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Bridging the digital divide: libraries providing access for all?

Information management functions in national economies.

An analysis of the information sector in Austria[1]

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Abstract

The information sector has been an area of research for more than 40 years and researchers still try to find different approaches to this topic. The project presented in this contribution approaches the information sector from an information science perspective. Information management functions (IMF) – i.e. all functions and processes related to information selection, acquisition, description, preservation, product creation and services – will serve as a starting point for analysis. The fundamental assumption is that these functions do not occur only in libraries but also in other contexts. Accordingly, economic costs associated with IMF, represented by labor and capital necessary for their performance can be measured in a wide range of contexts, including libraries but also industries of various kinds.

One of the main goals of the project is to investigate the extent of IMF in knowledge industries of the Austrian national economy. Since the project uses a methodology developed by Robert M. Hayes, who has already conducted similar research in the U.S., it will be possible to position the project outcome in an international context.

Introduction

Nowadays only few people would disagree with the assertion that we live in an information dominated era, where *"... the information factor increasingly holds the key to growth, output*

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and employment…" (Martin 1988, 69). Factors of production like land, labor and capital, the basic economic resources in the industrial society, lost economic importance and are increasingly replaced by the factor information. The rising significance of the information sector is undisputed. Drucker noticed the emergence of the new industry around 1960, when he introduced the terms "knowledge work" and "knowledge worker" (Drucker 1993, 5). Only two years later Machlup conducted the first important study on the "knowledge industry" which concluded that already in 1959 approximately 43% of the "potential civilian labor force" could be assigned to the "knowledge producing industry" (Machlup 1962, 386). Another ground-breaking study was performed by Marc Uri Porat in 1977, who introduced the term "information economy". This study has not yet lost its significance because much research is still based on or related to it. This applies, for instance, to Rubin and Taylor who updated Porat's data concerning the information economy in 1981, or to Apte and Nath (2004), whose aim was to measure the size and the structure of the US information economy and to compare the results with Porat's study.

As this short literature review shows, the concept of the information economy has been known for more than 40 years but has not attracted an enormous interest in economic circles (Martin 1988). The total number of research studies on the information sector is still rather small although the information segment has been steadily increasing. This increase of importance has, for instance, been taken into account by the U.S. Census Bureau, which introduced a new industry category "information" in its 1997 Economic Census.

The project described here follows an approach developed by Robert M. Hayes, who has been working on this topic for many years and who has conducted a similar project in the United States. The collaboration with Robert M. Hayes offers the opportunity to adopt the already available framework and to investigate the Austrian situation, because no similar research – as far as the authors know – has been conducted in Austria up to now. The methodology differs from other approaches in that it advances the investigation of the information sector from an

information science perspective. Accordingly, information management functions form the starting point when analyzing the information sector.

Definitions

The two key terms as they are used in the project are

- national information economies and
- information management functions.

National information economies

In the past national economies have been divided into "industry sectors", which historically included:

(1) agriculture sector

(2)manufacturing sector

(3)services sector.

Because of statistical data and the general perception of the increasing importance of information, there is more and more evidence to suggest the introduction of an

(4) information sector.

According to Hayes (2001) this sector can be subdivided into three segments:

- information technology industries
- information transaction industries
- knowledge industries.

The term national information economy is used in this project to represent these three segments of the information sector (Hayes 1992). This distinction will allow a more precise analysis of the information sector.

(In this context it should be noted that the information sector draws some component industries from the traditional manufacturing industries sector and those industries are therefore removed from the manufacturing industries sector. In the same vein, the information sector draws most of its industries from the traditional services sector, and those industries are therefore removed from the services sector.)

Information technology industries: This segment includes industries that produce hardware and software for telecommunications, computers, and a variety of other technologies that acquire, communicate, and process data (such as medical and scientific instrumentation). Furthermore, it contains industries, which provide the technical infrastructure for (tele)communication technologies.

Information transaction industries: This segment includes those industries in which the primary emphasis is on the processing of transactions which represent actions taken but have substantive value only in that processing. This includes telecommunication services, banking and related financial activities, retail and wholesale transactions, reservation services (such as for hotels, air travel, cars, tourism), and a wide variety of similar transaction processing contexts.

Knowledge industries: This segment includes those industries in which the substantive content of the information is significant. It includes education, research and development, the areas of law, medicine, engineering, architecture, etc. and what traditionally are called "Miscellaneous Business Services" (e.g., consulting, related services). Also libraries and universities are an integral part of this segment.

Information management functions

Information management functions are essentially those functions and processes which are connected with

- information selection

- information acquisition
- information description (metadata creation)
- information preservation
- information product creation and
- information services.

Traditionally, these functions are well defined in libraries and information centers.

Information selection: These are the processes involved in selecting material to be acquired. This collection development involves assessment of relevance, quality, reliability, the nature of the source, and the costs. It requires a balancing of costs (for acquisition and for related processing) versus needs on the one hand, and of costs of acquisition versus potential losses from not acquiring on the other.

Information acquisition: These are the processes involved in actually acquiring material, including ordering and paying for it, in handling the materials, and in preparing them for storage and use.

Information description: Historically, of course, the formalized description of information was known as cataloging, although the term "metadata creation" nowadays is frequently used to represent the same process. Certainly, whatever its name, it is a crucial technical service, providing the means both for managing the collection of materials and for using it. In libraries, it provides the database for the online catalog for both internal operations and services to users.

Information preservation: Preservation is one of the two imperatives especially for major research and national libraries (the other imperative being access). It has two aspects: preservation of the artifact and preservation of the content. Each is important, but for different reasons. And in each aspect, economic issues are significant, again for different reasons.

In the age of the electronic distribution and digital libraries, preservation is even more important, and there are major national and international efforts to assure that the records of the internet, just as an example, will be appropriately preserved.

Information product creation: An "information product" is a pre-established package intended to meet the needs of a group of customers without essential change or intervention by staff. In libraries, examples of information products are the online catalog for a library, subject guides for students and similar online databases produced and/or maintained by the library. Another example would be pre-packaged reference protocols. For libraries with unique special collections, digital libraries based on them are increasingly important. Packaged library instructional programs, either online or in person, are provided by most academic libraries. Some libraries also take responsibility for production of scholarly publications.

Information services: In contrast to information products, information services respond to the need of individual customers. Circulation of materials in libraries is certainly a service of primary importance as is individual reference services, whether online or face-to-face. Frequently, instructional services are one-to-one rather than pre-packaged. Many libraries provide consulting services; indeed, this is especially important in company libraries and information centers.

Assumptions and hypotheses

As already mentioned before, several studies investigating the information sector were performed in the past. Most of these studies (for instance, Boon, Britz & Harmse 1994; Dostal 1986; Machlup 1962; Porat 1977; Shifflet 2001) date back many years. As a consequence, this research should bring new insights into the information sector of the Austrian national economy. The relevant research questions are:

(1) Which is the size of the Austrian information sector (in terms of the gross national product and the number of employees) (research question 1)?

(2) How are the relations of the information (sub)sector(s) with the other sectors and industries (research question 2)?

And finally, the prime research question:

(3) Which are the estimated staffing requirements for information management functions in knowledge industries (research question 3)?

Especially with regard to the last research question, we make the following assumptions:

(1) Universities are a typical exponent of the knowledge industries.

(2) In universities, information management functions are mainly performed by the university library. However, information management functions also occur in other industries. Especially in the knowledge industries they play an important role.

(3) Information management functions, represented by labor and capital necessary for performance of them, are well defined and can be measured in libraries because there are well established and reliable data sources.

(4) The counterpart in industries for the information acquisition costs in a library are the purchases of knowledge products and services from the publishing industries by the knowledge industries.

(5) Since universities are an exponent of the knowledge industries, the staff for performing the information management functions within libraries can serve as a basis to get a rough estimate for the staffing requirements necessary to carry out these functions in other industries of this segment of the information sector.

Methodology

The research method in the area of libraries is based on the determination of two categories of library personnel (technical services and reader services staff) using the Library Planning Model.

The research method for investigating the national economy is based first upon allocation of industries to identified sectors of the economy and to segments within them, second, on the use of input-output tables to represent the structure of the economy and the use of information segments within it by the various sectors of the economy, and, third, upon determination of the labor and capital involved in information centers in each component of that structure.

The methodology involved in this investigation consists of various sets of data and the following two specific tools:

- Library Planning Model
- National Input-Output System.

Library Planning Model

The Library Planning Model (LPM) (Hayes 2001) is a means for estimating staffing requirements to meet identified workloads on information management functions in technical services and reader services. The input data including number of users, holdings and number of acquired materials are considered as workloads. To these workloads the LPM applies workload factors, which are the estimated times for library staff to perform a transaction for each library function. As a result (output data), the LPM offers estimates for two categories of staff required: reader services staff and technical services staff. Additionally, the LPM provides values for “Supervise/Manage” and “G&A”. While “Supervise/Manage” relates to tasks such as supervision, assignment and scheduling, assessment and evaluation, “G&A” (general management and central administration)

relates to tasks dealing with accounting, personnel and systems and includes e.g. also the library director.

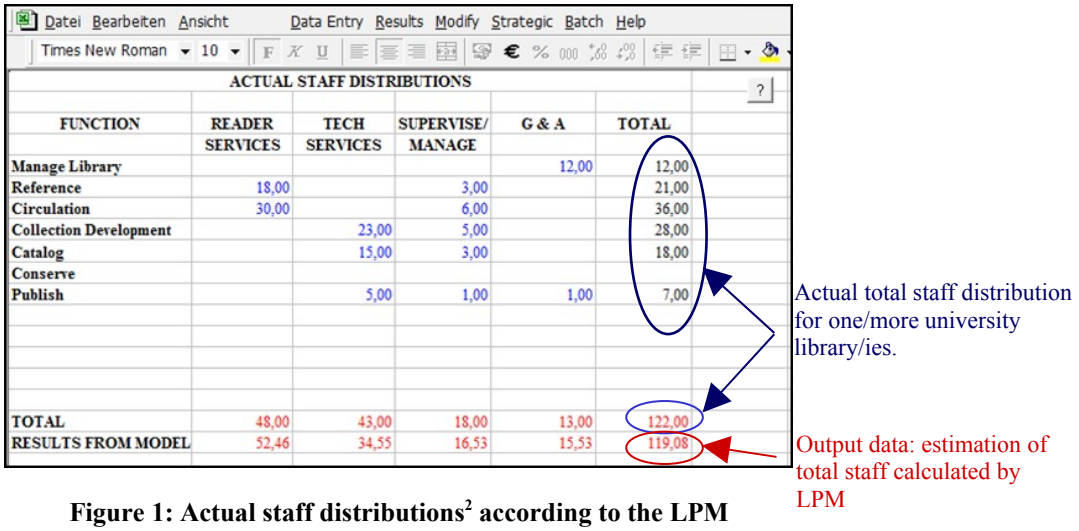

Figure 1: Actual staff distributions[2] according to the LPM

National Input-Output System

The National Input-Output System (including supply, use and symmetric input output tables) is a useful tool that represents the purchases by each industry from each industry within a national economy (Leontief 1986). The most important use of an input-output matrix is to determine the distribution of production in order to achieve a desired level of final consumption. But it can serve other purposes as well, among them identifying the relationship between production in a given industry or group of industries and a given industry's use of the resources from other industries. It is the latter purpose with which this research project is concerned.

Table 1: Input-output analysis at sector level (data for U.S. economy in 1996, in billions) (source: Hayes)

	Agriculture	Manu-facturing	Services	Information	Industry Sales	User Sales	Total Sales
Agriculture	$295	$33	$75	$19	$422	$371	$792
Industry	$112	$1,820	$196	$405	$2,533	$2,458	$4,990

[2] The table "ACTUAL STAFF DISTRIBUTIONS" shows the comparison of the actual data (blue numbers plus the sum per staff category "TOTAL") with the "RESULTS FROM MODEL", which are provided by the LPM.

Services	$54	$320	$107	$161	$642	$2,476	$3,118
Information	$62	$433	$417	$1,399	$2,311	$2,575	$4,886
Purchases	$523	$2,604	$795	$1,984			
Value Added	$271	$2,289	$2,264	$2,988			
Totals	$794	$4,894	$3,059	$4,972	$5,907	$7,880	$13,786

The input-output matrix for the U.S., for instance, consists of 107 national accounts (= 107 rows and columns) in 1996. For purposes of analysis, industries can be aggregated at different levels. When assigning these industries to the four main sectors, one gets the values shown in Table 1 showing both the size of the information sector (research question 1) and the relations among the four sectors (research question 2). As can be seen, the services sector, for instance, receives most of its input ($ 417) from the information sector. Please note that this limited display is simply to illustrate the process of analysis. The array of such analyses that will be done in the project will be far more detailed and extensive. At a further level of detail, these sectors can be subdivided into segments. A potential analysis (conducted by Hayes for Australian data) could then determine the percentage of value added spent by each of these segments for purchases of information products and services (see Table 2).

Table 2: Percentage of value added spent for information (Australian data) (source: Hayes)

		Information/Value Added		
		I1	I2	I3
A	Agriculture	0.01%	0.44%	4.02%
B0	Mining	0.20%	0.19%	1.50%
B1	Low Technology Mfg	0.65%	1.10%	8.73%
B2	Services	0.68%	3.23%	9.13%
C	High Technology Mfg	1.35%	4.04%	17.62%
I1	Information Technology Industries	9.14%	5.32%	19.58%
I2	Information Transaction Industries	0.18%	11.60%	24.24%
I3	Knowledge Industries	0.38%	7.02%	25.98%
Totals	For all Industries and Services	0.85%	3.99%	13.81%

Sources of data

There are three primary foci for sources of data:

- library related data
- university related data
- national economy related data.

Library related data:

Statistics Austria (http://www.statistik.at), responsible for performing statistical services in the area of federal statistics, and Magistratsabteilung 5 (Statistics and Analyses) of the city of Vienna did an extensive gathering of statistical data on libraries (academic, special and public libraries) in Austria. These data have been published within the framework of the Austrian "Kulturstatistik 2007" and are available online (Statistics Austria 2007). Nevertheless, it is assumed that additional data collection will be necessary in a few cases.

University related data:

University libraries provide information management functions for scholars and students. We get the necessary user data from the Data warehouse uni:data (Bundesministerium für Wissenschaft und Forschung 2008). Like the library related data, the user data are processed by the LPM.

National economy related data:

For the economic analyses we use national input-output data and national occupational data both of which are also made available by Statistics Austria. The Austrian input-output system is the primary source of data for our analyses. Occupational data are provided also two-dimensional by both industries and occupational categories. Therefore it is possible to

determine the number of knowledge workers (which correspond to scholars and students in a university library context) and information professionals (performing the information management functions) for a particular industry.

It must be noticed that Austria uses a different industry classification system (ÖNACE) than the U.S. (NAICS). ÖNACE is an extension of NACE which is in use in the European Union. Table 3 shows the structure of ÖNACE 2003 (Statistics Austria, 2008a) which is applied in the project. As can be seen, ÖNACE is divided in sections, subsections, divisions, groups, classes and subclasses. Austrian input-output tables are usually made available at the level of divisions.

Table 3: Structure of ÖNACE 2003

Level	Size	Codes
Sections	17	A - Q
Subsections	31	AA - QA
Divisions	62	01 - 99
Groups	224	01.1 - 99.0
Classes	514	01.11 - 99.00
Subclasses	722	01.11-00 - 99.00-00

Project schematic

The following schematic shows the general framework of this project. Basically, it can be divided into two contexts: the university libraries context and the knowledge industries context. Whereas the former is the starting point, namely the determination of information specialists (performing the information management functions) in university libraries, the determination of information specialists in the latter is the intended outcome of the project (research question 3).

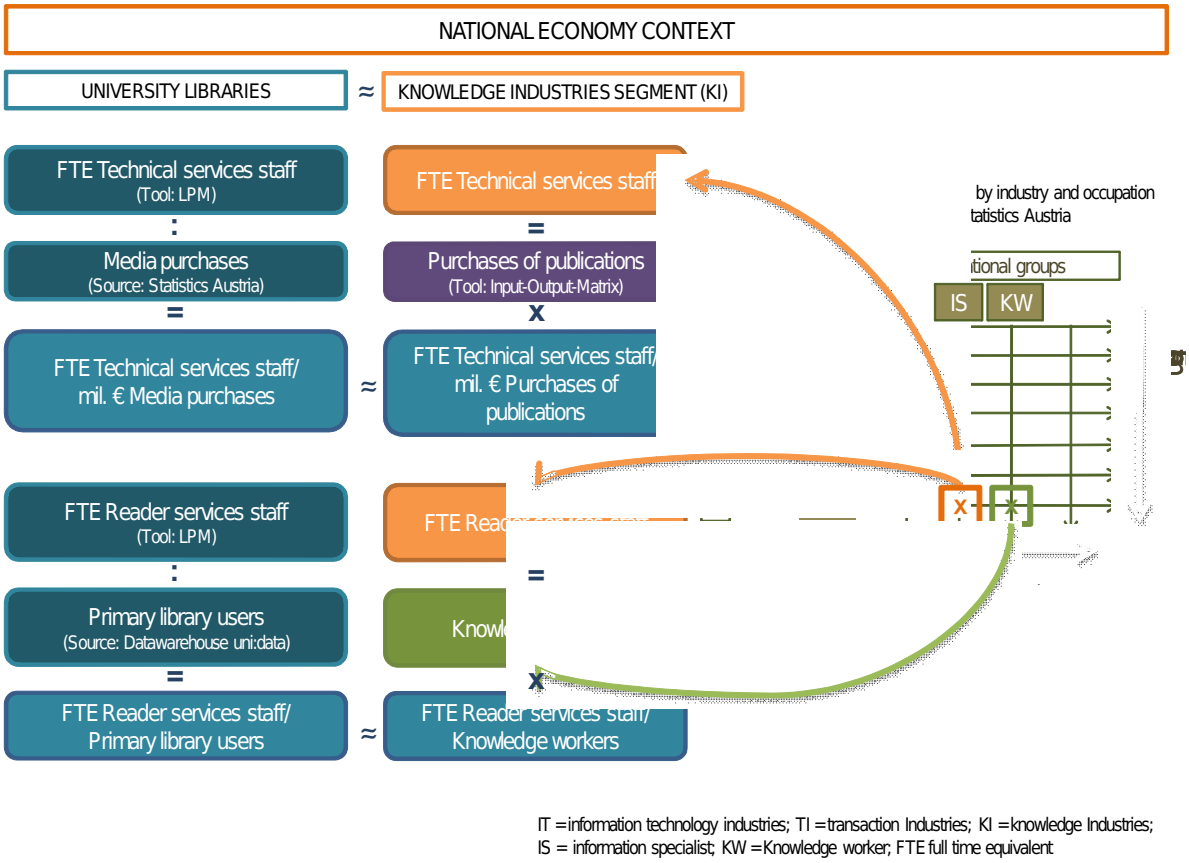

Figure 2: General schematic of the project including data flows, sources and tools

In the university libraries context two ratios are determined: "*technical services staff per media purchases*" and "*reader services staff per primary library users*". These two ratios are the links between the university libraries context and the knowledge industries. We assume that these ratios are applicable to all knowledge industries and we therefore transfer them from the university libraries to the knowledge industries segment.

In order to be able to estimate the number of staffing for IMF in the knowledge industries segment ("*technical services staff*" and "*reader services staff*"), two further factors need to be collected in the national economy context: "*purchases of publications*" and number of "*knowledge workers*". The input-output tables are used to identify how much knowledge industries spend for publishing products (called "*purchases of publications*" in the schematic). The occupational matrix allows the determination of „*knowledge workers* in the knowledge

industries. The product of the factor "*reader services staff per knowledge worker*" and "*knowledge workers"* gives the number of reader services staff, the multiplication of the factor "*technical services staff per mil. purchases of publications*" with the "*purchases of publications*" shows the number of "*technical services staff*". The sum of the two should approximately correspond to the number of "*information specialists"*, which is again collected from the industry occupation matrix.

Future prospects

The project started in autumn 2007. Up to now we have completed the first phase the goal of which was to adopt the LPM, which was originally developed in a U.S. context, to the Austrian situation (Hayes/Karlics 2008). Since both libraries and universities operate under different surrounding conditions in these two countries – for instance, there are no admission restrictions to Austrian universities which allows everybody, who completed school leaving examination successfully, to enroll on a degree program – the adaptation turned out to be much more difficult than anticipated.

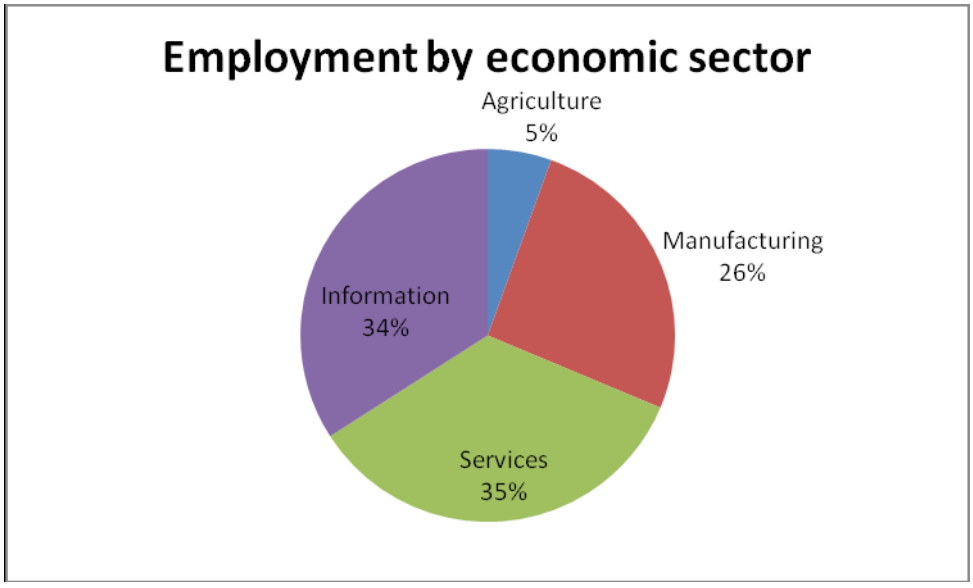

Figure 3: Proportion of employees in each sector of the Austrian economy in 2005

Furthermore, we completed occupational analyses and are currently performing last economic analyses in the input-output area. Figure 3 shows the outcome of an analysis based on occupational data.

Since there are different industry classification systems in Austria and in the U.S., we face the problem of non-matching industry categories here. The scheduled project end will be in spring 2010.

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