problem statements, research methodology and techniques in LIS show the same general traits of multiplicity and variations in different research orientations and milieus. They are important when analyzing the relation of LIS to other research fields and the general academic environment. The methods, mainly from the social sciences, range from interviews and surveys to statistical methods, all depending on particular research orientations, local specialties, and so on (10). Basically the only method developed within LIS, and to have received attention outside the field, is bibliometrics and its applications in science studies.

The main deviations from the general social science methodology can be found in two separate research areas or orientations. Library science–oriented research has depended to a large extent on humanistic, primarily historical, methods. However, this orientation has been declining throughout the last decades. In IR research, methods adapted from Computer Science have been used in the construction and evaluation of information systems.

As mentioned earlier, Hjørland (10) in his definition of LIS suggested that there is a lack of *theory* in LIS research and that there is no clear line identifiable between theories, approaches or models, and philosophical positions. An analysis of 1,160 articles from 1993 to 1998 in six journals by Pettigrew and McKechnie (13) found that almost 35 percent of the articles discussed theory in some way. Of these, 45 percent of the theories

were drawn from the social sciences (primarily from Sociology, Psychology and Management Research), 30 percent was developed within LIS, 20 percent in the natural sciences, and 5 percent in the humanities. They report that seventy-one authors suggested new LIS theories.

These findings suggest an increase in the use of theory in LIS, but at the same time there seems to be some confusion as to what constitutes a theory. Pettigrew and McKechnie report several examples of statements about a theory *and* a model, or a theory *and* a method. What has been claimed to be theories ranges from mathematical laws on distributions to models that can help explain or predict social phenomena. This confusion increases because of inconsistencies in the way in which theories are used. The different conceptions of what constitutes a theory can at least partly be explained by the various subject backgrounds and research orientations of LIS scholars (13).

As in the case of the definitions of LIS, the theoretical implications of research methods primarily bent on reputational autonomy. Since the number of unique research methods is very limited, the possibility for researchers outside the LIS field of making significant contributions to knowledge goals in LIS is high, which helps explain the finding that LIS "imports" ideas in significant numbers. At the same time, the formulation of research problems in LIS is characterized by a close relation to the field of practice and a relatively low degree of generality outside the field of LIS research and practice. This means that not only do other fields of research influence the setting of performance standards, but also the field of practice exerts such an influence. In addition to outside influences, the variety of methods, problems, and theories in the field also makes it hard to find a common ground for assessing the value of problem formulation, research strategies, and task outcomes. Since no definition of the main task of LIS is generally accepted, but rather remains the subject of discussion, it is hard to validate how much a research task contributes to the general goal.

LIS Communication System

What remains to be analyzed is the formal communication systems of LIS. There are four distinct parts that can be identified and analyzed: the *media* for the dissemination of LIS knowledge, the *authors* of LIS research, the *audience*, and, finally, ways of *organizing* LIS documents (e.g., subject specific databases).

Media of Communcation

The media used to communicate LIS knowledge are varied because of different research orientations, differences in publishing traditions, national differences, and differences in adjacent fields. In library science–oriented research, the predominate means of formal communication has been publication of research outcomes in books, a feature that it shares with the humanities in general, and also with the social sciences until recently. In LIS in general, publications of articles has become the main way of communicating research. The journal market is growing at the same time as it is increasingly difficult to get articles accepted in the most influential journals. In terms of influence, the journal market is dominated by a number of general LIS journals, of which the majority on the "top ten" list (based on journal citation impact rankings) are published in America and are also oriented toward information science. The American domination is also evident in the companies that publish LIS books. In addition to the scientific journals (i.e., they meet criteria such as peer review procedures and so on), there are also journals published by scholarly institutions that fail to meet these criteria, and trade journals that also publish scientific results.

LIS Authors

The authors of articles in LIS journals are, like many other aspects and features of LIS, diverse. This diversity depends not only on research orientations and specialties, but also on institutional affiliations. The majority of the LIS articles in the scientific journals are authored by LIS scholars, but there are a significant number of authors from other disciplines as well (11), and also from library and information practice (10). Like journals, the majority of the authors of international journal articles are American or affiliated with American institutions. This can to some extent be explained by the fact that the French and German LIS researchers, for example, choose to publish in their national journals and in their own language. This is an even stronger trend in studying Swedish LIS. Only a few Swedish LIS scholars publish in international journals; the majority publishes in Swedish or Nordic journals or in books and conference proceedings.

The Audience for LIS Research

The structure of the LIS research audience is not easy to estimate. In the general scientific context, the number of citations from other fields and their journals indicates that LIS research gains little attention from scholars in other disciplines. The audience in the professional field is harder to estimate, but judging from the number of articles in international research journals authored by library and informational professionals and the number of the professional personnel attending the major conferences, the professional field provides an important and influential audience.

Most disciplines or research areas have subject-specific databases and so on that provide an organized bibliographical apparatus of indexes and abstracts by means of which research publications are made retrievable. LIS is no exception in this case. *Library and Information Science Abstracts* (LISA) database indexes and abstracts and provides other information about LIS-related journal articles, books, and documents. LISA has some interesting features that indicate the relation between LIS research and practice. The journals indexed are not only research journals, but also trade journals for library and information practitioners, and journals and magazines about more general information-related phenomena. This indicates the close relation of, and the problem of separating, professional practice and research. This probably has some effect on the choice of index terms, and may help account in LISA for both inconsistencies in the use of index terms as well as the presence of misleading terms.

The LIS communication system is interesting since to some extent it contradicts earlier theoretical discussions. The development of a formal communication system based on journals is obvious in LIS, where a number of journals have gained a position as "core" journals in terms of influence and impact. This suggests an increasing level of autonomy over performance and significance standards, as well as an increased centralization of control over access to the means of communication.

This is also something that can affect the characterization of the field's domain, its problem formulations, and descriptive language. The increased efforts to be published in a limited set of prestigious journals will probably have homogenizing effects on the choice of research problems, the research methods adopted, and vocabulary use among other things. Related to the standardization of skills and symbol systems is a dependence on national or local systems for access to rewards. However, there are still large differences within these journals in relation to problems addressed and topics dealt with. Because the journals provide the primary media for meta-theoretical discussions on the nature of LIS, any uncer-

tainty about the definition of LIS is also explicit in them.

Although the journals have increased substantially in importance as media for addressing LIS research problems, they are by no means the single most important media, and large variations still exist in terms of choice of media for disseminating LIS research. Another factor to consider in terms of reputational autonomy and the development of rigorously scientific journals is the fact that professional practitioners still constitute a significant proportion of authors in these journals and thus are part of the process of setting the research agenda in determining what enters the communication system. Another issue is the problems related to index terms in LISA, for example, where inconsistencies and ambiguities suggests a less developed consensus around the descriptive language and vocabulary in the field.

The structure of the LIS audience with its strong lay component, its small audience in the wider academic community, and the fact that the LIS community itself holds such a variety of research orientations that it constitutes a highly diverse audience itself help explain the relatively low degree of theoretical integration in the field, even though the set of prestigious journals is quite small and therefore should be able to strengthen homogenization.

Discussion

Theories about the development of scientific fields are numerous, ranging over general development patterns (1), contextualization of scientific work processes (5, 6), and scientific communication (3, 4). An important aspect of the development of the sciences over the last 50 years or so, is what Gibbons et al. (7) refers to as a change from mode 1 to mode 2 of knowledge production. Mode 2 is characterized by a general scientific trends toward knowledge produced in the context of applications, transdisciplinarity, and organizational diversity.

Whitley (2) has outlined a framework for analyzing these aspects of knowledge production, where the social dimension is examined in terms of the degree of mutual dependency, and the intellectual aspects in terms of the degree of task uncertainty. According to Whitley, modern sciences are essentially reputational work organizations, where the aforementioned aspects regulate the coordination and direction of science through the allocation of rewards. The advantage of Whitley's theories is that they make possible an analysis of both the organizational and intellectual aspects of scientific fields as well as their interaction. His model is also

general in the sense that it allows analysis of different fields without us-
ing a particular scientific orientation as a model or norm. It also allows
for comparisons between different fields or within fields with differences
depending on either research orientations or regional diversities.

The focus of this paper has been the influence on the fields of LIS
research of both lay groups and other research fields, which Whitley as-
sesses in terms of three contextual factors: the degree of reputational au-
tonomy, the degree of concentration of control over resources, and the
structure of the audiences. These concepts have been used in this chapter
to identify four aspects of scientific work that form the empirical basis
for an analysis of LIS: definitions of the field, institutional structure, re-
search work, and communication structures.

The presentation of aspects of LIS research, and some preliminary
analyses, suggests that LIS is a field with a high level of task uncertainty
and a low degree of mutual dependency, which reflects the diversity of
research orientations within the field. The influence of professional prac-
tice is significant in terms of reputational autonomy and audience struc-
ture, and to some extent the control of resources. The formulation of
research problems and the general tasks of LIS is closely related to the
practice of mediating knowledge, and professional practitioners also take
an active part in the research process. The relation between LIS and other
fields of research is complex; LIS is largely dependent on other fields for
theories, research methods, and techniques, while LIS research receives
little attention and has small impact on other fields of research.

The contextual factors of Whitley's theories serve to identify how
professional practices and lay groups can exert influence on research in
different ways, not only in terms of the formulation and execution of
research work, but also in the provision of influential audiences. As with
other sciences evolving from professional practices, such as the nursing
sciences, the influence from practice seems evident but not always easy
to capture empirically. The obvious influence is on the formulation of
research problems and research objects, but how this relates to the social
and intellectual organization of the sciences is less clear. By studying
how task formulations and task uncertainty, and mutual and external de-
pendency, are affected by the professional context, it becomes clear that
the organization of LIS is heavily influenced by shared control over prob-
lem formulation and by its dependence on the field of practice for access
to audiences.

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