# The Classification of Interdisciplinary Journals:

# A New Approach

# (Version 2.0)

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# The Classification of Interdisciplinary Journals: A New Approach

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## *Abstract*

*A new approach for classifying Science Citation Index journals for the purposes of bibliometric analysis has been devised. It was developed in response to a need to be able to identify changing publication activity in inter-disciplinary journals and the unavailability of an updated CHI journal classification. The new scheme which is based on the ISI 154 sub-field classification was examined by UK policy makers and users and tested on a unified 1981-91 (now update to 1994) UK SCI data set. This inter-disciplinary journal scheme allowed us to tracked publication trends in traditional disciplines (natural, life and engineering & materials sciences), as well as publication activity in inter-field (inter-field natural, inter-field life and inter-field engineering & materials ) and inter-disciplinary (life-natural, life-engineering & mateirals and natural-engineering&materials) journals while maintaining the capable for detailed analysis at the 154 sub-field level. Preliminary results suggest that this new journal classification scheme maybe useful for developing indirect indicators of the change in inter-disciplinary scientific research publications.*

## 1 INTRODUCTION

Using journal classification schemes to categorise research papers into scientific areas is a well-established bibliometric technique. Since no standard classification scheme has been adopted by the bibliometric community, inter-country comparative analyses are almost impossible. In this paper we present the details of a new journal classification scheme which was developed to meet the needs of a large UK bibliometric project examining sectoral output and collaborative activity. We hope that other researchers will examine this scheme, experiment with it and perhaps make suggestions or modifications that might ultimately lead to the acceptance of a standard journal classification scheme.

In June 1992, the Science Policy Research Unit at University of Sussex launched the *Bibliometric Evaluation of Sectoral Scientific Trends* (BESST) project. It has explored sectoral relationships within the UK scientific community using as indicators the numbers of publications contained in the 1981-1991 *Science Citation Index* (*SCI)*. The objectives have been (a) to determine the share of national scientific output in various scientific fields contributed by different institutional sectors ( e.g. universities, industry, research councils, government laboratories, hospitals, etc.), (b) to map the changes during the 1980's in patterns of inter- and intra-sectoral collaboration in different scientific fields, (c) to investigate changes in the patterns of international collaboration engaged in by UK institutions, and (d) to use the data to investigate policy-relevant questions. A second phase of the project began in 1995 with an aim to (a) extend the database coverage to 1994, (b) develop a graphical interface in Excel 5.0 to provide user friendly access to the sectoral level data, and (c) explore in detail the publication and collaboration activity of UK industry.

A journal classification scheme was needed to investigate how sectoral output and collaboration patterns have varied across scientific fields. The project sponsors also expressed interest in examining patterns of interdisciplinary publishing. To facilitate comparison with US data, we initially hoped to use the *CHI*[1] journal classification scheme. However, the version of the scheme current in 1993 dated from 1986[2]. Furthermore, it was not entirely suitable for our purposes. For example, agriculture is not a separate field[3] in the *CHI* scheme, but in the UK during the 1980s it was funded by a separate research council. Secondly, inter-disciplinary journals are not identified. Although the *CHI* classification is widely used, for example in the NSF Science Indicators[4], by Luukkonen et al. in studying collaboration[5], and by the Observatoire des Science et des Techniques[6], no international standard bibliometric research classification scheme has been agreed[7] upon. Similarly, governments do not use internationally standard classifications of scientific fields when analysing their research funding[8].

This paper outlines an interdisciplinary journal classification scheme specifically designed to meet our objectives. It first describes the precursor to the scheme: the *Institute of Scientific Information* (ISI) journal classification scheme as adapted by researchers in Australia. Then the problems with using that scheme in our project are noted and our modifications to the scheme are described. Finally, the advantages and robustness of the SPRU scheme are explained.

## 2 BASIC JOURNAL CLASSIFICATION SCHEME

The starting point for the SPRU journal classification scheme is the *ISI* journal classification system. *ISI* classified the journals in the *SCI* into 154 sub-fields using a combination of journal-journal citation patterns, keyword analysis and user feedback[9].

These 154 sub-fields were classified into the 10 broad fields of the *Australian Standard Research Classification Scheme* (ASRC) used by the Australian government to analyse research funding. This work was performed by Prof. Paul Bourke and Ms. Linda Butler at the Research School of Social Sciences at the Australian National University who validated the scheme through discussions with various experts and scientists. The Australian scheme consisted of the following fields: agricultural sciences (Agr), applied sciences & technologies (Ast), biological sciences (Bio), chemical sciences (Chm), earth sciences (Eth), engineering (Eng), information, computing & communications technologies (Ict), mathematical sciences (Mth), medical and health sciences (Med) and physical sciences (Phy).

Most *ISI* sub-fields could be allocated to one of these field in the *ASRC* structure. However, eight *ISI* sub-fields spanned two or more fields and were assigned to the 'non-field specific' (Nfs) category. The sub-fields in Nfs are: biotechnology & applied microbiology, energy & fuels, microbiology, nuclear science & technology, parasitology, metallurgy & mining, environmental sciences, and education scientific disciplines.

### 2.1 The SPRU scheme

The *ASRC* scheme was unsatisfactory our purposes for several reasons:

1. The 'Applied science and technology' which containing sub-fields: aerospace & technology, construction & building technology, ergonomics, food science & technology, materials science, materials science-ceramics, materials science-paper & wood, photographic technology and 'Non-field specific' fields were meaningless in the UK context.
2. more than 120 journals are classified by *ISI* as multidisciplinary; Nature and Science are in this category.
3. *ISI* assigns 18% of its journals to two or more sub-fields. Consequently, these journals can fall into two or more *ASRC* fields. For example, Table 1 lists a few journals that have multiple *ASRC* classifications.

After consulting with our steering committee, we eliminated the field 'Applied science & technology' by creating a 'Materials science' field from the materials sub-fields together with the previously 'Non-field specific' sub-field of metallurgy & mining. The remainder of the 'Applied science and technology' sub-fields were assigned to one of the 10 basic SPRU fields. Thus the basic BESST field classification contains 10 fields which are listed in Table 2.

**Table 1 - Journals with Multiple *ASRC* Assignments**

| Journal | *ASRC* field assignments | | | |
|---|---|---|---|---|
| ACRIDA | Bio | Med | | |
| ACT PHAR SI | Chm | Med | | |
| ACT TROP | Bio | Med | Nfs | |
| ADV SPACE R | Ast | Eth | Phy | |
| ANAL CH A | Chm | Eng | Ict | Nfs |
| ARTIF INTEL | Ast | Ict | | |
| BIOC BIOP R | Bio | Phy | | |
| BIOPHYS CH | Bio | Chm | Phy | |
| BIOS BIOT B | Agr | Ast | Bio | Nfs |

**Table 2 - Basic SPRU journal classification fields**

| SPRU field | Abbreviation |
|---|---|
| Agricultural Sciences | Agr |
| Biological Sciences | Bio |
| Chemical Sciences | Chm |
| Earth Sciences | Eth |
| Engineering | Eng |
| Information, Computers & Communications Technologies | Ict |
| Materials Science | Mat |
| Mathematical Sciences | Mth |
| Medical and Health Sciences | Med |
| Physical Sciences | Phy |

This left the problems of the *ISI* sub-fields formerly contained in the Nfs field, and interdisciplinary journals and fields still unresolved, as inidicated in the second and third points list above. Therefore, we elaborated the basic set of fields. Our aim was to produce a journal classification that accurately reflected the interdisciplinary nature of research in the 1980's. We did this by drawing on the hierarchical model of science, namely: sub-field, field and discipline (see Figure 1). We first grouped the 10 basic fields into three broad disciplines. This is process is summarised in Table 3:

## Table 3 - Discipline-field Relationship

| Discipline | Field |
|---|---|
| Life Sciences | Agricultural Sciences |
| | Biological Sciences |
| | Medical and Health Sciences |
| Natural Sciences | Chemical Sciences |
| | Mathematical Sciences |
| | Physical Sciences |
| | Earth Sciences |
| Engineering & Materials Sciences | Engineering |
| | Information, Computers & Communications Technologies |
| | Materials Science |

We then added three fields based upon the disciplinary groups to the original list of ten fields. The categories are: inter-field life, inter-field natural and inter-field engineering & materials. They contain only journals and *ISI* sub-fields that cannot be classified into one field - that is, journals that span two or more fields within each discipline. For example, ACRIDA (see Table 2) is classified under both medicine and biology and is assigned to inter-field life. Also, five of the eight non-field specific sub-fields were assigned to inter-field categories as described in Table 4.

**Table 4 - Reassignment of Nfs to Inter-field Categories**

| NFS sub-field | Inter-field category |
|---|---|
| Biotechnology & applied microbiology | Life |
| Microbiology | Life |
| Parasitology | Life |
| Energy & fuels | Engineering & Materials |
| Nuclear science & technology | Engineering & Materials |

Second, three categories were added to contain journals that span two of our three braod disciplines. The categories are: inter-disciplinary life-natural, inter-disciplinary life-engineering & materials and inter-disciplinary natural-engineering & materials. They contain "inter-disciplinary" journals, that is journals that span fields in two different disciplines. Such journals were classified by *ISI* into two or more sub-fields which fall into fields coming under two different disciplines. For example, BIOC BIOP C falls into chemistry and medicine and ACT PHAR SI is classified under biology and physics (see Table 2). Both span the life and natural sciences and would be classified as inter-disciplinary life-natural.

The final new category is 'multi-disciplinary' and contains three types of journals:

1. Journals that span all three broad disciplines - life, natural and engineering & materials. Such journals were classified by *ISI* into at least three sub-fields, with at least one from each discipline.
2. Journals classified by *ISI* into the environmental sciences sub-field. The subject matter of this non-field specific sub-field seems to incorporate elements from life, natural and engineering & materials sciences. Therefore we could not classify it into one of the three inter-field categories.
3. The journals classified by *ISI* as multidisciplinary. These contain papers from more than one discipline, although individual papers may not report interdisciplinary work. Nature and Science fall into this category.

**Table 5 - Hierarchy of Science**

| Level | Category names | Category contents | No. |
|---|---|---|---|
| Sub-field | | *ISI* sub-fields | 154 |
| Field | Eng, Ict, Agr, Bio, Mat, Med, Chm, Eth, Phy, Mth | Field specific journals (see Table 5B) | 10 |

| | | | |
|---|---|---|---|
| Discipline | Inter-field natural, inter-field life and inter-field engineering & materials sciences | Journals and sub-fields that span two or more fields within a single discipline | 3 |
| Inter-disciplinary | Inter-disciplinary life-natural, inter-disciplinary life-engineering & materials, inter-disciplinary natural-engineering & materials | Journals that span two or more fields in two different disciplines | 3 |
| Multi-disciplinary | multi-disciplinary | - Journals that span three or more fields, one from each of the three broad disciplines<br>- Environmental science journals<br>- Nature, Science etc. | 1 |

A diagram of the logic behind the journal classification scheme is depicted in Figure 1 and described in Table 5. The table lists the names of each level in the hierarchy of science, names the categories associated with each level, describes how categories at each level are used in the classification scheme, and lists the number of categories found at each level.

## 3. ADVANTAGES, DISADVANTAGES, ROBUSTNESS AND SAMPLE RESULTS

There are several analytic advantages to using this scheme in comprehensive, time series bibliometric work. Firstly, because the journal set is not 'frozen', the evolution that characterises scientific research maybe incorporated in the publication data and so the analysis will be more

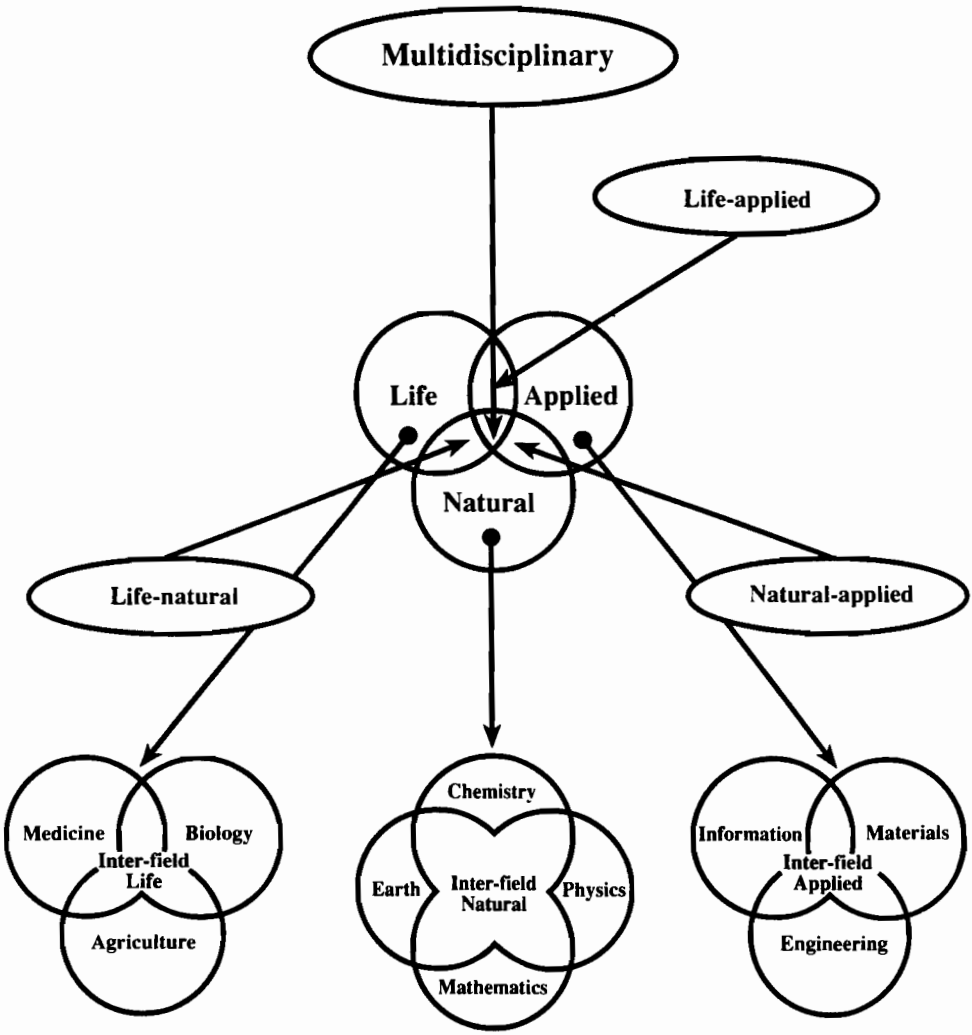


**Figure 1. SPRU Classification Scheme**

current. Policy interest tends to focus on change rather than stability; therefore it would seem important not to eliminate change from the data before the analysis begins.

Secondly, because field spanning journals are not hidden through fractionation, publication activity in inter-disciplinary journals[10] can be analysed. Inter-disciplinarity is an often noted feature of the research system that is frequently said to be increasing. It is also said that inter-disciplinary work is likely to produce path-breaking results. Therefore, it would seem prudent to facilitate the indirect tracking of this kind of research by examining publication activity in inter-disciplinary journals.

**Table 6 - *ISI* Journals (1981-91) in SPRU Categories**

| Category | Abbreviation | Number of journals | Percentage of journals |
|---|---|---|---|
| **Life Sciences** | | | |
| Medical and Health Sciences | Med | 2138 | 30.1% |
| Biological Sciences | Bio | 763 | 10.8% |
| Agricultural Sciences | Agr | 464 | 6.5% |
| **Natural Sciences** | | | |
| Chemical Sciences | Chm | 381 | 5.4% |
| Physical Sciences | Phy | 288 | 4.1% |
| Earth Sciences | Eth | 284 | 4.0% |
| Mathematical Sciences | Mth | 257 | 3.6% |
| **Engineering & Materials Sciences** | | | |
| Engineering | Eng | 437 | 6.2% |
| Information, Computers & Communications Technologies | Ict | 272 | 3.8% |
| Materials science | Mat | 218 | 3.1% |
| **Inter-field** | | | |
| Inter-field life | Ifl | 390 | 5.5% |
| Inter-field engineering & materials | Ifa | 219 | 3.1% |
| Inter-field natural | Ifn | 50 | 0.7% |
| **Inter-disciplinary** | | | |
| Inter-disciplinary natural-engineering & materials | Dna | 343 | 4.8% |
| Inter-disciplinary life-natural | Dln | 118 | 1.7% |
| Inter-disciplinary life-engineering & materials | Dla | 97 | 1.4% |
| **Multi-disciplinary** | | | |
| Multi-disciplinary | Mul | 379 | 5.3% |
| Total: | | 7098 | 100% |

Thirdly, the scheme is flexible. For example, one analysis might examine all 17 fields individually. Another might work with the life, natural, engineering & materials and multidisciplinary categories. Alternatively, the field-spanning categories might be compared to single field categories. Sub-fields could be examined individually if needed. Finally, one could group all categories related to life sciences. Thus the scheme facilitates both detailed and broad brush analyses. Although such classifications will never suit the needs of field or speciality level analyses, the flexibility may make this scheme suitable for a broader range of national and international high-level analyses than other schemes. If so, bibliometric studies would become more comparable, facilitating the accumulation of results into a single body of knowledge about research systems world-wide.

Table 6 lists the categories used in the SPRU journal classification scheme, their abbreviations and the number and percentage of journals in each category list in the *SCI* between 1981 and 1991. The total number of journal names appearing in the *SCI* during this period was 7098. Journals are dropped, added, renamed or split into two each year and so only a few thousand are active in any one year.

The number of journals recorded in each SPRU category was counted by year for the UK *SCI* data. These counts were used to examine the robustness of the classification scheme by determining if there was any appreciable increase or decrease in the percentage share of of journals in each category. Table 7 gives the percentage of the total number of journals in each category by year and the average number of journals plus and minus one standard deviation for all years.

**Table 7 - Percentage of Journals in SPRU Categories**

| Field | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Life Sciences** | | | | | | | | | | | | |
| Med | 31.7 | 32.0 | 31.2 | 30.9 | 30.9 | 30.4 | 30.5 | 30.5 | 30.8 | 30.8 | 30.8 | 30.9±0.5 |
| Bio | 13.3 | 13.7 | 13.9 | 14.0 | 14.0 | 14.1 | 13.8 | 13.9 | 13.8 | 13.7 | 13.7 | 13.8±0.2 |
| Agr | 4.1 | 4.6 | 4.9 | 4.8 | 4.9 | 4.9 | 5.1 | 5.1 | 5.0 | 4.9 | 4.8 | 4.8±0.3 |
| **Natural Sciences** | | | | | | | | | | | | |
| Chm | 7.3 | 7.5 | 7.4 | 7.3 | 7.2 | 7.2 | 7.1 | 7.1 | 7.0 | 7.0 | 7.1 | 7.2±0.2 |
| Phy | 5.8 | 5.5 | 5.4 | 5.5 | 5.4 | 5.3 | 5.3 | 5.3 | 5.4 | 5.4 | 5.4 | 5.4±0.1 |
| Mth | 4.3 | 4.3 | 4.1 | 4.1 | 4.0 | 4.0 | 3.9 | 3.9 | 3.8 | 3.8 | 3.7 | 4.0±0.2 |
| Eth | 4.1 | 4.0 | 4.0 | 4.0 | 4.1 | 4.2 | 4.2 | 4.1 | 4.2 | 4.1 | 4.1 | 4.1±0.1 |
| **Engineering & Materials** | | | | | | | | | | | | |
| Eng | 3.8 | 3.9 | 4.5 | 4.5 | 4.3 | 4.2 | 4.1 | 4.1 | 4.1 | 4.0 | 4.0 | 4.1±0.2 |
| Mat | 1.6 | 1.7 | 1.7 | 2.1 | 2.1 | 2.2 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.1±0.3 |
| Ict | 0.8 | 0.8 | 0.9 | 1.0 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.0±0.1 |
| **Inter-field** | | | | | | | | | | | | |
| Ifl | 6.5 | 6.7 | 6.6 | 6.4 | 6.6 | 6.6 | 6.7 | 6.7 | 6.9 | 7.0 | 7.1 | 6.7±0.2 |
| Ifa | 2.3 | 2.1 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.5 | 2.4 | 2.4 | 2.5 | 2.3±0.1 |
| Ifn | 0.9 | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9±0.1 |
| **Interdisciplinary** | | | | | | | | | | | | |
| Dna | 5.2 | 4.6 | 4.7 | 4.6 | 4.5 | 4.7 | 4.5 | 4.5 | 4.5 | 4.6 | 4.6 | 4.6±0.2 |
| Dln | 2.3 | 2.3 | 2.2 | 2.3 | 2.4 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3±0.0 |
| Dla | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 0.5±0.0 |
| **Multidisciplinary** | | | | | | | | | | | | |
| Mul | 5.4 | 5.1 | 5.0 | 5.0 | 4.9 | 5.1 | 5.3 | 5.2 | 5.2 | 5.2 | 5.2 | 5.1±0.1 |

The data indicate that the percentage of journals in each SPRU category remains reasonably stable and the percentages are comparable to those found in the overall *ISI* journal set (see Table 6 column 4). We do not know if this stability is a by-product of *ISI*'s journal selection process or is a reflection of the natural evolution of scientific journals. However, no matter what mechanism is active we can see that a change in the number of papers in a SPRU field is likely to be the result of a change in publishing activity than a change in the number of journals in a field. If one wishes to account for the change in the percentage share of journals in a field, perhaps to gain more precision for time series studies, the paper counts could be normalised to the yearly journal percentages to remove any inflation/deflation effects resulting from the changes in number of journals in each category.

The SPRU journal classification is a variable journal set unlike the fixed journal set developed by *CHI*. The idea behind a fixed journal set is that about 90% of papers in *SCI* are published in 40-60% of the journals. *CHI* adopted the fixed journal set approach "because working with a changing data set would require much additional statistical manipulation, and because it is unlikely that the additional 10% of the publications would alter the overall findings significantly"[11]. The SPRU scheme adopts the philosophy that a variable journal set better reflects the changing character of science; requires minimal, if any, additional statistical manipulation because of the relative stability of the journal distribution across fields and disciplines using *ISI*'s sub-fields; and illuminates publishing activity in interdisciplinary journals.

Table 8 is an illustration of the type of data that can be generated using the SPRU journal classification scheme[12]. This table gives the number of papers and percentage of all papers published by sector for each of the SPRU fields. The important thing to notice is that the published output and percentage contribution in each field

by each sector makes intuitive sense. For example, hospitals participate mainly in publications in medicine, inter-field life and inter-disciplinary life-natural and life-engineering & materials. Industry participates mostly in publications in engineering, material science, inter-field engineering & materials and inter-disciplinary life-engineering & materials.

**Table 8 -Percentage Publications in 1981-91 *SCI* for UK Sectors by SPRU Journal Field**

| **Paper count** | **Life** | | | **Natural** | | | | **Eng & Mat** | | | **Inter-field** | | | **Multi-disciplinary** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sector** | **Med** | **Bio** | **Agr** | **Chm** | **Phy** | **Eth** | **Mth** | **Eng** | **Mat** | **Ict** | **Ifl** | **Ifa** | **Ifn** | **Dna** | **Dln** | **Dla** | **Mul** | **All** |
| University | 38.0 | 62.0 | 40.7 | 82.1 | 85.3 | 73.2 | 93.4 | 68.1 | 73.3 | 69.0 | 56.0 | 62.6 | 86.4 | 76.4 | 64.2 | 27.7 | 63.7 | 57.8 |
| Hospital | 50.1 | 7.1 | 1.2 | 1.1 | 0.3 | 0.0 | 0.2 | 3.1 | 0.2 | 0.6 | 17.0 | 3.9 | 1.9 | 0.8 | 10.9 | 25.0 | 6.1 | 21.7 |
| Research Council | 8.6 | 23.1 | 31.7 | 3.1 | 10.3 | 15.8 | 1.2 | 1.0 | 0.5 | 2.3 | 17.7 | 1.8 | 4.4 | 5.4 | 13.2 | 30.3 | 14.9 | 11.4 |
| Industry | 4.8 | 3.3 | 11.9 | 13.1 | 5.4 | 3.8 | 1.8 | 25.1 | 18.8 | 21.0 | 7.5 | 23.8 | 6.4 | 15.0 | 9.6 | 3.4 | 8.3 | 7.5 |
| SHA & BPG | 10.5 | 2.1 | 0.4 | 0.4 | 0.1 | 0.0 | 0.0 | 0.3 | 0.1 | 0.4 | 3.3 | 0.3 | 0.1 | 0.2 | 3.1 | 5.7 | 2.1 | 4.6 |
| Government | 1.7 | 3.8 | 16.5 | 3.5 | 5.8 | 7.6 | 1.1 | 5.0 | 10.4 | 5.8 | 4.3 | 11.3 | 4.1 | 7.8 | 4.1 | 8.7 | 6.0 | 4.1 |
| Non-profit | 1.6 | 6.4 | 4.3 | 0.8 | 0.7 | 4.1 | 0.2 | 0.6 | 0.9 | 1.0 | 2.7 | 0.5 | 0.9 | 0.5 | 3.3 | 1.0 | 5.3 | 2.4 |
| Polytechnic | 0.8 | 2.1 | 1.0 | 5.3 | 1.7 | 3.1 | 3.2 | 4.5 | 3.6 | 4.7 | 2.4 | 4.6 | 2.2 | 3.2 | 2.9 | 3.1 | 2.5 | 2.1 |
| Other | 4.0 | 1.6 | 6.0 | 1.0 | 0.4 | 1.4 | 1.0 | 1.4 | 1.2 | 2.3 | 3.5 | 1.6 | 0.5 | 1.0 | 1.7 | 7.4 | 2.1 | 2.6 |
| Total Percent[1] | 120 | 111 | 114 | 110 | 110 | 109 | 102 | 109 | 109 | 107 | 114 | 110 | 107 | 110 | 113 | 112 | 111 | 114 |

Notes:
1.The total percentages do not add up to 100% due to collaboration between sectors

A disadvantage with the SPRU classification scheme is that it is based on *ISI*'s 154 sub-field classifications. Little is known about the methodology that *ISI* uses to classify its journals or even if its journal classifications are updated each year to reflect the changing nature of a given journal. Ideally, a more informed dialogue between the bibliometric community and *ISI* might helpful. Finally, the inter-field, inter-disciplinary and multi-disciplinary categories be troublesome for analysing small countries and may produce low paper counts. This problem may be over come by grouping these categories together into a single multi-disciplinary category.

## 4. SUMMARY

SPRU has produced a variable journal set classification scheme for use in examining UK sectoral bibliometric trends. This scheme is derived from *ISI*'s 154 sub-fields. It contains 17 fields that can be grouped into four higher level, disciplinary categories. This scheme allows analysts to focus on change and interdisciplinarity in the science system, and is flexible enough to serve a broad variety of purposes while maintaining comparability between studies. The field categories are reasonably stable over time, giving confidence in time series analyses using the 17 fields. The scheme also produces intuitively correct results at the sectoral level. We hope that other researchers will apply the SPRU journal sceme to their bibliometric studies and explore its potential for studying publications activity in traditional fields and interdisciplinary journals.

* The authors are grateful to the Economic and Social Research Council, Office of Science and Technology, Department of Trade and Industry, Medical Research Council, Natural Science and Engineering Research Council and Department of Health for support.

[1] This fixed journal scheme was devised by Francis Narin of *Computer Horizons Incorporated* (see Narin F. (1976). *Evaluative Bibliometrics: The use of publication and citation analysis in the*

**Notes and References:**

*evaluation of scientific activity*. National Science Foundation Contract NSF C-627, Project No. 704R)

[2] An updated version of the *CHI* journal scheme was received in October 1994, too late to be used in the BESST project.

[3] In the *CHI* scheme agriculture and food science and dairy and animal science are sub-fields of biology and veterinary medicine is a sub-field of clinical medicine.

[4] National Science Board, *Science and Engineering Indicators - 1993*. Washington, DC: U.S. Government Printing Office, 1993. (NSB 93-1).

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[8] Irvine J, Martin BR and Isard PA (1990). *Investing in the Future: An international comparison of government funding of academic and related research* (Edward Egar: Chelbenham UK), pp. 251-265.

[9] Private communication with Henry Small, *ISI* Philadelphia.

[10] An inter-disciplinary journal does not necessarily contain inter-disciplinary articles but may contain a number of single discipline articles. In other words, the journal may be read by researchers in different disciplines even though the articles are uni-disciplinary.

[11] Narin F. (1976). *Evaluative Bibliometrics: The use of publication and citation analysis in the evaluation of scientific activity*. National Science Foundation Contract NSF C-627, Project No. 704R p 138.

[12] No interpretation of these results is provided in this paper. Also, the reader is cautioned that some of the tabulated values may change slightly by the time the analysis is completed.