

**THE EVALUATION OF GREY LITERATURE USING BIBLIOMETRIC INDICATORS
A METHODOLOGICAL PROPOSAL**

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ABSTRACT: Grey Literature (GL), defined as material in print and electronic format not readily available through regular market channels or not widely distributed, has received increasing attention in the last decade. Widespread agreement exists on its importance as an information source. However, problems related to the actual use of GL have not been adequately investigated.

This paper proposes a methodology to analyze the use of GL in bibliographic references of journal articles, already applied in some disciplinary fields (Physics, 1994, Agricultural economics, 1995; Demography & Computer sciences, 2004).

In order to verify to what extent GL contributes to scientific work, we use bibliometric indicators (frequency of GL use, frequency of GL citing), similar to the ones widely used for conventional literature. A specific bibliometric indicator, that seems useful for measuring GL impact namely the intensity of GL citing, i.e., the average frequency of GL references per article containing GL, is described. Moreover, the potential use of the impact factor as an indicator of variability in GL use is considered.

The issues connected with the difficulty of locating and identifying citations to GL are also briefly discussed.

Introduction

It is widely held that Grey Literature is as important a source of information as conventional literature and that they differ not in terms of scientific value but in content and purpose as well as in methods of production and diffusion. Moreover, use of Internet has almost entirely eliminated one of the problems affecting LG, namely its availability.

More recently, the “open access” movement is gradually changing the scientific community’s conception of documents that are not subject to peer review (and

consequently excluded from evaluation for career development purposes), in the process bringing grey literature closer still to white literature.

Besides, GL has always been part of the scientific communication network as is amply demonstrated by citations of GL documents in the bibliographic references in scientific articles. To a certain extent, GL is an *ante litteram* form of what today is commonly termed scholarly communication (Luzi, 2005).

In the light of these developments, the focus on GL has shifted from the difficulties of definition and typology, that have now become all but irrelevant for users, towards analysis of bibliographic references, that constitute the common ground between conventional and non-conventional literature.

In this paper we propose a methodology to analyze the use of GL in bibliographic references of journal articles, already applied in some disciplinary fields. The method has a theoretical grounding in the concepts and instruments used in citation studies (Garfield, 1970). Regardless of the fact that no genuine citation theory has been elaborated (Leydesdorff, 1998), and that the application of bibliographic instruments does not provide broadly valid conclusions, it nevertheless remains an important tool for measuring and comparing scientific and technical literature.

Citation studies are based on analysis of the bibliographic references found at the end of scientific articles. Selected bibliometric indicators are variously used to evaluate the standing of an author, a periodical, an institution and even a nation.

Different studies have used bibliometric instruments to evaluate the impact of GL on conventional literature. Some of these used such instruments to evaluate the impact of GL of a particular type of document and its producer (Cordes, 2004) or on a particular sub-disciplinary field, and trace the existence or lack of interdependence between conventional and grey literature (Dunn, 2004). The method has been used by others to follow the work of the authors in the GL-conference series. (Farace et al., 2004). Others still have used quantitative parameters to assess the impact of GL in different disciplines (Alberani, De Castro 1990, 1994; Di Cesare, 1994; Di Cesare, Sala 1994 ; Di Cesare et al., 2004).

Nevertheless, despite the interest in these bibliometric instruments, illustrated in the studies mentioned above, the problems regarding the effective use of GL would appear to merit further analysis.

Our proposal is grounded on the use of three indicators that have previously seen application in the analysis of GL in certain fields (Physics, 1994, Agricultural economics, 1995; Demography & Computer sciences, 2004). Use of these indicators enables quantitative evaluation of the impact of GL on conventional literature and the comparison of impact in different sectors.

Materials and methods

The data that has been used derives from analysis of the impact of GL in different fields and is as follows:

- Sector
- Period when analysis was carried out
- Data collection strategy
- Total number of articles considered and the number of these containing GL citations
- Total number of bibliographic references and the number of GL documents

Table 1 illustrates the data chosen for the analysis. Absolute values for the data on use of GL in articles and in bibliographic references in the various sectors can be found to the right.

It should be pointed out that all the periodicals taken into consideration, excluding those pertaining to Information sciences, are to be found in Journal citation reports (JCR), which is the basic instrument for bibliometric analysis carried out by the Institute for scientific information (ISI).

Table 1: Data used for the analysis

Disciplinary fields	Period of investigation	Data collection strategy	Total number of articles	Articles with GL	Total number of references	References to GL
Health sciences (1)	1987-1988	Secondary source	1,398	933	22,072	3,526
Information sciences (2)	1990-1991	Primary source	537	318	6,229	1,377
Physical sciences (3)	1991	Primary source	1,480	852	38,869	2,332
Agricultural economics (4)	1994	Primary source	226	182	5,275	1,143
Veterinary sciences (5)	2000	Secondary source	2,189		55,823	3,564
Demography (6)	1995	Primary source	85	81	2,822	945
Computer sciences (6)	1995	Primary source	112	85	2,561	288
Demography (6)	2003	Primary source	114	112	4,181	980
Computer sciences (6)	2003	Primary source	167	127	3,872	619

- (1) Alberani, De Castro , 1990
- (2) Alberani, De Castro, 1994
- (3) Di Cesare, 1994
- (4) Di Cesare, Sala, 1996
- (5) Pelze, Wiese, 2003
- (6) Di Cesare et al., 2004

As can be seen from Table 1, in the majority of cases the data came from the primary source. This can be justified by the difficulty of locating and identifying citations to GL in automatic indexing systems, due to incomplete and imprecise GL citation arising from the lack of standardization.

Indicators

The following indicators were calculated on the basis of the gathered data:

- The *frequency of GL use* (i.e. the proportion of articles with GL citation, out of all the articles examined);
- the *frequency of GL citing* (i.e. the proportion of GL references out of all the references examined);
- the *intensity of GL use* (i.e. the frequency of GL citing divided by the frequency of GL use) – this is an indicator of the average frequency of GL references per article with GL;

Results

Table 2 illustrates the distribution of the three indicators used for our analysis by disciplinary fields.

Table 2: Values for the indicators in the various fields in question

Disciplinary fields	Frequency of GL		Intensity of GL use (%)
	Use (%)	Citing (%)	
<i>Health Sciences</i>	66.77	16.7	24.0
<i>Information sciences</i>	59.2	22.1	37.3
<i>Physical sciences</i>	57.5	6.0	10.4
<i>Agricultural economics</i>	80.5	21.7	27.0
<i>Demography</i>	95.3	33.5	35.2
<i>Computer sciences</i>	75.9	11.2	14.8
<i>Demography</i>	98.2	23.4	23.8
<i>Computer Science</i>	75.9	16.0	21.1
<i>Veterinary sciences</i>		6.4	

The table shows that results differ for the two parameters of frequency of use and frequency of citations.

The first of these parameters merely considers the percentage of articles containing citations of GL documents, regardless of their concentration. There is no distinction between articles containing a high number of GL citations and those containing low or negligible quantities.

In turn, the *frequency of GL citing* parameter makes no distinction between percentages that reflect a high “concentration” in a limited number of articles and those that reflect a broader presence in the bibliography of literature of a specific sector.

When evaluating the impact of GL in a specific sector, using only one of these parameters can give rise to distorted results and misleading conclusions when comparing different scientific fields. Conversely, the intensity of use parameter illustrates the overall use of bibliographic citations.

CONCLUSION

We have applied a methodology of citation analysis of GL to discover its impact on different scientific fields through the use of bibliometric indicators.

Our results confirm that grey literature is an important source of information, even if great variability in its use and intensity has been observed among the different disciplinary fields.

Our research also confirms that bibliometric tools designed for analysis of conventional literature have valid applications in GL analysis. Nevertheless, parameters have still to be codified for the evaluation of GL impact on the conventional literature in different scientific sectors.

Our work has compared three parameters: *frequency of GL use*, *frequency of GL citing* and the *intensity of GL use* and we have shown that only the last of these gives a clear idea of the impact that GL can have in a given sector and enables a reliable comparison between different sectors.

Were we to use the frequency of use parameter, we would have to conclude that the impact of GL is more or less equal in Physical and Information sciences. In the same way, were we to use only the frequency of GL citing, there would be no difference between Information sciences and Demography (considering the year 2003).

On the other hand, using the intensity of GL use parameter, that considers both frequency of use and frequency of citing, reveals significant differences in both these cases. Turning to Veterinary sciences, it is impossible to draw any valid conclusions on the impact of GL on this sector precisely because it is impossible to establish the value of the intensity parameter from the available data.

Finally, the use of this parameter enables the highlighting of eventual variations in impact over time, as can be seen from the data for Demography and Computer sciences, studied over a period of years. This parameter has promise both for the evaluation of impact in individual sectors and for the study of evolution of impact as a result of changes in the processes of diffusion of information. Consequently, it can be profitably used during this current phase when the use of Internet is progressively breaking down the confines between grey and conventional literature.

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